Title: Tooling Project Schedule Optimization Using Linear Programming

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Tooling Project Schedule Optimization

Using Linear Programming

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Dr. R. Deckro

Abstract

Linear programming was used to optimize scheduling for a 9 week tooling forecast at a plastic molding company. Model constraints included work content, schedule requirements, labor availability, equipment availability, and tool build processing. The objective function was minimization of tooling cost. Two versions of the model were run to optimize scheduling with different overtime rates, yielding optimal minimum costs of $61,640 and $64,690. The optimal solutions are sensitive to changes in the estimated work content, labor availability, and labor rates, due in part to the model complexity and the demanding project schedules. Since schedules change frequently the use of an LP scheduling package is recommended for ongoing evaluation of projects and resources.

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Executive Summary

Planning a tool project schedule to meet customer demand, while maintaining competitive costs, is challenging. Linear programming (LP) was applied to the scheduling of tooling projects for a local plastic molding company that specializes in printer and computer parts. The company builds plastic injection mold tooling internally and when tooling work exceeds shop capacity it is subcontracted.

The project was based on the forecast tooling requirements of twelve projects over a nine week period. Considering literature on similar shop scheduling optimization cases in conjunction with an analysis of the relevant scheduling parameters, the key factors were narrowed to: forecast schedule requirements, available internal labor, contract labor availability, specialized machining equipment availability, and the tool building process. These key factors were essential for project completion and were modeled as constraints.

The objective function was to minimize tooling project costs for the company. Internal regular labor was not included in the objective function since it was a fixed cost. Regular and overtime contract labor were set at rates of $50 and $72 per hour respectively. Since internal overtime rates were not known precisely, two versions of the objective function were developed using rates of $45 and $55 per hour.

The objective function and constraints were modeled in LINDO© format using a spreadsheet. Optimal minimum costs of $61,640 and $64,690 were obtained using LINDO© for versions 1 and 2, respectively. The optimal solutions for the two versions differ by only 5%, indicating the limited effect of changes in the internal overtime rate.

The project schedule demands were light in weeks 1 and 9 due to the finite nature of the forecast. During weeks 2 through 6 all available internal regular, internal overtime and contract regular labor hours were used, indicating these projects require most of the available capacity. The results are particularly sensitive to changes in the forecast project estimates and changes in available internal and external labor hours.

The results are useful in showing how extended the tooling resources are for the forecast projects. Further, since tooling requirements and estimates often change over time, an effective LP scheduling tool could be very beneficial for an ongoing evaluation of the company's tooling demands and resources.

Introduction

The project company is a local plastic injection molding business, primarily supplying plastic parts for the printer and computer industry. The name of the company was omitted at the request of management. Since the company operates as a job shop, mold tooling is either supplied by the customer or the customer purchases mold tooling for the job. For purchased tooling, the company either makes the mold or subcontracts the tool construction through another supplier.

With fluctuating demands for tooling the company has had difficulty planning tooling projects and tool shop capacity. Historically, they have used conventional project management to schedule work based on jobs with firm orders. They desire to evaluate tooling project capacity and workloads over a longer term, beyond firm orders. Primary objectives for the company are to provide tooling to customer specification, on schedule, and at minimum cost. This was an opportunity for our project group to analyze the projected tooling projects and develop a model to optimally schedule tooling projects while meeting the company objectives.

The project objectives were to: 1) collect data on the tool project cycle, 2) model the tooling operation, 3) analyze the operation using the model, and 4) determine optimal methods to minimize tooling costs and maximize tooling project performance.

Literature Search

It was necessary to complete a literature search for the design and implementation of the tool room scheduling project. The search included an investigation of similar tool room scheduling. The search focused on: 1) categorization of the project scheduling problem; is a) linear, b) integer [0,1], or, c) a mixed integer scenario; 2) if categories b) or c) apply, then how to modify it to apply linear programming, 3) how to transfer the model from a spreadsheet to LINDO©, 4) cases of "roughcut" scheduling, 5) examples of LP's applied to jobs shops, and 7) literature ideas and methods, that would provide a benefit to the company. The following paragraphs discuss our literature search and detail ideas and information found useful for our project.

Categorizing Scheduling Problems

Production scheduling has become very complex, given all the production oriented constraints and valuing systems. Professional managers need to consider performance criteria such as throughput, inventory, machine setup times, equipment and labor

utilization, customer service, supplier times, etc.. All these cost items affect the bottom line. Graves (1981, p. 646-675), has categorized scheduling problems based upon the requirements to be generated. He distinguishes between open and closed shops. Open shops are those companies that produce for specific customer orders - a classic job shop. A closed shop produces relatively standardized items and the primary production goal is to produce for inventory. Further, Graves distinguishes between increasing complexity as related to job shop problems: a one-stage, one facility shop; a single-stage shop with parallel facilities; a multi-stage, flow shop; and the multi-stage, job-shop facility. Each of these "types" have different constraints and pose different implications for scheduling LP models. Another criterion, that of production motivation, is also considered by Graves. Production schedule motivation is of two primary types: those based upon monetary consequences and those based upon due dates. Although Grave's paper was published in 1981, his definitions still hold. Since that time, cost accounting has evolved from being primarily a volume based system to an activity based system.. A Grave's categorization for the company job shop would be defined as an open shop, with multi-stage, job shop problems, and producing primarily for customer needs.

Trigerio, et. al (1989, p. 353-366), in a more recent paper, extended Graves' definitions further and defines job shop production as being multi-period, multi-item, with finite horizon, lot sizing. This model comes closer to our job shop scheduling project. At the company, injection mold machining can be performed on several machines, but there are dedicated tasks which only one type of machine can produce, i.e., electro-discharge machines (EDM). Furthermore, different tool and die makers are specialists on certain equipment. They are allowed to work only on certain types of customer molds. The authors' model, however, focuses on a single machine model, whereas at our company project, there are simultaneous scheduling demands for parallel machines. Additionally, the authors' model emphasizes the trade-off between inventory and setup costs, which were not considered in our production planning LP model . In most scheduling problems, setup costs are not as important (or rarely dominate the problem) as the overall cost scheduling structure (objective function - maximize tool hours, profit, labor, etc.). At the project company, the primary emphasis is on sequencing job start times, via the use of allowable work hours, per employee, per machine, per week and fixed in-house labor overtime and job contract out hours.

Constraining Mixed Integer Schedules to Linear Models

Akinc (1993, p. 54-64), in his paper on scheduling at a textile firm, discusses the problem of using massive constraints and an unwieldy objective function to solve a company's scheduling problems. His approach is to tone down, or dampen, this scenario by solving the mixed-integer LP problem by, temporarily, fixing the integer variables. This allows the solving of the integer problem and then using the information to obtain a better interim solution. He references Benders' partitioning and upper bound criteria.

The optimal solution is used to modify the integer problem. This is called the "restricted master." The solution yields a lower bound and a new solution. Akinc (1993, p.54-64) relates: "...just as in Benders' partitioning, a series of 'improved' integer solutions are generated using the duals of the associated LP's." The problem with this scenario is that the LP has to be solved at each iteration, however, the priority is to reduce infeasibility at each turn.

Schrage (1991, p. 27-30), discusses the need and methods, whereby, mixed integer and non linear programs can be constrained to LP's. Integer programs (IP) are difficult to solve. For an LP, the time to solve is proportional with the number of variables and approximately proportional with the square of the constraints. For an IP, the solving time can actually decrease as the number of constraints increase. However, as the number of IP variables increase, the solution time may increase dramatically. Even small IP's with few variables are extremely difficult to solve. To produce a good IP, it requires technical skills beyond what has been learned in the EMGT 540 class. Schrage (1991, p. 242-254) further discusses, in mathematical presentation, how to constrain 0/1 integer variables. Variables such as $y_1 + y_2$ and y_1^2 can be changed to linear representations by transformation. If, for example we have a variable $x + y$, and y is 0/1 and x is a non-negative continuous variable, then the transformation solution is to replace the nonlinear component with a bigger (M), linear component value. If we have an upper bound for M_X and an upper bound M_Y for the variable $x + y$, then by setting a third value $S = x + y$, a linear constraint can be achieved by the following mathematical expression:

If: $x \geq S$, and
$M_Y (y) \geq S$, then
$S \geq x - M_X (1-y)$.

The constraining of integer variables into continuous, non-negative variables has been necessary for our project in order to solve the solution in LP, non integer format. Although, for example, using 3.14 or 7.93, for machined molds produced is not realistic.

The decimals can be rounded off to affect a real solution for our, constrained non integer LP solution or another unit of measure such as hours can be used.

Reducing Complex Scheduling Models

Rogers, et. al. (1991, p. 553-582), have prepared an excellent paper on rightsizing LP models for simplified use. There are many reasons to reduce the size of optimization problems. These include the study of subsets of a larger problem, reducing the math computational burden in a problem, facilitating problem use for, generalized, "rough cut" schedules, making quick approximations, and providing a set of simplified tools for manipulating data for use by different levels of decision makers. Another feature of aggregation and disaggregation techniques involves constraining LP models with mixed integer, 0-1 variables. By constraining to a non integer problem, the number of constraints and variables can be significantly reduced. The larger, mixed integer LP can be set aside and used, exclusively, for tactical decisions. The authors go on to demonstrate that empirical results in an LP problem may be insensitive to the level of detail required in the model and, thus, coarser, or rough cut models may be employed to closely estimate the LP variables.

Definitions of aggregation and disaggregation methods are also presented. Aggregation applies to the method of determining which elements of a model are similar and can be combined into single elements. Disaggregation involves methods for deriving elements of a more refined model from an aggregate model. Many aggregation examples are cited, whereby, models have been aggregated into clusters, i.e., minimize and maximize, in order to reduce the scope of the original LP. After clustering, model parameters are selected from the reduced problem. This is the defining point between aggregation and decomposition. Decomposition involves clustering, but still uses the original parameters. This post-clustering method is defined as combination. Fixed weight combination is used to weight each cluster decision variable. Another method, combination by dominance, involves weighting only one variable in the cluster. These methods of aggregation can: a) provide control of an LP to a smaller size, b) reduce an integer, 0-1 to a non-integer problem, and c) control the upper and lower bound elements.

Disaggregation methods involve the reversal of aggregation analysis. Results of the smaller, reduced problem are used to estimate a larger problem, as needed, for complex, tactical decision making. Additionally, cluster levels can be examined, as needed, for additional research and information. Key methods of disaggregation involve the undoing of vectors used to produce clusters in the aggregation method., i.e., the method of

dissection. The most common method of dissection involves the undoing of the fixed weightings of the decision variables. Another benefit of disaggregation involves error analysis. By disaggregation, the modeler can study errors in the aggregation model. If the errors are at unacceptable levels, then, the use of the disaggregation method can further fine tune the aggregation model to reduce error levels.

Job Shop Scheduling Parameters

Adler, et. al. (1993, p. 641-8), describe the job scheduling support system implemented for multiple, parallel plants, manufacturing, multiply, paper bags and utilizing the flexible flow manufacturing process. Flexible flow shops (FFS) are those operations that require a number of stages, in series, with a number of machines in parallel at each stage. The plants produce solely for customer demand and not for inventory. The FFS operation is more complex than at our project company, but several notations from the article are worth mentioning.

As with our project company, the authors cite that the main scheduling parameter any job shop encounters is to meet product (run) due (shipping) dates. Another concern is throughput. If we formulate a labor hour minimization problem for our project problem, then throughput should also be minimized. Apparent tardiness cost (APC) is a constraint that is applied to products and machines to handle due date deadlines, excess WIP, inventory buildup and machine availability. By applying weightings to jobs, processing time and due dates, then the tardiness rule can strongly affect production and machine priorities. Key issues the authors identify that help in scheduling include: bottleneck identification, computation of time windows for jobs at bottleneck stages, scheduling jobs at the bottleneck stages and scheduling jobs at the non-bottleneck stages. They recommend to initially identify the most constraining bottleneck and then, schedule it first. If two stages of the production process represent bottlenecks, then schedule the most downstream bottleneck first. For each job, a time window exists when the job can start (release date) and when it can end (due date). Scheduling jobs at the bottleneck should be done in accordance with the APC rule, relating to due date, shipping date, machine capacity and labor weighted constraints. Finally, the non-bottleneck stages of the production can be scheduled. Scheduling at the bottleneck more or less determines the sequence of jobs going through the other non-bottleneck stages.

Efficient Job Shop Scheduling

Wein and Chevalier (1992, p. 1018-1033), further define job shop scheduling using more refined product due dates for, dynamic, walk in work, for releasing jobs from backlog to the floor, and for implementing a queuing network for product work to further reduce WIP. This boils down to due date job releases, priority sequencing for the job floor and three performance measure parameters. The performance measures are: minimize WIP, inventory, and DDLT. DDLT is the job's due date minus its arrival time. Like our project problem, jobs dynamically arrive at the shop and must, therefore, be scheduled for work into the existing work flow plan. According to customer needs and machine availability, due dates are set. If the due dates are not right with the customer, then the company loses the work. The key issue from this article, is the conclusion that job shops must better sequence their work. This can be accomplished with more information from the floor. Since all jobs compete for the various resources on the job floor, it is imperative that proper, fine tuned scheduling be implemented to create the competitive edge for maximization of profits and efficiency of job shop floor flow sequence. The article proposes a new procedure for scheduling, but assumes the job shop scheduler knows, in advance, the processing time distribution of each task of each product. The procedure ignores job due dates and instead focuses on efficient system performance. Efficient system performance minimizes WIP inventory subject to a throughput rate constraint. With these constraints, due dates are set to minimize the DDLT subject to a job tardiness constraint. Wein and Chevalier formulate their performance scheduling process into the following rules:

1) A reduction of DDLT by minimizing job tardiness can be developed by basing due dates on the production and job backlog levels, the type of arriving job, and on the earlier mentioned job release and priority sequencing requirements.
2) Regulating the amount of work at the bottleneck can substantially reduce WIP and, at the same time, maintain acceptable throughput levels.
3) Better due date performance can be achieved by better focusing on efficient system performance and ignoring due dates. If the system is efficient, then due dates become less important because they will be achieved.

Spreadsheet Use for Model Format and Input

Spreadsheet data representation is beneficial for use with LINDO©. This is especially true for LP programs that have more than a few constraints and objective function variables. Many LP software packages are data entry only. The LP allows the

user data input, but only, limited, remedial, editing capability. There are no commands that allow copying, cell orientation, parsing, sorting or other data base management tools. A spreadsheet, however, allows quick formatting for compilation of the LP constraints and the objective function. Once constructed, the spreadsheet information can be quickly transferred into an LP software package via the use of an MPS format system.

Davis, et. al. (1990, p. 90-93), have refined the method of linking spreadsheet data to LP for forest planning analysis. They describe the procedures used with Lotus© and Excel© software spreadsheets in concert with LINDO©, their preferred LP software package. They claim 95% of the data generated on a spreadsheet can be easily transferred into LINDO©. Information on forest yields, etc., is entered, organized and printed as a file and then converted into equations in a text editor that are easily read in LINDO©. The production and control files are matched by an MS-DOS© copy command and entered into LINDO© as a file. Each cell in the spreadsheet has an identifier number that is compatible with the LINDO© format. For example, the naming convention of X_{ij}, Y_{ij}, for columns and rows in the spreadsheet quickly identifies cell information for easy entry into LINDO©. This format also allows the use of two headings, i.e., stand of trees and harvest value. This is of particular value in our project problem that involves scheduling incoming jobs with operators and machines into a, week by week, work flow LP. The value of a spreadsheet format also allows for quick changes in the LP. For example, information in a spreadsheet file can be more easily changed, altered or updated than in a LINDO© file. Use of a spreadsheet for preparing and managing LINDO© programs has advantages in time savings for data entry and flexibility for making changes in the constraints and the objective function.

Murphy et. al.(1992, p. 964-991) discuss representation schemes for LP models. They stress the need for adequate external representation of the problem. The term generality identifies the need for a wide range of program applicability. Programs should be non-procedural, rather than procedural. Non-procedural is a representation that should define what the problem is, rather than how the computer is to construct the problem statement. The labor-intensiveness of a program should be minimized. Statements in algebraic form are better than many, complex graphic representations. The concreteness of the program is another parameter the authors considered. In this respect, graphs provide good visual concepts. The use of icons gives the user good manipulation skills. Decision makers rely more often on conceptualizations for their decision making skills and, therefore, graphs and visual scenario representations in an LP is a strong recommendation. Another aspect includes conceptual modularity. Generalized concepts should support classes of essential details. In graphic representations, classes of nodes

and arcs should be portrayed, rather than portraying only individual nodes and arcs. A top-down decomposition procedure should also be in the program so the "global" factory, as a whole, can be examined, as well as the factories' individual unit component processes. Also, a bottom-up problem solving strategy would allow reuse of previous LP's and fragments, thereof. Finally, the authors consider a "piecemeal" approach for the ideal model that allows the computer to provide missing pieces of a small problem fragment. This would be ideal for use in disaggregation LP work. Lastly, model independence is important. Model data independence should be isolated from model solver independence. Thus, sizes and sets of values could be changed or altered without affecting the problem statement of the overall model.

Murphy, et al. (1992, p. 964-991), go on to discuss and demonstrate how a simple problem can be formatted into MPS, requiring a problem statement and then the data input. Matrix generators are also discussed. Matrix generator programs include OMNI©, DATAFORM© and GAMMA©. Block schematic LP representations include PAM©, MIMI©and MathPro©.

LP Software for Job Shop Scheduling

Murphy, et. al. (1992, p. 948-963), have provided information on "canned" LP's for use in job shop scheduling. Although, the focus of their paper deals with composing LP's, it also includes vital information regarding existing LP's that can be easily modified to suit the needs of job shop production scheduling operations. The development of the PC, with expanded capability, bolstered by the need for sophisticated model techniques, has made it clear that LP's are now being run by technical individuals and managers who have limited, operations research and industrial engineering skills and experience. Additionally, the use of these computerized programs significantly reduces problem development costs. A smaller portion of the cost of building and running models is now being spent. More money is being spent on the building (modifying) and interpretation phases of existing LP models.

LPFORM© is a program that translates graphic components into algebraic fragments that can be linked together. This program can be linked to the GAMS© program, which provides the user algebraic statement input capability. Additional LP models either developed or under development, include parameters for LP graphic model simulations and management based systems. Other programs available include MathPro©, MIMI© and PAM©. These programs contain icons that can automatically generate, standardized

inventory structures. With limited training, the user can program and input the quantitative data.

In order to recommend an LP software system for our project company, we investigated the PAM© software system. We contacted Jack Stockton, technical representative for Platinum Manufacturing, Inc., Beaverton, Oregon. Mr. Stockton said the Platinum Advanced Manufacturing Systems (PAM©) software package is ideal for job shop work scheduling. It was originally written specifically for a small, job shop. A full blown PAM© software package, including project planning and shop floor scheduling sells for about $10,000. A 1 to 3 person user's license costs an additional $1,500. Since the PAM© software is specifically designed for job shop production scheduling, there would be very little software modification required for our project company. The software is designed as a management tool around a shop floor work center. It is basically a route sheet, that records units per time, queuing times, tardiness costs, etc., on a daily, or longer duration, work and production schedule. A job shop schedule can be programmed in a "firm plan" or in "plan status" format. The firm plan status format is an unchangeable schedule. In plan status format, the schedule can be completely modified to suit the needs of continually changing constraints and work capacity. An "infinite" schedule format is also available in the PAM© LP, whereby, jobs that come in as emergencies with higher priority, can be immediately inserted into the current job shop schedule. The LP, then, would bump or adjust the work schedule in order to meet the needs of an infinite schedule. PAM© also has contiguous and non contiguous programming capability. In non contiguous mode, a job can be run for a period of time, interrupted and set aside and, then, rescheduled to be worked on later. The PAM© LP software uses a "bucket system" for categorization of work. Jobs are placed in buckets according to minimum hours, maximum external hours, etc. The LP is run according to due dates with priorities set for each job. It has the capacity to do forward as well as backward scheduling, often needed for planning and forecasting purposes. The PAM© LP utilizes a betry format system, whereby, all inputs into the program are real time. The program also accepts a myriad of spreadsheet software formats, including the MPS system for ease of file input and external data analysis and representation.

Literature Summary

Most of the information we needed for our project was found in the literature search. Particularly helpful, was the Davis article on forest planning. This helped our

spreadsheet formulations. The Murphy article provided LP software references and this lead us our investigation of the PAM© LP from Platinum Manufacturing, Inc. The Graves, Adler, et al., and Wein and Chevalier articles helped define the job shop scenario at our project company. From the Trigerio, et al., article, we gained insight on the necessary constraint parameters needed for our project LP formulation.

The Akinc and Schrade references provided information on how to constrain our project problem into a linear program. The Rogers, et al., article provided information to simplify the project and take advantage of the reduced scope LP in order to solve the problem. This article was especially useful to understand that not all constraints or shop information are critical to the objective function, nor do they have much effect on the outcome. We were satisfied in the selection of our constraints that our objective function would reasonably reflect an optimal schedule for our project company.

Model Development

The primary objectives of the company for injection mold tooling are to provide customer tooling on schedule, to specifications and at a minimum cost to the company. Since meeting customer schedules and specifications are necessary they were incorporated within the model as constraints that had to be satisfied. Minimization of total tooling cost became the objective function of the model.

To provide scheduling output and incorporate schedule constraints the model had to have discrete variables for each time interval. Smaller scheduling intervals are advantageous in that they can be more time specific, but have a disadvantage in that model complexity grows proportionately. Larger scheduling intervals are advantageous because they simplify the model, but reduce the specificity of scheduling information. A weekly interval was selected after considering; 1) the forecast project start and completion dates were estimated to the nearest week, 2) the majority of regular overtime as well as overtime to accommodate unplanned events occur on the weekend, 3) the shop currently tends to do rough scheduling in terms of weeks, 4) contract shops also tend to schedule work in terms of weeks, 5) a monthly interval was too long since specific projects had to be completed by during specific weeks, 6) the analysis would not be specific enough to provide a weekly scheduling to complete projects to schedule, and 7) model complexity versus needs.

Data and Assumptions

Data for the model and analysis consisted of the available forecast tooling requirements for a 9 week period. A total of 12 tooling projects were anticipated as shown in Figure 1. Estimated total project labor hours and electro discharge machining (EDM) hours are listed for each project. The scheduled start week and the scheduled completion week are listed for each of the projects.

Figure 1

Tooling Project Data

Project #	Labor Hours	EDM Hours	Start Week #	Complete Week #
1	350	200	3	6
2	130	80	4	6
3	200	10	4	6
4	160	40	4	6
5	800	20	2	7
6	200	40	1	3
7	100	25	2	3
8	200	40	2	4
9	100	25	4	5
10	200	40	6	8
11	100	25	8	9
12	150	40	7	8

Significant Factors

There are many factors that affect the tooling process beyond completion schedules and specifications. Significant factors include: 1) purchasing, 2) tool design, 3) materials 4) personnel resources and capabilities, 5) tool shop periodic tooling maintenance and emergency repairs, 6) subcontract facilities, 7) equipment requirements and availability, and 8) tooling type and complexity. Each of these areas could be detailed extensively. To simplify the model, rather than increase the complexity, all of the constraints were evaluated relative to the schedule requirements.

Tool purchasing and design for the forecast tooling projects were not constraining factors. Purchasing had more than adequate resources.

Tool design capacity was not constraining since most of the projects were for duplicate tooling, in which case the tooling designs were already complete. It could be

possible to have a mix of tooling in which the design capacity would be a limiting factor. In those cases constraints for tooling design capacity would have to be added.

Material costs such as the main cavity blocks and slides, are purchased by the tool shop. Primary material and supply prices are quite stable. Therefore, they were considered fixed for the purposes of this analysis and have been excluded from the model.

The company tool shop has 8 toolmakers. Six of the toolmakers are journeyman and work on new tool projects, tool modification and repair. The other 2 toolmakers are dedicated exclusively to periodic tool maintenance. Since the other 2 toolmakers work exclusively on periodic maintenance their hours are not available for tooling projects and they were not included as part of the model. They are, essentially, a separate fixed cost for the department that did not change for this analysis.

The 6 journeyman toolmakers are available for a total of 240 regular hours per week. Their time must be allotted for scheduled projects and emergency repairs of tools that fail in operation. Of the total 240 hours, 40 hours are reserved for emergency tool repairs, illness and other time off. The remaining 200 hours are the maximum regular labor hours available per week for the 12 forecast projects.

The journeyman toolmakers are available to work some overtime. Overtime varies by individual and demand. Some individuals have put in 20 hours of overtime per week during critical needs, while other toolmakers choose not to work any overtime. When there is a demand for overtime, the total group will average 50 hours per week. The maximum internal overtime is constrained to 50 hours per week in the model.

All of the 6 toolmakers available for project work are journeyman and are all capable of working interchangeably on any of the forecast projects. While it is often most efficient to have people assigned to specific tasks that match their desires, there are not significant differences among the toolmakers in terms of job completion times and quality. This could likely be a result that the shop supervisor is a journeyman toolmaker and is an integral part of the projects. He ensures that the toolmakers have the proper tooling, equipment, and adequate time to do the job correctly so that it does not have to be repeated. There is little schedule pressure to rush jobs. The shop is primarily concerned with completing the job correctly. This appears to have a leveling effect on job completion times.

Other tool shops perform tool work on a contract basis. Shops available to perform this specialized tooling work are limited. A total of up to 100 hours per week of regular contract toolmaker labor is available each week and up to 100 hours per week of contract overtime labor is available each week. Toolmakers at the contract shops are journeyman

and are capable of performing the work. Their job completion times are very comparable to the internal toolmakers, and any differences are usually within estimate uncertainties.

Plastic injection molding tooling is made of hardened steel and has configurations that often can not be machined with conventional milling machines and lathes. Electro discharge machining (EDM) is used extensively in machining plastic injection mold tooling. Electro discharge machining is process using electric current through an electrode to machine steel by burning it away. The EDM can be used to machine hardened steel and create narrow pockets in steel often found in plastic part configurations, that can not be readily accomplished with conventional machining equipment. EDM machines are expensive and the machining process is time consuming, making EDM equipment availability a constraint for most tooling shops. The model for this application includes internal and contract EDM equipment availability constraints. The internal EDM equipment has a capacity of 150 hours per week and the external EDM equipment has a capacity of 80 hours per week.

While in operation the EDM equipment must be attended by a machinist and this is accounted for with constraints that assure an hour of EDM is supported with an hour of labor. The internal EDM time is supported with internal labor hours and likewise the external EDM time is supported with external labor hours. This constraint is also incorporated in the model.

Since conventional equipment is not a limiting factor for internal or contract machining or external machining, it was not included in the constraints in order to simplify the model. Typically there are always many slack hours available on the conventional machining equipment. In the few cases where more than one toolmaker needs to use the same piece of machining equipment, the toolmakers work sequencing is flexible enough that the equipment does not present a resource constraint. One may question why EDM operations can not be done like this. Conventional machining operations can be broken down o tasks that typically take an hour or less to complete, allowing for significant flexibility. EDM operations, however, often take 4 or more hours to complete.

Toolmaking is a complex process involving sequential work. An 80 hour job can not be completed in 1 day by 10 toolmakers, simply because 10 toolmakers physically can not all work on the same tool at the same time and many of the machining operations are sequential. The maximum number of number of labor hours that can be put into a tooling project per week are limited by the type of work. For most projects, it was limited to 100 hours per week based on the type and scope of work, while the largest project could go up to 150 hours per week. While there is much that could be analyzed in terms of the most

effective sequence of operations for the process of making an individual tool, this was not included since 1) each toolmaker has their own individual style and methods, 2) toolmakers perceive themselves as craftsman and must be allowed a certain degree of flexibility to work as they see fit, and 3) the model would become unnecessarily complex since the toolmakers would not likely follow the type of detail proposed.

The internal and contract toolmakers that were available to work on projects could work interchangeably on any job. With this flexibility project labor could be modeled with toolmaker labor hours instead of labor hours by individual toolmaker. This allowed the model to fit the characteristics of linear programming with linearity and continuity (Markland, 1989, p.35-36). To assign a specific toolmaker to a job for the extent of the project would have necessitated the use of integer programming.

Variables

Considering the previously discussed factors the model includes the 4 available types of labor hours and the 2 sources of EDM hours. These constitute the key variables that can be expressed in terms of schedule and resource constraints and an objective function based on cost. The variables are as follows:

IR_{ij} Internal regular labor hours.

IO_{ij} Internal overtime labor hours.

CR_{ij} Contract regular labor hours.

CO_{ij} Contract overtime labor hours.

Where i designates the week number (1 through 9) and j designates the project number (1 through 12). For the given projects, schedule requirements and the modeled weekly interval there are a total of 212 decision variables.

Constraints

Considering the previous discussion of the key factors the following constraints were developed:

1) The required labor hours by project (Constraint rows 2 - 13, Appendix A):

$(\sum IR_i + \sum IO_i + \sum CR_i + \sum CO_i)_j \geq$ Required Labor Hours for project j.

Where i is over the duration of the project from start week to completion week.

2) The required EDM hours by project (Constraint rows 14 - 25, Appendix A):

$(\sum IE_i + \sum CE_i)_j \geq$ Required EDM Hours for project j.
Where i is over the duration of the project from start week to completion week.

3) The maximum weekly labor hours (Constraint rows 26 - 61, Appendix A):

$(\sum IR_j)_i \leq$ Maximum weekly internal regular labor hours for week i.
Where j is all of the projects available for work that week.

$(\sum IO_j)_i \leq$ Maximum weekly internal overtime labor hours for week i.
Where j is all of the projects available for work that week.

$(\sum CR_j)_i \leq$ Maximum weekly contract regular labor hours for week i.
Where j is all of the projects available for work that week.

$(\sum CO_j)_i \leq$ Maximum weekly contract overtime regular labor hours for week i.
Where j is all of the projects available for work that week.

4) The maximum weekly EDM hours (Constraint rows 62 - 79, Appendix A):

$(\sum IE_j)_i \leq$ Maximum weekly EDM hours for week i.
Where j is all of the projects available for work that week.

$(\sum CE_j)_i \leq$ Maximum weekly EDM hours for week i.
Where j is all of the projects available for work that week.

5) The maximum weekly labor hours that can be completed on each project (Constraint rows 80 - 327, Appendix A):

$IR_{ij} \leq$ Maximum internal regular hours possible week i on project j.
$IO_{ij} \leq$ Maximum internal overtime hours possible week i on project j.
$CR_{ij} \leq$ Maximum contract regular hours possible week i on project j.
$CO_{ij} \leq$ Maximum contract overtime hours possible week i on project j.
$IR_{ij} + IO_{ij} + CR_{ij} + CO_{ij} \leq$ Maximum labor hours possible week i on project j.
For all i weeks and j projects

6) Each EDM hour must be supported by a corresponding labor hour; internal for internal EDM and contract for contract EDM, (Constraint rows 328-395, Appendix A):

$IR_{ij} + IO_{ij} \geq IE_{ij}$ rearranged: $IE_{ij} - (IR_{ij} + IO_{ij}) \leq 0$

$CR_{ij} + CO_{ij} \geq CE_{ij}$ rearranged: $CE_{ij} - (CR_{ij} + CO_{ij}) \leq 0$

For all i weeks and j projects where EDM hours are required.

Objective Functions

The objective functions minimize total cost based on the following:

1) Internal regular labor is a fixed cost since they do not send any tool makers home if they are short on work and no reductions in the number of tool makers are planned. Each toolmaker will put in 40 hours of regular time on the job each week, excluding special circumstances such as illness or vacation.

2) Outside contract regular labor is an expense of $50 per hour at qualified, available shops.

3) Outside contract overtime labor is an expense of $72 per hour at qualified, available shops. All of the qualified shops charge the same contract regular and overtime rates.

4) Internal overtime rates were not readily available, but estimated to be between $45 and $55 per hour.

As such, 2 versions of the objective function were developed; the first with a $45 per hour rate for internal overtime and the second with a $55 per hour rate for internal overtime Theses rates are loaded rates and include overhead, equipment and incidental material costs. The objective function is of the form:

Minimize $Z = \sum 45\ IO_{ij} + \sum 50\ CR_{ij} + \sum 72\ CO_{ij}$ (Version 1)

Minimize $Z = \sum 55\ IO_{ij} + \sum 50\ CR_{ij} + \sum 72\ CO_{ij}$ (Version 2)

For all i weeks and j projects.

Model Set-Up

The objective function and constraints set up were facilitated with the use of a spreadsheet. Spreadsheet software allowed block copying, pattern duplication, mathematical checks for accuracy, and easy modifications. The spreadsheet data when saved in a text file format contained tabs. Word processing software was used to remove

the tabs quickly and easily. These steps allowed the transformation of spreadsheet data into a text file that could be loaded in LINDO© using the TAKE command. SUPER LINDO©/PC 5.02 (4 MAR 92) was used since the model exceeded the limits of the student version of LINDO©.

The objective function would not read in past the first line using the TAKE command, while multiple lines could be read in for any constraint. To get around this problem the objective function was loaded in as a dummy constraint. Within the LINDO© editor the dummy constraint was simply appended to the first line of the objective function and the SUBJECT TO line moved to the first actual constraint. The model was saved in LINDO© format and then run for the solution and sensitivity analysis. The process was repeated for version 2 since it had a different objective function. The computer model files in both the spreadsheet format and LINDO© format are contained in Appendix A.

Solutions

Both versions of the model were run using SUPER LINDO©. The optimal solution for Version 1 was found at step 142 with an objective function value of $61,640. The optimal solution for Version 1 was found at step 139 with an objective function value of $64,690. Figures 2 and 3 contain the solutions in the form of a scheduling matrices. Appendix B contains the solution output in LINDO© format and in a spreadsheet format.

The optimal objective function values differ by only 5% despite the significant change in internal overtime rate from $45 in version 1 to $55 per hour in version 2. This is due to a combination of factors. One reason is that even though the internal overtime rate differs by approximately 20% from version 1 to version 2, internal overtime only accounts for 13% of the total hours in the version 1 solution and only 9% of the total hours in the version 2 solution. This is primarily due to the heavy schedule requirements weeks 2 through 6 consuming all of the available internal overtime labor and contract regular labor. For the lower demand weeks the lower internal overtime rate of $45 per hour in version 1 biases the work to internal overtime since the contract regular rate is $50 per hour. In version 2 the work is biased toward contract overtime at $50 per hour rather than internal overtime at $55 per hour.

Figure 2 Schedule Matrix

Version 1

Optimal Internal Regular Hours (IR_{ij})

Week i \ Project j	1	2	3	4	5	6	7	8	9	10	11	12	Total	Slack
1	----	----	----	----	----	80	----	----	----	----	----	----	80	120
2	----	----	----	----	100	70	30	0	----	----	----	----	200	0
3	40	----	----	----	80	0	0	80	----	----	----	----	200	0
4	50	0	0	40	100	----	----	0	10	----	----	----	200	0
5	50	50	30	0	20	----	----	----	50	----	----	----	200	0
6	30	50	0	50	70	----	----	----	----	0	----	----	200	0
7	----	----	----	----	110	----	----	----	----	80	----	10	200	0
8	----	----	----	----	----	----	----	----	----	80	40	80	200	0
9	----	----	----	----	----	----	----	----	----	----	60	----	60	140
													1540	

Optimal Internal Overtime Hours (IO_{ij})

Week i \ Project j	1	2	3	4	5	6	7	8	9	10	11	12	Total	Slack
1	----	----	----	----	----	20	----	----	----	----	----	----	20	30
2	----	----	----	----	0	20	20	10	----	----	----	----	50	0
3	10	----	----	----	30	10	0	0	----	----	----	----	50	0
4	0	20	0	0	30	----	----	0	0	----	----	----	50	0
5	0	0	20	20	10	----	----	----	0	----	----	----	50	0
6	20	0	0	0	30	----	----	----	----	0	----	----	50	0
7	----	----	----	----	10	----	----	----	----	20	----	20	50	0
8	----	----	----	----	----	----	----	----	----	20	0	20	40	10
9	----	----	----	----	----	----	----	----	----	----	0	----	0	50
													360	

Optimal Contract Regular Hours (CR_{ij})

Week i \ Project j	1	2	3	4	5	6	7	8	9	10	11	12	Total	Slack
1	----	----	----	----	----	0	----	----	----	----	----	----	0	100
2	----	----	----	----	50	0	0	50	----	----	----	----	100	0
3	50	----	----	----	0	0	50	0	----	----	----	----	100	0
4	50	10	0	0	0	----	----	40	0	----	----	----	100	0
5	50	0	0	0	50	----	----	----	0	----	----	----	100	0
6	0	0	50	0	50	----	----	----	----	0	----	----	100	0
7	----	----	----	----	0	----	----	----	----	0	----	20	20	80
8	----	----	----	----	----	----	----	----	----	0	0	0	0	100
9	----	----	----	----	----	----	----	----	----	----	0	----	0	100
													520	

Optimal Contract Overtime Hours (CO_{ij})

Week i \ Project j	1	2	3	4	5	6	7	8	9	10	11	12	Total	Slack
1	----	----	----	----	----	0	----	----	----	----	----	----	0	100
2	----	----	----	----	0	0	0	0	----	----	----	----	0	100
3	0	----	----	----	40	0	0	20	----	----	----	----	60	40
4	0	0	0	0	20	----	----	0	0	----	----	----	20	80
5	0	0	50	0	0	----	----	----	40	----	----	----	90	10
6	0	0	50	50	0	----	----	----	----	0	----	----	100	0
7	----	----	----	----	0	----	----	----	----	0	----	0	0	100
8	----	----	----	----	----	----	----	----	----	0	0	0	0	100
9	----	----	----	----	----	----	----	----	----	----	0	----	0	100

Figure 3 Schedule Matrix

Version 2

Optimal Internal Regular Hours (IR_{ij})

Week i \ Project j	1	2	3	4	5	6	7	8	9	10	11	12	Total	Slack
1	----	----	----	----	----	80	----	----	----	----	----	----	80	120
2	----	----	----	----	100	70	30	0	----	----	----	----	200	0
3	50	----	----	----	70	0	0	80	----	----	----	----	200	0
4	30	0	0	50	95	----	----	0	25	----	----	----	200	0
5	80	25	40	0	30	----	----	----	25	----	----	----	200	0
6	80	0	0	50	70	----	----	----	----	0	----	----	200	0
7	----	----	----	----	120	----	----	----	----	80	----	0	200	0
8	----	----	----	----	----	----	----	----	----	80	40	80	200	0
9	----	----	----	----	----	----	----	----	----	----	60	----	60	140
													1540	

Optimal Internal Overtime Hours (IO_{ij})

Week i \ Project j	1	2	3	4	5	6	7	8	9	10	11	12	Total	Slack
1	----	----	----	----	----	0	----	----	----	----	----	----	0	50
2	----	----	----	----	0	10	20	20	----	----	----	----	50	0
3	0	----	----	----	30	20	0	0	----	----	----	----	50	0
4	20	0	0	0	30	----	----	0	0	----	----	----	50	0
5	20	0	10	20	0	----	----	----	0	----	----	----	50	0
6	20	0	0	0	30	----	----	----	----	0	----	----	50	0
7	----	----	----	----	0	----	----	----	----	0	----	0	0	50
8	----	----	----	----	----	----	----	----	----	0	0	0	0	50
9	----	----	----	----	----	----	----	----	----	----	0	----	0	50
													250	

Optimal Contract Regular Hours (CR_{ij})

Week i \ Project j	1	2	3	4	5	6	7	8	9	10	11	12	Total	Slack
1	----	----	----	----	----	20	----	----	----	----	----	----	20	80
2	----	----	----	----	50	0	0	50	----	----	----	----	100	0
3	0	----	----	----	50	0	50	0	----	----	----	----	100	0
4	50	0	0	40	10	----	----	0	0	----	----	----	100	0
5	0	50	0	0	50	----	----	----	0	----	----	----	100	0
6	0	50	0	0	50	----	----	----	----	0	----	----	100	0
7	----	----	----	----	0	----	----	----	----	20	----	50	70	30
8	----	----	----	----	----	----	----	----	----	20	0	20	40	60
9	----	----	----	----	----	----	----	----	----	----	0	----	0	100
													630	

Optimal Contract Overtime Hours (CO_{ij})

Week i \ Project j	1	2	3	4	5	6	7	8	9	10	11	12	Total	Slack
1	----	----	----	----	----	0	----	----	----	----	----	----	0	100
2	----	----	----	----	0	0	0	0	----	----	----	----	0	100
3	0	----	----	----	0	0	0	20	----	----	----	----	20	80
4	0	5	50	0	15	----	----	30	0	----	----	----	100	0
5	0	0	50	0	0	----	----	----	50	----	----	----	100	0
6	0	0	50	0	0	----	----	----	----	0	----	----	50	50
7	----	----	----	----	0	----	----	----	----	0	----	0	0	100
8	----	----	----	----	----	----	----	----	----	0	0	0	0	100
9	----	----	----	----	----	----	----	----	----	----	0	----	0	100
													270	

The workload is maximal during weeks 2 through 6 and with some reflection on the constraints it appears that the solution is reasonable. However, the mix of hours by project and week is not so apparent. It is for this reason that this method of modeling and analysis for scheduling can be so beneficial. Most projects have fluctuations in weekly hours as a result of minimizing the total cost for all projects. While the scheduled project hours for a given week and labor type may not have been very practical to implement, such as 0.7 hours, the minimum scheduled time allotment is 10 hours in the version 1 solution and 5 hours in the version 2 solution. These scheduling quantities are relatively easy to accommodate.

As previously noted for most of the labor hour constraints there is no surplus in the high demand weeks. Figures 4 - 7 show graphically the amount of labor hours required by week against available labor. In the weeks of lower demand there are slack labor hours, occurring primarily in the higher priced labor. The EDM hours have sufficient slack in most cases (Figures 8 - 9). This indicates the labor is more constraining than EDM hours for this mix of projects. It could be possible to have a mix of products that would result in the EDM hours becoming more of a constraining resource than the labor, since there are fewer EDM hours available than labor hours. It should also be noted that during weeks 1 and 9 there are slack internal regular labor hours. This is due mostly to the finite window of projects. If projects could be accurately forecast further in time it is likely the tail off slack shown with this model would be consumed with future projects not presently anticipated.

It is also important to realize that there is more than one optimal solution for each version. The alternate solutions will have the same optimal minimum cost, yet have a slightly different schedule solution. This allows the user to evaluate the effect of including a particular variable, such as IR_{405}, in the solution. Variables that can be entered into the solution are those having a zero value and a zero dual price (Appendix B). This is significant in that there are many other solutions that are also optimal and result in the same minimum total cost. The results indicate that there are 60 labor variables for version 1 and 61 labor variables for version 2 that could enter the solution, one at a time.

Figure 4

Figure 5

Figure 6

Figure 7

Figure 8

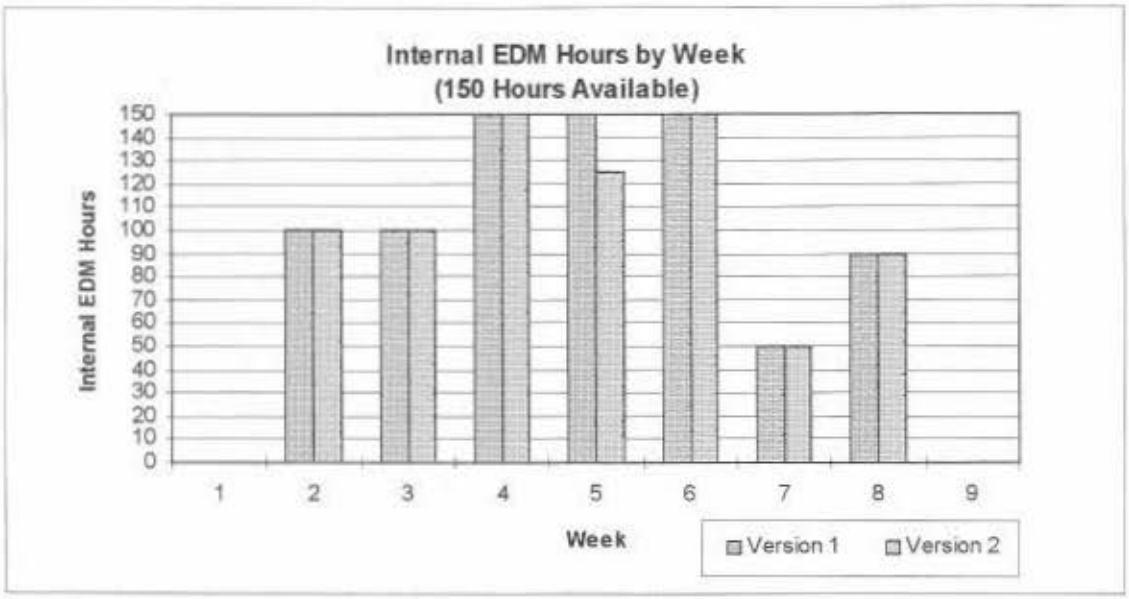
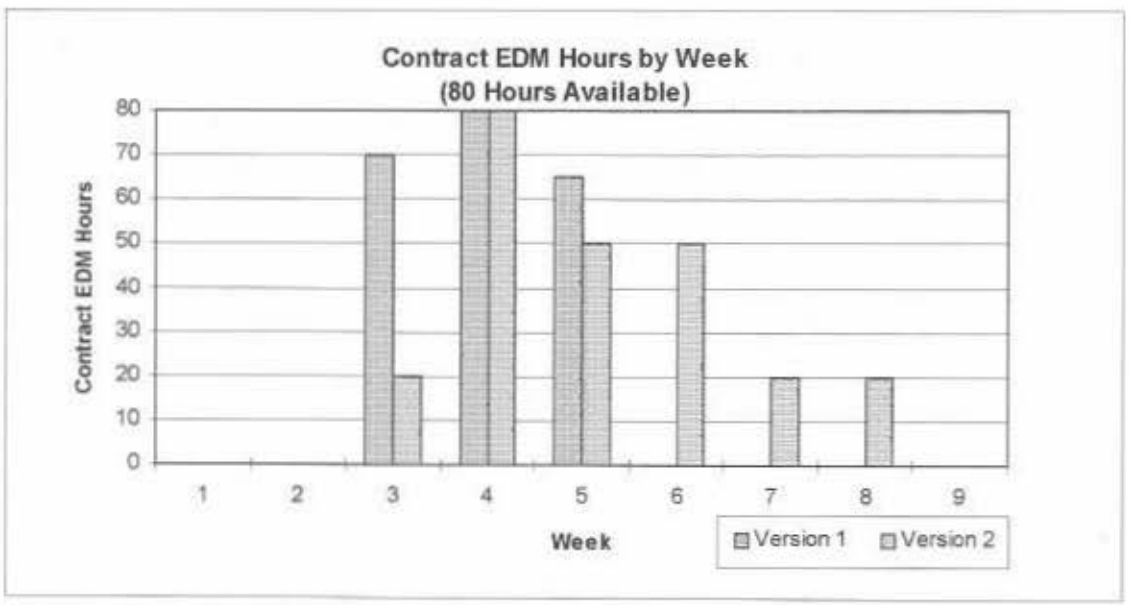


Figure 9



Rather than run and output a total of 121 alternate optimal solutions, some general guidelines are offered to determine alternate optimal schedules. The model can be run for the optimal solution and then the PIVOT command can be used in LINDO© to bring in any one of the basic variables having a zero value. While many of the variables enter the solution at a value of zero, some will enter at a positive value. This could be helpful in a case where continuity of labor hours on a particular project was desirable for some reason not addressed in the constraints. For instance, in week 5, on project 4 the internal regular labor zero value variable IR_{405} could be entered in the solution if it was desired to see if continuous internal regular hours could be scheduled.

Sensitivity Analysis

Sensitivity analyses were run for both versions. The range on the right hand side (RHS) values for the constraints are contained in Appendix B. The ranges on the RHS for the required labor hours for each job (constraints 2 - 13) revealed that the solution is quite sensitive to changes in the estimated labor hours for each project. For version 2 any increase in the estimated project hours for 11 of the 12 projects would result in the present solution no longer being optimal. For version 1 any increase of more than 10 hours for most projects would also result in the present solution no longer being optimal. It is quite evident that for this model the accuracy of the estimated hours can have an impact on the optimal solution.

The ranges on the required EDM hours (constraints 14 - 25) as a whole are less sensitive to variations in estimates. The required EDM hour estimates are only critical for projects 4 and 5. The other project estimates can be off by up to 20% before the solution will no longer be optimal.

Changes in the available internal and contract labor hours (constraints 26 - 61) can affect the optimal solution, particularly in weeks 2 through 6, that have the heaviest requirements. In general, if 2 labor days are missed (16 hours) beyond the unplanned reserve hours during any of the busy weeks it will result in the present solution no longer being optimal. The tradeoff for a lost internal regular hour is $72 during the busy weeks, assuming the optimal solution still holds. The $72 is the cost of a contract overtime labor hour to replace the lost hour, since all other resources are consumed. It is also likely this marginal rate would hold, even if the optimal solution did not hold, since this is the only source of replacement labor at peak demands.

Reductions in the available EDM hours, internal and external, are only critical in weeks 4 and 5, which correspond to peak EDM load. For the other weeks, significant

reductions (30 + hours) in the available EDM hours can occur, while the solution remains optimal. Since the cost of the EDM is included in the hourly rate for labor, the value of a lost EDM hour would appear when the present solution was no longer optimal.

The maximum hours that can be completed per week (constraints 80 - 327) for the most part have a large allowable range without changing the present solution from optimal. Ranges on these limits are not as significant since they are upper limit capacities on how many hours can be worked on a project each week that are not likely to be exceeded. Further, if a limit is exceeded it will only be by a minor amount.

The allowable ranges on the objective function coefficients, which correspond to the hourly labor rates, are listed by variable in Appendix B. Changes to any of the internal and external labor rates result in the present solution no longer being optimal. Adding a charge for EDM hours would also result in the present solution no longer being optimal. While changes are possible, labor rates have historically been stable. In the event labor costs change or if EDM time were assessed an additional premium charge the model would need to be revised and the solution reevaluated.

The uncertainty of the internal overtime labor rate was handled with the multiple versions as previously discussed. This provided the impact of changes in internal overtime labor rate changes.

Conclusions

Modeling operational scheduling, even on a small scale, can become very complex. This case of tooling project scheduling, starting with only 12 projects over a 9 week span, quickly expanded to include 212 decision variables and 394 constraints, even after a number of justifiable simplifications were made.

Two versions of the model were developed to evaluate the effect of different internal overtime rates. Since the total cost results differed by only 5%, it indicated that the financial impact of varying overtime rates for this scenario is well within the uncertainty of the project estimates. Changing internal overtime rates will bias the work scheduling. At an internal overtime rate of $45 per hour internal overtime will be favored, and at an internal overtime rate of $55 per hour contract regular labor will be favored. This is important to consider in cases of borderline loads that do not fully consume internal overtime labor and contract regular labor. It is economical to favor the use of the labor that is actual lowest cost to the company.

The LINDO© model gives optimal scheduling results that are quite appropriate for this particular problem. While linear programs can output fractional results, such as 0.7

hours, all results were whole numbers and the resulting minimum quantity of scheduled labor hours for all sources was 5 hours, which could fit quite readily into project scheduling. The results also indicate multiple optimal alternate solutions exist. Many of alternate optimal solutions are not significantly different from the optimal solution presented, yet they allow the decision makers the option of evaluating and choosing other schedules.

The forecast project schedule will place a heavy demand on the available labor resources. If this were an isolated incident of high demand, then the company would probably desire to take advantage of the contract labor sources available. On the other hand, if this level of demand was recurring, then management would probably be wise to evaluate adding internal toolmakers. Adding toolmakers, as fixed labor costs, would be justifiable, provided the long term cost of the additional employee(s) was less than the long term cost of the contract labor with the present staffing.

Project requirements and resource availability often change. For this model and conditions the present solution would no longer be optimal for changes in labor rates, changes in project work content, and significant changes in available labor. The model would need to be rerun for changes to evaluate the impact. In large part, this is the result of almost fully consuming labor resources and the complexity of the model.

To use LINDO© with this type of modeling a matrix generator would be necessary to efficiently transform the available data into model format. Ideally the company management information system (MIS) would be linked in such a manner the matrix generator could directly pull the necessary MIS data. This would allow for quick updating of the model when conditions change. Further discussions on alternative methods for linear programming and optimization are covered in the next section.

Further Applications

Off the shelf packages are available for scheduling optimization, such as the PAM© software system, which was previously discussed in the literature search. It is specifically designed for job shop production scheduling. Of particular interest for this company and the ever changing needs are the plan status format and the infinite schedule format. In the plan status format the schedule can be completely modified to suit the needs of continually changing constraints and work capacity. The infinite schedule format allows for jobs that come in as emergencies with higher priority to be immediately inserted into the current schedule.

A complete PAM© package sells for about $10,000. This may seem like a significant investment in software, yet, when considered against the cost of contract labor at $50 per hour it may be an excellent payoff. Consider, if improved planning and utilization of internal labor would result in 20 hours of contact labor avoidance per month, this package would pay for itself within a year. Additionally, it could be used for complete operational planning, which could have much larger payoff potential.

Developing a system that would integrate PAM© with the present company MIS system would undoubtedly take some time. When integrated it would be quick and convenient to update as well as allow for forecasting based on past workloads.

LINDO© software could be purchased and the existing model format could be used to evaluate the benefits of linear programming for scheduling before making a significant investment in scheduling software. A matrix generator could be programmed or an existing matrix generator software package, such as LINGO© could be purchased through LINDO©, to make effective use of LINDO© software for the company's particular applications.

For business planning goal programming may be applied with the company's overall objectives in mind. Goal programming allows the user to model the ranked business objectives and goals. The model progressively attempts to satisfy the goals in order of importance. In this study all of the constraints were established as requirements that had to be satisfied. With goal programming multiple goals may be incorporated in the model, such as, minimize tooling cost for the company, complete tooling first that has the best molded part profitability, provide quick tooling completion, and pursue specialized market segments. The model could become very complex, resulting in another project for a programmer, system analyst. However, modeling business requirements and optimizing the product mix and scheduling can be extremely beneficial in aligning the use of the company's resources to most effectively meet desired business objectives.

References

Adler, Leonard, Nelson Fraiman, Edward Kobacker, Michael Pinedo, Juan Carlos Plotnicoff, and Tso Pang Wu, "BPSS: A Scheduling Support System For the Packaging Industry," *Operations Research*, Vol. 41, No. 4, July-August 1993, p. 641-648.

Akinc, Umit, "A Practical Approach to Lot and Setup Scheduling at a Textile Firm," *IIE Transactions*, Vol. 25, No. 2, March 1993, p. 54-64.

Davis, Lawrence S., Frieder Schurr, Roger Church, J. Keith Gilless, and P.J. Daugherty, "The Spreadsheet Connection for Forest Planning Analysis that Everyone Can Understand and Trust," *Western Journal of Applied Forestry*, Vol. 5, No. 3, July 1990, p. 90-93.

Graves, Stephen C., "A Review of Production Scheduling," *Operations Research*, Vol. 29, No. 4, July-August 1981 p. 646-675.

Markland, Robert E., *Topics in Management Science*, John Wiley & Sons, New York, 1989, p. 111-113.

Johnson, Lynwood A., and Douglas C. Montgomery, *Operations Research in Production Planning, Scheduling, and Inventory Control*, John Wiley & Sons, New York, 1974, p. 225-398.

Murphy, Frederic H., Edward A. Stohr, and Ajay Asthana, "Representation Schemes For Linear Programming Models," *Management Science*, Vol. 38, No. 7, July 1992, p. 964-991.

Murphy, Frederic H., Edward A. Stohr, and Pai-Chun Ma, "Composition Ruler for Building Linear Programming Models From Component Models," *Management Science*, Vol. 38, No. 7, July 1992, p.. 948-963.

Rogers, David F., Robert D. Plante, Richard T. Wong and James R. Evans, "Aggregation and Disaggregation Techniques and Methodology in Optimization," *Operations Research*, Vol. 39, No. 4, July-August 1991, p. 553-582.

References

Schrage, Linus, *Linear, Integer and Quadratic Programming with LINDO*, 4th Edition, 1987.

Schrage, Linus, *LINDO, An Optimization System*, The Scientific Press, San Francisco, 4th edition, 1987, p. 374.

Schrage, Linus, *Users Manual, Release 5.0*, The Scientific Press, San Francisco, 1991.

Trigerio, William W., Joeseph L. Thomas, and John O. McClain, "Capacitated Lot Sizing With Setup Times," *Management Science*, Vol. 35, No. 1, 1989, p. 353-366.

William W., Joseph L. Thomas, and John O. McClain, "Capacitated Lot Sizing with Setup Times," *Management Science*, Vol. 35, No. 1, 1989, p. 353-366.

Wein, Lawrence M., and Philippe B. Chevalier, "A Broader View of the Job-Shop Scheduling Problem," *Management Science*, Vol. 38, No. 7, July 1992, p. 1018-1033.

ROW	I Minimum Labor Hours Required for Each Job																																				
2	IR	301	+	IO	301	+	CR	301	+	CO	301	+	IR	401	+	IO	401	+	CR	401	+	CO	401	+	IR	501	+	IO	501	+	CR	501	+	CO	501	+	
																									IR	601	+	IO	601	+	CR	601	+	CO	601	>	350
3	IR	402	+	IO	402	+	CR	402	+	CO	402	+	IR	502	+	IO	502	+	CR	502	+	CO	502	+	IR	602	+	IO	602	+	CR	602	+	CO	602	>	130
4	IR	403	+	IO	403	+	CR	403	+	CO	403	+	IR	503	+	IO	503	+	CR	503	+	CO	503	+	IR	603	+	IO	603	+	CR	603	+	CO	603	>	200
5	IR	404	+	IO	404	+	CR	404	+	CO	404	+	IR	504	+	IO	504	+	CR	504	+	CO	504	+	IR	604	+	IO	604	+	CR	604	+	CO	604	>	160
6	IR	205	+	IO	205	+	CR	205	+	CO	205	+	IR	305	+	IO	305	+	CR	305	+	CO	305	+	IR	405	+	IO	405	+	CR	405	+	CO	405	+	
	IR	505	+	IO	505	+	CR	505	+	CO	505	+	IR	605	+	IO	605	+	CR	605	+	CO	605	+	IR	705	+	IO	705	+	CR	705	+	CO	705	>	800
7	IR	106	+	IO	106	+	CR	106	+	CO	106	+	IR	206	+	IO	206	+	CR	206	+	CO	206	+	IR	306	+	IO	306	+	CR	306	+	CO	306	>	200
8	IR	207	+	IO	207	+	CR	207	+	CO	207	+	IR	307	+	IO	307	+	CR	307	+	CO	307													>	100
9	IR	208	+	IO	208	+	CR	208	+	CO	208	+	IR	308	+	IO	308	+	CR	308	+	CO	308	+	IR	408	+	IO	408	+	CR	408	+	CO	408	>	200
10	IR	409	+	IO	409	+	CR	409	+	CO	409	+	IR	509	+	IO	509	+	CR	509	+	CO	509													>	100
11	IR	610	+	IO	610	+	CR	610	+	CO	610	+	IR	710	+	IO	710	+	CR	710	+	CO	710	+	IR	810	+	IO	810	+	CR	810	+	CO	810	>	200
12	IR	811	+	IO	811	+	CR	811	+	CO	811	+	IR	911	+	IO	911	+	CR	911	+	CO	911													>	100
13	IR	712	+	IO	712	+	CR	712	+	CO	712	+	IR	812	+	IO	812	+	CR	812	+	CO	812													>	150
ROW	I Minimum EDM Hours Required for Each Job																																				
14	IE	301	+	CE	301	+	IE	401	+	CE	401	+	IE	501	+	CE	501	+	IE	601	+	CE	601	>	200												
15	IE	402	+	CE	402	+	IE	502	+	CE	502	+	IE	602	+	CE	602							>	80												
16	IE	403	+	CE	403	+	IE	503	+	CE	503	+	IE	603	+	CE	603							>	10												
17	IE	404	+	CE	404	+	IE	504	+	CE	504	+	IE	604	+	CE	604							>	40												
18	IE	405	+	CE	405	+	IE	505	+	CE	505	+	IE	605	+	CE	605	+	IE	705	+	CE	705	>	200												
19	IE	106	+	CE	106	+	IE	206	+	CE	206	+	IE	306	+	CE	306							>	40												
20	IE	207	+	CE	207	+	IE	307	+	CE	307													>	25												
21	IE	208	+	CE	208	+	IE	308	+	CE	308	+	IE	408	+	CE	408							>	40												
22	IE	409	+	CE	409	+	IE	509	+	CE	509													>	25												
23	IE	610	+	CE	610	+	IE	710	+	CE	710	+	IE	810	+	CE	810							>	40												
24	IE	811	+	CE	811	+	IE	911	+	CE	911													>	25												
25	IE	712	+	CE	712	+	IE	812	+	CE	812													>	40												
ROW	I Maximum Weekly Labor Hours Available																																				
26																IR	106																			<	200
27												+	IR	205	+	IR	206	+	IR	207	+	IR	208													<	200
28	IR	301										+	IR	305	+	IR	306	+	IR	307	+	IR	308													<	200
29	IR	401	+	IR	402	+	IR	403	+	IR	404	+	IR	405							+	IR	408	+	IR	409										<	200
30	IR	501	+	IR	502	+	IR	503	+	IR	504	+	IR	505										+	IR	509										<	200
31	IR	601	+	IR	602	+	IR	603	+	IR	604	+	IR	605													+	IR	610							<	200
32													IR	705													+	IR	710				+	IR	712	<	200
33																												IR	810	+	IR	811	+	IR	812	<	200
34																															IR	911				<	200
35																IO	106																			<	50
36												+	IO	205	+	IO	206	+	IO	207	+	IO	208													<	50
37	IO	301										+	IO	305	+	IO	306	+	IO	307	+	IO	308													<	50
38	IO	401	+	IO	402	+	IO	403	+	IO	404	+	IO	405							+	IO	408	+	IO	409										<	50
39	IO	501	+	IO	502	+	IO	503	+	IO	504	+	IO	505										+	IO	509										<	50
40	IO	601	+	IO	602	+	IO	603	+	IO	604	+	IO	605													+	IO	610							<	50
41													IO	705													+	IO	710				+	IO	712	<	50
42																												IO	810	+	IO	811	+	IO	812	<	50
43																															IO	911				<	50
44																CR	106																			<	100
45												+	CR	205	+	CR	206	+	CR	207	+	CR	208													<	100
46	CR	301										+	CR	305	+	CR	306	+	CR	307	+	CR	308													<	100
47	CR	401	+	CR	402	+	CR	403	+	CR	404	+	CR	405							+	CR	408	+	CR	409										<	100
48	CR	501	+	CR	502	+	CR	503	+	CR	504	+	CR	505										+	CR	509										<	100
49	CR	601	+	CR	602	+	CR	603	+	CR	604	+	CR	605													+	CR	610							<	100
50													CR	705													+	CR	710				+	CR	712	<	100
51																												CR	810	+	CR	811	+	CR	812	<	100
52																															CR	911				<	100
53																CO	106																			<	100
54												+	CO	205	+	CO	206	+	CO	207	+	CO	208													<	100
55	CO	301										+	CO	305	+	CO	306	+	CO	307	+	CO	308													<	100
56	CO	401	+	CO	402	+	CO	403	+	CO	404	+	CO	405							+	CO	408	+	CO	409										<	100
57	CO	501	+	CO	502	+	CO	503	+	CO	504	+	CO	505										+	CO	509										<	100
58	CO	601	+	CO	602	+	CO	603	+	CO	604	+	CO	605													+	CO	610							<	100
59													CO	705													+	CO	710				+	CO	712	<	100
60																												CO	810	+	CO	811	+	CO	812	<	100
61																															CO	911				<	100
	I Maximum Weekly EDM Hours Available																																				
62																IE	106																			<	150
63															+	IE	206	+	IE	207	+	IE	208													<	150
64	IE	301													+	IE	306	+	IE	307	+	IE	308													<	150
65	IE	401	+	IE	402	+	IE	403	+	IE	404	+	IE	405							+	IE	408	+	IE	409										<	150
66	IE	501	+	IE	502	+	IE	503	+	IE	504	+	IE	505										+	IE	509										<	150
67	IE	601	+	IE	602	+	IE	603	+	IE	604	+	IE	605													+	IE	610							<	150
68													IE	705													+	IE	710				+	IE	712	<	150
69																												IE	810	+	IE	811	+	IE	812	<	150
70																															IE	911				<	150
71																CE	106																			<	80
72															+	CE	206	+	CE	207	+	CE	208													<	80
73	CE	301													+	CE	306	+	CE	307	+	CE	308													<	80
74	CE	401	+	CE	402	+	CE	403	+	CE	404	+	CE	405							+	CE	408	+	CE	409										<	80

75	CE	501	+	CE	502	+	CE	503	+	CE	504	+	CE	505										+	CE	509										<	80
76	CE	601	+	CE	602	+	CE	603	+	CE	604	+	CE	605													+	CE	610							<	80
77													CE	705													+	CE	710				+	CE	712	<	80
78																												CE	810	+	CE	811	+	CE	812	<	80
79																															CE	911				<	80

ROW	I Maximum Hours per Week by Project			
80	IR	106	<	80
81	IO	106	<	20
82	IE	106	<	50
83	CR	106	<	50
84	CO	106	<	50
85	CE	106	<	50
86	IR	205	<	120
87	IO	205	<	30
88	CR	205	<	50
89	CO	205	<	50
90	IR	206	<	80
91	IO	206	<	20
92	IE	206	<	50
93	CR	206	<	50
94	CO	206	<	50
95	CE	206	<	50
96	IR	207	<	80
97	IO	207	<	20
98	IE	207	<	50
99	CR	207	<	50
100	CO	207	<	50
101	CE	207	<	50
102	IR	208	<	80
103	IO	208	<	20
104	IE	208	<	50
105	CR	208	<	50
106	CO	208	<	50
107	CE	208	<	50
108	IR	301	<	80
109	IO	301	<	20
110	IE	301	<	50
111	CR	301	<	50
112	CO	301	<	50
113	CE	301	<	50
114	IR	305	<	120
115	IO	305	<	30
116	CR	305	<	50
117	CO	305	<	50
118	IR	306	<	80
119	IO	306	<	20
120	IE	306	<	50
121	CR	306	<	50
122	CO	306	<	50
123	CE	306	<	50
124	IR	307	<	80
125	IO	307	<	20
126	IE	307	<	50
127	CR	307	<	50
128	CO	307	<	50
129	CE	307	<	50
130	IR	308	<	80
131	IO	308	<	20
132	IE	308	<	50
133	CR	308	<	50
134	CO	308	<	50
135	CE	308	<	50
136	IR	401	<	80
137	IO	401	<	20
138	IE	401	<	50
139	CR	401	<	50
140	CO	401	<	50
141	CE	401	<	50
142	IR	402	<	80
143	IO	402	<	20
144	IE	402	<	50
145	CR	402	<	50
146	CO	402	<	50
147	CE	402	<	50
148	IR	403	<	80
149	IO	403	<	20
150	IE	403	<	50
151	CR	403	<	50
152	CO	403	<	50

153	CE	403	<	50
154	IR	404	<	80
155	IO	404	<	20
156	IE	404	<	50
157	CR	404	<	50
158	CO	404	<	50
159	CE	404	<	50
160	IR	405	<	120
161	IO	405	<	30
162	IE	405	<	100
163	CR	405	<	50
164	CO	405	<	50
165	CE	405	<	50
166	IR	408	<	80
167	IO	408	<	20
168	IE	408	<	50
169	CR	408	<	50
170	CO	408	<	50
171	CE	408	<	50
172	IR	409	<	80
173	IO	409	<	20
174	IE	409	<	50
175	CR	409	<	50
176	CO	409	<	50
177	CE	409	<	50
178	IR	501	<	80
179	IO	501	<	20
180	IE	501	<	50
181	CR	501	<	50
182	CO	501	<	50
183	CE	501	<	50
184	IR	502	<	80
185	IO	502	<	20
186	IE	502	<	50
187	CR	502	<	50
188	CO	502	<	50
189	CE	502	<	50
190	IR	503	<	80
191	IO	503	<	20
192	IE	503	<	50
193	CR	503	<	50
194	CO	503	<	50
195	CE	503	<	50
196	IR	504	<	80
197	IO	504	<	20
198	IE	504	<	50
199	CR	504	<	50
200	CO	504	<	50
201	CE	504	<	50
202	IR	505	<	120
203	IO	505	<	30
204	IE	505	<	100
205	CR	505	<	50
206	CO	505	<	50
207	CE	505	<	50
208	IR	509	<	80
209	IO	509	<	20
210	IE	509	<	50
211	CR	509	<	50
212	CO	509	<	50
213	CE	509	<	50
214	IR	601	<	80
215	IO	601	<	20
216	IE	601	<	50
217	CR	601	<	50
218	CO	601	<	50
219	CE	601	<	50
220	IR	602	<	80
221	IO	602	<	20
222	IE	602	<	50
223	CR	602	<	50
224	CO	602	<	50
225	CE	602	<	50
226	IR	603	<	80
227	IO	603	<	20
228	IE	603	<	50
229	CR	603	<	50
230	CO	603	<	50
231	CE	603	<	50

232	IR	604	<	80									
233	IO	604	<	20									
234	IE	604	<	50									
235	CR	604	<	50									
236	CO	604	<	50									
237	CE	604	<	50									
238	IR	605	<	120									
239	IO	605	<	30									
240	IE	605	<	100									
241	CR	605	<	50									
242	CO	605	<	50									
243	CE	605	<	50									
244	IR	610	<	80									
245	IO	610	<	20									
246	IE	610	<	50									
247	CR	610	<	50									
248	CO	610	<	50									
249	CE	610	<	50									
250	IR	705	<	120									
251	IO	705	<	30									
252	IE	705	<	100									
253	CR	705	<	50									
254	CO	705	<	50									
255	CE	705	<	50									
256	IR	710	<	80									
257	IO	710	<	20									
258	IE	710	<	50									
259	CR	710	<	50									
260	CO	710	<	50									
261	CE	710	<	50									
262	IR	712	<	80									
263	IO	712	<	20									
264	IE	712	<	50									
265	CR	712	<	50									
266	CO	712	<	50									
267	CE	712	<	50									
268	IR	810	<	80									
269	IO	810	<	20									
270	IE	810	<	50									
271	CR	810	<	50									
272	CO	810	<	50									
273	CE	810	<	50									
274	IR	811	<	80									
275	IO	811	<	20									
276	IE	811	<	50									
277	CR	811	<	50									
278	CO	811	<	50									
279	CE	811	<	50									
280	IR	812	<	80									
281	IO	812	<	20									
282	IE	812	<	50									
283	CR	812	<	50									
284	CO	812	<	50									
285	CE	812	<	50									
286	IR	911	<	80									
287	IO	911	<	20									
288	IE	911	<	50									
289	CR	911	<	50									
290	CO	911	<	50									
291	CE	911	<	50									
292	IR	106	+	IO	106	+	CR	106	+	CO	106	<	100
293	IR	205	+	IO	205	+	CR	205	+	CO	205	<	150
294	IR	206	+	IO	206	+	CR	206	+	CO	206	<	100
295	IR	207	+	IO	207	+	CR	207	+	CO	207	<	100
296	IR	208	+	IO	208	+	CR	208	+	CO	208	<	100
297	IR	301	+	IO	301	+	CR	301	+	CO	301	<	100
298	IR	305	+	IO	305	+	CR	305	+	CO	305	<	150
299	IR	306	+	IO	306	+	CR	306	+	CO	306	<	100
300	IR	307	+	IO	307	+	CR	307	+	CO	307	<	100
301	IR	308	+	IO	308	+	CR	308	+	CO	308	<	100
302	IR	401	+	IO	401	+	CR	401	+	CO	401	<	100
303	IR	402	+	IO	402	+	CR	402	+	CO	402	<	100
304	IR	403	+	IO	403	+	CR	403	+	CO	403	<	100
305	IR	404	+	IO	404	+	CR	404	+	CO	404	<	100
306	IR	405	+	IO	405	+	CR	405	+	CO	405	<	150
307	IR	408	+	IO	408	+	CR	408	+	CO	408	<	100
308	IR	409	+	IO	409	+	CR	409	+	CO	409	<	100
309	IR	501	+	IO	501	+	CR	501	+	CO	501	<	100
310	IR	502	+	IO	502	+	CR	502	+	CO	502	<	100

311	IR	503	+	IO	503	+	CR	503	+	CO	503	<	100
312	IR	504	+	IO	504	+	CR	504	+	CO	504	<	100
313	IR	505	+	IO	505	+	CR	505	+	CO	505	<	150
314	IR	509	+	IO	509	+	CR	509	+	CO	509	<	100
315	IR	601	+	IO	601	+	CR	601	+	CO	601	<	100
316	IR	602	+	IO	602	+	CR	602	+	CO	602	<	100
317	IR	603	+	IO	603	+	CR	603	+	CO	603	<	100
318	IR	604	+	IO	604	+	CR	604	+	CO	604	<	100
319	IR	605	+	IO	605	+	CR	605	+	CO	605	<	150
320	IR	610	+	IO	610	+	CR	610	+	CO	610	<	100
321	IR	705	+	IO	705	+	CR	705	+	CO	705	<	120
322	IR	710	+	IO	710	+	CR	710	+	CO	710	<	100
323	IR	712	+	IO	712	+	CR	712	+	CO	712	<	100
324	IR	810	+	IO	810	+	CR	810	+	CO	810	<	100
325	IR	811	+	IO	811	+	CR	811	+	CO	811	<	100
326	IR	812	+	IO	812	+	CR	812	+	CO	812	<	100
327	IR	911	+	IO	911	+	CR	911	+	CO	911	<	100
ROW	Labor Constraint for EDM												
328	IE	301	-	IR	301	-	IO	301	<	0			
329	IE	401	-	IR	401	-	IO	401	<	0			
330	IE	501	-	IR	501	-	IO	501	<	0			
331	IE	601	-	IR	601	-	IO	601	<	0			
332	IE	402	-	IR	402	-	IO	402	<	0			
333	IE	502	-	IR	502	-	IO	502	<	0			
334	IE	602	-	IR	602	-	IO	602	<	0			
335	IE	403	-	IR	403	-	IO	403	<	0			
336	IE	503	-	IR	503	-	IO	503	<	0			
337	IE	603	-	IR	603	-	IO	603	<	0			
338	IE	404	-	IR	404	-	IO	404	<	0			
339	IE	504	-	IR	504	-	IO	504	<	0			
340	IE	604	-	IR	604	-	IO	604	<	0			
341	IE	405	-	IR	405	-	IO	405	<	0			
342	IE	505	-	IR	505	-	IO	505	<	0			
343	IE	605	-	IR	605	-	IO	605	<	0			
344	IE	705	-	IR	705	-	IO	705	<	0			
345	IE	106	-	IR	106	-	IO	106	<	0			
346	IE	206	-	IR	206	-	IO	206	<	0			
347	IE	306	-	IR	306	-	IO	306	<	0			
348	IE	207	-	IR	207	-	IO	207	<	0			
349	IE	307	-	IR	307	-	IO	307	<	0			
350	IE	208	-	IR	208	-	IO	208	<	0			
351	IE	308	-	IR	308	-	IO	308	<	0			
352	IE	408	-	IR	408	-	IO	408	<	0			
353	IE	409	-	IR	409	-	IO	409	<	0			
354	IE	509	-	IR	509	-	IO	509	<	0			
355	IE	610	-	IR	610	-	IO	610	<	0			
356	IE	710	-	IR	710	-	IO	710	<	0			
357	IE	810	-	IR	810	-	IO	810	<	0			
358	IE	811	-	IR	811	-	IO	811	<	0			
359	IE	911	-	IR	911	-	IO	911	<	0			
360	IE	712	-	IR	712	-	IO	712	<	0			
361	IE	812	-	IR	812	-	IO	812	<	0			
362	CE	301	-	CR	301	-	CO	301	<	0			
363	CE	401	-	CR	401	-	CO	401	<	0			
364	CE	501	-	CR	501	-	CO	501	<	0			
365	CE	601	-	CR	601	-	CO	601	<	0			
366	CE	402	-	CR	402	-	CO	402	<	0			
367	CE	502	-	CR	502	-	CO	502	<	0			
368	CE	602	-	CR	602	-	CO	602	<	0			
369	CE	403	-	CR	403	-	CO	403	<	0			
370	CE	503	-	CR	503	-	CO	503	<	0			
371	CE	603	-	CR	603	-	CO	603	<	0			
372	CE	404	-	CR	404	-	CO	404	<	0			
373	CE	504	-	CR	504	-	CO	504	<	0			
374	CE	604	-	CR	604	-	CO	604	<	0			
375	CE	405	-	CR	405	-	CO	405	<	0			
376	CE	505	-	CR	505	-	CO	505	<	0			
377	CE	605	-	CR	605	-	CO	605	<	0			
378	CE	705	-	CR	705	-	CO	705	<	0			
379	CE	106	-	CR	106	-	CO	106	<	0			
380	CE	206	-	CR	206	-	CO	206	<	0			
381	CE	306	-	CR	306	-	CO	306	<	0			
382	CE	207	-	CR	207	-	CO	207	<	0			
383	CE	307	-	CR	307	-	CO	307	<	0			
384	CE	208	-	CR	208	-	CO	208	<	0			
385	CE	308	-	CR	308	-	CO	308	<	0			
386	CE	408	-	CR	408	-	CO	408	<	0			
387	CE	409	-	CR	409	-	CO	409	<	0			
388	CE	509	-	CR	509	-	CO	509	<	0			

389	CE	610	-	CR	610	-	CO	610	<	0
390	CE	710	-	CR	710	-	CO	710	<	0
391	CE	810	-	CR	810	-	CO	810	<	0
392	CE	811	-	CR	811	-	CO	811	<	0
393	CE	911	-	CR	911	-	CO	911	<	0
394	CE	712	-	CR	712	-	CO	712	<	0
395	CE	812	-	CR	812	-	CO	812	<	0

Objective Function

Version 1																							
Minimize	45	IO	106	+	45	IO	205	+	45	IO	206	+	45	IO	207	+	45	IO	208	+	45	IO	301
+	45	IO	305	+	45	IO	306	+	45	IO	307	+	45	IO	308	+	45	IO	401	+	45	IO	402
+	45	IO	403	+	45	IO	404	+	45	IO	405	+	45	IO	408	+	45	IO	409	+	45	IO	501
+	45	IO	502	+	45	IO	503	+	45	IO	504	+	45	IO	505	+	45	IO	509	+	45	IO	601
+	45	IO	602	+	45	IO	603	+	45	IO	604	+	45	IO	605	+	45	IO	610	+	45	IO	705
+	45	IO	710	+	45	IO	712	+	45	IO	810	+	45	IO	811	+	45	IO	812	+	45	IO	911
+	50	CR	106	+	50	CR	205	+	50	CR	206	+	50	CR	207	+	50	CR	208	+	50	CR	301
+	50	CR	305	+	50	CR	306	+	50	CR	307	+	50	CR	308	+	50	CR	401	+	50	CR	402
+	50	CR	403	+	50	CR	404	+	50	CR	405	+	50	CR	408	+	50	CR	409	+	50	CR	501
+	50	CR	502	+	50	CR	503	+	50	CR	504	+	50	CR	505	+	50	CR	509	+	50	CR	601
+	50	CR	602	+	50	CR	603	+	50	CR	604	+	50	CR	605	+	50	CR	610	+	50	CR	705
+	50	CR	710	+	50	CR	712	+	50	CR	810	+	50	CR	811	+	50	CR	812	+	50	CR	911
+	72	CO	106	+	72	CO	205	+	72	CO	206	+	72	CO	207	+	72	CO	208	+	72	CO	301
+	72	CO	305	+	72	CO	306	+	72	CO	307	+	72	CO	308	+	72	CO	401	+	72	CO	402
+	72	CO	403	+	72	CO	404	+	72	CO	405	+	72	CO	408	+	72	CO	409	+	72	CO	501
+	72	CO	502	+	72	CO	503	+	72	CO	504	+	72	CO	505	+	72	CO	509	+	72	CO	601
+	72	CO	602	+	72	CO	603	+	72	CO	604	+	72	CO	605	+	72	CO	610	+	72	CO	705
+	72	CO	710	+	72	CO	712	+	72	CO	810	+	72	CO	811	+	72	CO	812	+	72	CO	911
Version 2																							
Minimize	55	IO	106	+	55	IO	205	+	55	IO	206	+	55	IO	207	+	55	IO	208	+	55	IO	301
+	55	IO	305	+	55	IO	306	+	55	IO	307	+	55	IO	308	+	55	IO	401	+	55	IO	402
+	55	IO	403	+	55	IO	404	+	55	IO	405	+	55	IO	408	+	55	IO	409	+	55	IO	501
+	55	IO	502	+	55	IO	503	+	55	IO	504	+	55	IO	505	+	55	IO	509	+	55	IO	601
+	55	IO	602	+	55	IO	603	+	55	IO	604	+	55	IO	605	+	55	IO	610	+	55	IO	705
+	55	IO	710	+	55	IO	712	+	55	IO	810	+	55	IO	811	+	55	IO	812	+	55	IO	911
+	50	CR	106	+	50	CR	205	+	50	CR	206	+	50	CR	207	+	50	CR	208	+	50	CR	301
+	50	CR	305	+	50	CR	306	+	50	CR	307	+	50	CR	308	+	50	CR	401	+	50	CR	402
+	50	CR	403	+	50	CR	404	+	50	CR	405	+	50	CR	408	+	50	CR	409	+	50	CR	501
+	50	CR	502	+	50	CR	503	+	50	CR	504	+	50	CR	505	+	50	CR	509	+	50	CR	601
+	50	CR	602	+	50	CR	603	+	50	CR	604	+	50	CR	605	+	50	CR	610	+	50	CR	705
+	50	CR	710	+	50	CR	712	+	50	CR	810	+	50	CR	811	+	50	CR	812	+	50	CR	911
+	72	CO	106	+	72	CO	205	+	72	CO	206	+	72	CO	207	+	72	CO	208	+	72	CO	301
+	72	CO	305	+	72	CO	306	+	72	CO	307	+	72	CO	308	+	72	CO	401	+	72	CO	402
+	72	CO	403	+	72	CO	404	+	72	CO	405	+	72	CO	408	+	72	CO	409	+	72	CO	501
+	72	CO	502	+	72	CO	503	+	72	CO	504	+	72	CO	505	+	72	CO	509	+	72	CO	601
+	72	CO	602	+	72	CO	603	+	72	CO	604	+	72	CO	605	+	72	CO	610	+	72	CO	705
+	72	CO	710	+	72	CO	712	+	72	CO	810	+	72	CO	811	+	72	CO	812	+	72	CO	911

look all

LINDO MODEL VERSION I

```
 MIN      45 IO106 + 45 IO205 + 45 IO206 + 45 IO207 + 45 IO208 + 45 IO301
       + 45 IO305 + 45 IO306 + 45 IO307 + 45 IO308 + 45 IO401 + 45 IO402
       + 45 IO403 + 45 IO404 + 45 IO405 + 45 IO408 + 45 IO409 + 45 IO501
       + 45 IO502 + 45 IO503 + 45 IO504 + 45 IO505 + 45 IO509 + 45 IO601
       + 45 IO602 + 45 IO603 + 45 IO604 + 45 IO605 + 45 IO610 + 45 IO705
       + 45 IO710 + 45 IO712 + 45 IO810 + 45 IO811 + 45 IO812 + 45 IO911
       + 50 CR106 + 50 CR205 + 50 CR206 + 50 CR207 + 50 CR208 + 50 CR301
       + 50 CR305 + 50 CR306 + 50 CR307 + 50 CR308 + 50 CR401 + 50 CR402
       + 50 CR403 + 50 CR404 + 50 CR405 + 50 CR408 + 50 CR409 + 50 CR501
       + 50 CR502 + 50 CR503 + 50 CR504 + 50 CR505 + 50 CR509 + 50 CR601
       + 50 CR602 + 50 CR603 + 50 CR604 + 50 CR605 + 50 CR610 + 50 CR705
       + 50 CR710 + 50 CR712 + 50 CR810 + 50 CR811 + 50 CR812 + 50 CR911
       + 72 CO106 + 72 CO205 + 72 CO206 + 72 CO207 + 72 CO208 + 72 CO301
       + 72 CO305 + 72 CO306 + 72 CO307 + 72 CO308 + 72 CO401 + 72 CO402
       + 72 CO403 + 72 CO404 + 72 CO405 + 72 CO408 + 72 CO409 + 72 CO501
       + 72 CO502 + 72 CO503 + 72 CO504 + 72 CO505 + 72 CO509 + 72 CO601
       + 72 CO602 + 72 CO603 + 72 CO604 + 72 CO605 + 72 CO610 + 72 CO705
       + 72 CO710 + 72 CO712 + 72 CO810 + 72 CO811 + 72 CO812 + 72 CO911
 SUBJECT TO
        2)   IO301 + IO401 + IO501 + IO601 + CR301 + CR401 + CR501 + CR601
       + CO301 + CO401 + CO501 + CO601 + IR301 + IR401 + IR501 + IR601
       >=   350
        3)   IO402 + IO502 + IO602 + CR402 + CR502 + CR602 + CO402 + CO502
       + CO602 + IR402 + IR502 + IR602 >=   130
--MORE--
        4)   IO403 + IO503 + IO603 + CR403 + CR503 + CR603 + CO403 + CO503
       + CO603 + IR403 + IR503 + IR603 >=   200
        5)   IO404 + IO504 + IO604 + CR404 + CR504 + CR604 + CO404 + CO504
       + CO604 + IR404 + IR504 + IR604 >=   160
        6)   IO205 + IO305 + IO405 + IO505 + IO605 + IO705 + CR205 + CR305
       + CR405 + CR505 + CR605 + CR705 + CO205 + CO305 + CO405 + CO505
       + CO605 + CO705 + IR205 + IR305 + IR405 + IR505 + IR605 + IR705
       >=   800
        7)   IO106 + IO206 + IO306 + CR106 + CR206 + CR306 + CO106 + CO206
       + CO306 + IR106 + IR206 + IR306 >=   200
        8)   IO207 + IO307 + CR207 + CR307 + CO207 + CO307 + IR207 + IR307
       >=   100
        9)   IO208 + IO308 + IO408 + CR208 + CR308 + CR408 + CO208 + CO308
       + CO408 + IR208 + IR308 + IR408 >=   200
       10)   IO409 + IO509 + CR409 + CR509 + CO409 + CO509 + IR409 + IR509
       >=   100
       11)   IO610 + IO710 + IO810 + CR610 + CR710 + CR810 + CO610 + CO710
       + CO810 + IR610 + IR710 + IR810 >=   200
       12)   IO811 + IO911 + CR811 + CR911 + CO811 + CO911 + IR811 + IR911
       >=   100
       13)   IO712 + IO812 + CR712 + CR812 + CO712 + CO812 + IR712 + IR812
       >=   150
       14)   IE301 + CE301 + IE401 + CE401 + IE501 + CE501 + IE601 + CE601
       >=   200
--MORE--
       15)   IE402 + CE402 + IE502 + CE502 + IE602 + CE602 >=    80
       16)   IE403 + CE403 + IE503 + CE503 + IE603 + CE603 >=    10
       17)   IE404 + CE404 + IE504 + CE504 + IE604 + CE604 >=    40
       18)   IE405 + CE405 + IE505 + CE505 + IE605 + CE605 + IE705 + CE705
       >=   200
       19)   IE106 + CE106 + IE206 + CE206 + IE306 + CE306 >=    40
       20)   IE207 + CE207 + IE307 + CE307 >=    25
       21)   IE208 + CE208 + IE308 + CE308 + IE408 + CE408 >=    40
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      22)   IE409 + CE409 + IE509 + CE509 >=   25
      23)   IE610 + CE610 + IE710 + CE710 + IE810 + CE810 >=   40
      24)   IE811 + CE811 + IE911 + CE911 >=   25
      25)   IE712 + CE712 + IE812 + CE812 >=   40
      26)   IR106 <=   200
      27)   IR205 + IR206 + IR207 + IR208 <=   200
      28)   IR301 + IR305 + IR306 + IR307 + IR308 <=   200
      29)   IR401 + IR402 + IR403 + IR404 + IR405 + IR408 + IR409 <=   200
      30)   IR501 + IR502 + IR503 + IR504 + IR505 + IR509 <=   200
      31)   IR601 + IR602 + IR603 + IR604 + IR605 + IR610 <=   200
      32)   IR705 + IR710 + IR712 <=   200
      33)   IR810 + IR811 + IR812 <=   200
      34)   IR911 <=   200
      35)   IO106 <=   50
      36)   IO205 + IO206 + IO207 + IO208 <=   50
      37)   IO301 + IO305 + IO306 + IO307 + IO308 <=   50
--MORE--
      38)   IO401 + IO402 + IO403 + IO404 + IO405 + IO408 + IO409 <=   50
      39)   IO501 + IO502 + IO503 + IO504 + IO505 + IO509 <=   50
      40)   IO601 + IO602 + IO603 + IO604 + IO605 + IO610 <=   50
      41)   IO705 + IO710 + IO712 <=   50
      42)   IO810 + IO811 + IO812 <=   50
      43)   IO911 <=   50
      44)   CR106 <=   100
      45)   CR205 + CR206 + CR207 + CR208 <=   100
      46)   CR301 + CR305 + CR306 + CR307 + CR308 <=   100
      47)   CR401 + CR402 + CR403 + CR404 + CR405 + CR408 + CR409 <=   100
      48)   CR501 + CR502 + CR503 + CR504 + CR505 + CR509 <=   100
      49)   CR601 + CR602 + CR603 + CR604 + CR605 + CR610 <=   100
      50)   CR705 + CR710 + CR712 <=   100
      51)   CR810 + CR811 + CR812 <=   100
      52)   CR911 <=   100
      53)   CO106 <=   100
      54)   CO205 + CO206 + CO207 + CO208 <=   100
      55)   CO301 + CO305 + CO306 + CO307 + CO308 <=   100
      56)   CO401 + CO402 + CO403 + CO404 + CO405 + CO408 + CO409 <=   100
      57)   CO501 + CO502 + CO503 + CO504 + CO505 + CO509 <=   100
      58)   CO601 + CO602 + CO603 + CO604 + CO605 + CO610 <=   100
      59)   CO705 + CO710 + CO712 <=   100
      60)   CO810 + CO811 + CO812 <=   100
      61)   CO911 <=   100
--MORE--
      62)   IE106 <=   150
      63)   IE206 + IE207 + IE208 <=   150
      64)   IE301 + IE306 + IE307 + IE308 <=   150
      65)   IE401 + IE402 + IE403 + IE404 + IE405 + IE408 + IE409 <=   150
      66)   IE501 + IE502 + IE503 + IE504 + IE505 + IE509 <=   150
      67)   IE601 + IE602 + IE603 + IE604 + IE605 + IE610 <=   150
      68)   IE705 + IE710 + IE712 <=   150
      69)   IE810 + IE811 + IE812 <=   150
      70)   IE911 <=   150
      71)   CE106 <=   80
      72)   CE206 + CE207 + CE208 <=   80
      73)   CE301 + CE306 + CE307 + CE308 <=   80
      74)   CE401 + CE402 + CE403 + CE404 + CE405 + CE408 + CE409 <=   80
      75)   CE501 + CE502 + CE503 + CE504 + CE505 + CE509 <=   80
      76)   CE601 + CE602 + CE603 + CE604 + CE605 + CE610 <=   80
      77)   CE705 + CE710 + CE712 <=   80
      78)   CE810 + CE811 + CE812 <=   80
      79)   CE911 <=   80
```

```
        80)    IR106 <=    80
        81)    IO106 <=    20
        82)    IE106 <=    50
        83)    CR106 <=    50
        84)    CO106 <=    50
        85)    CE106 <=    50
--MORE--
        86)    IR205 <=    120
        87)    IO205 <=    30
        88)    CR205 <=    50
        89)    CO205 <=    50
        90)    IR206 <=    80
        91)    IO206 <=    20
        92)    IE206 <=    50
        93)    CR206 <=    50
        94)    CO206 <=    50
        95)    CE206 <=    50
        96)    IR207 <=    80
        97)    IO207 <=    20
        98)    IE207 <=    50
        99)    CR207 <=    50
       100)    CO207 <=    50
       101)    CE207 <=    50
       102)    IR208 <=    80
       103)    IO208 <=    20
       104)    IE208 <=    50
       105)    CR208 <=    50
       106)    CO208 <=    50
       107)    CE208 <=    50
       108)    IR301 <=    80
       109)    IO301 <=    20
--MORE--
       110)    IE301 <=    50
       111)    CR301 <=    50
       112)    CO301 <=    50
       113)    CE301 <=    50
       114)    IR305 <=    120
       115)    IO305 <=    30
       116)    CR305 <=    50
       117)    CO305 <=    50
       118)    IR306 <=    80
       119)    IO306 <=    20
       120)    IE306 <=    50
       121)    CR306 <=    50
       122)    CO306 <=    50
       123)    CE306 <=    50
       124)    IR307 <=    80
       125)    IO307 <=    20
       126)    IE307 <=    50
       127)    CR307 <=    50
       128)    CO307 <=    50
       129)    CE307 <=    50
       130)    IR308 <=    80
       131)    IO308 <=    20
       132)    IE308 <=    50
       133)    CR308 <=    50
-  ORE--
       134)    CO308 <=    50
       135)    CE308 <=    50
       136)    IR401 <=    80
```

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     137)   IO401 <=   20
     138)   IE401 <=   50
     139)   CR401 <=   50
     140)   CO401 <=   50
     141)   CE401 <=   50
     142)   IR402 <=   80
     143)   IO402 <=   20
     144)   IE402 <=   50
     145)   CR402 <=   50
     146)   CO402 <=   50
     147)   CE402 <=   50
     148)   IR403 <=   80
     149)   IO403 <=   20
     150)   IE403 <=   50
     151)   CR403 <=   50
     152)   CO403 <=   50
     153)   CE403 <=   50
     154)   IR404 <=   80
     155)   IO404 <=   20
     156)   IE404 <=   50
     157)   CR404 <=   50
--MORE--
     158)   CO404 <=   50
     159)   CE404 <=   50
     160)   IR405 <=   120
     161)   IO405 <=   30
     162)   IE405 <=   100
     163)   CR405 <=   50
     164)   CO405 <=   50
     165)   CE405 <=   50
     166)   IR408 <=   80
     167)   IO408 <=   20
     168)   IE408 <=   50
     169)   CR408 <=   50
     170)   CO408 <=   50
     171)   CE408 <=   50
     172)   IR409 <=   80
     173)   IO409 <=   20
     174)   IE409 <=   50
     175)   CR409 <=   50
     176)   CO409 <=   50
     177)   CE409 <=   50
     178)   IR501 <=   80
     179)   IO501 <=   20
     180)   IE501 <=   50
     181)   CR501 <=   50
--MORE--
     182)   CO501 <=   50
     183)   CE501 <=   50
     184)   IR502 <=   80
     185)   IO502 <=   20
     186)   IE502 <=   50
     187)   CR502 <=   50
     188)   CO502 <=   50
     189)   CE502 <=   50
     190)   IR503 <=   80
     191)   IO503 <=   20
     192)   IE503 <=   50
     193)   CR503 <=   50
     194)   CO503 <=   50
```

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      195)   CE503 <=   50
      196)   IR504 <=   80
      197)   IO504 <=   20
      198)   IE504 <=   50
      199)   CR504 <=   50
      200)   CO504 <=   50
      201)   CE504 <=   50
      202)   IR505 <=   120
      203)   IO505 <=   30
      204)   IE505 <=   100
      205)   CR505 <=   50
--MORE--
      206)   CO505 <=   50
      207)   CE505 <=   50
      208)   IR509 <=   80
      209)   IO509 <=   20
      210)   IE509 <=   50
      211)   CR509 <=   50
      212)   CO509 <=   50
      213)   CE509 <=   50
      214)   IR601 <=   80
      215)   IO601 <=   20
      216)   IE601 <=   50
      217)   CR601 <=   50
      218)   CO601 <=   50
      219)   CE601 <=   50
      220)   IR602 <=   80
      221)   IO602 <=   20
      222)   IE602 <=   50
      223)   CR602 <=   50
      224)   CO602 <=   50
      225)   CE602 <=   50
      226)   IR603 <=   80
      227)   IO603 <=   20
      228)   IE603 <=   50
      229)   CR603 <=   50
--MORE--
      230)   CO603 <=   50
      231)   CE603 <=   50
      232)   IR604 <=   80
      233)   IO604 <=   20
      234)   IE604 <=   50
      235)   CR604 <=   50
      236)   CO604 <=   50
      237)   CE604 <=   50
      238)   IR605 <=   120
      239)   IO605 <=   30
      240)   IE605 <=   100
      241)   CR605 <=   50
      242)   CO605 <=   50
      243)   CE605 <=   50
      244)   IR610 <=   80
      245)   IO610 <=   20
      246)   IE610 <=   50
      247)   CR610 <=   50
      248)   CO610 <=   50
      249)   CE610 <=   50
      250)   IR705 <=   120
      251)   IO705 <=   30
      252)   IE705 <=   100
```

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      253)   CR705 <=   50
--MORE--
      254)   CO705 <=   50
      255)   CE705 <=   50
      256)   IR710 <=   80
      257)   IO710 <=   20
      258)   IE710 <=   50
      259)   CR710 <=   50
      260)   CO710 <=   50
      261)   CE710 <=   50
      262)   IR712 <=   80
      263)   IO712 <=   20
      264)   IE712 <=   50
      265)   CR712 <=   50
      266)   CO712 <=   50
      267)   CE712 <=   50
      268)   IR810 <=   80
      269)   IO810 <=   20
      270)   IE810 <=   50
      271)   CR810 <=   50
      272)   CO810 <=   50
      273)   CE810 <=   50
      274)   IR811 <=   80
      275)   IO811 <=   20
      276)   IE811 <=   50
      277)   CR811 <=   50
--MORE--
      278)   CO811 <=   50
      279)   CE811 <=   50
      280)   IR812 <=   80
      281)   IO812 <=   20
      282)   IE812 <=   50
      283)   CR812 <=   50
      284)   CO812 <=   50
      285)   CE812 <=   50
      286)   IR911 <=   80
      287)   IO911 <=   20
      288)   IE911 <=   50
      289)   CR911 <=   50
      290)   CO911 <=   50
      291)   CE911 <=   50
      292)   IO106 + CR106 + CO106 + IR106 <=   100
      293)   IO205 + CR205 + CO205 + IR205 <=   150
      294)   IO206 + CR206 + CO206 + IR206 <=   100
      295)   IO207 + CR207 + CO207 + IR207 <=   100
      296)   IO208 + CR208 + CO208 + IR208 <=   100
      297)   IO301 + CR301 + CO301 + IR301 <=   100
      298)   IO305 + CR305 + CO305 + IR305 <=   150
      299)   IO306 + CR306 + CO306 + IR306 <=   100
      300)   IO307 + CR307 + CO307 + IR307 <=   100
      301)   IO308 + CR308 + CO308 + IR308 <=   100
--MORE--
      302)   IO401 + CR401 + CO401 + IR401 <=   100
      303)   IO402 + CR402 + CO402 + IR402 <=   100
      304)   IO403 + CR403 + CO403 + IR403 <=   100
      305)   IO404 + CR404 + CO404 + IR404 <=   100
      306)   IO405 + CR405 + CO405 + IR405 <=   150
      307)   IO408 + CR408 + CO408 + IR408 <=   100
      308)   IO409 + CR409 + CO409 + IR409 <=   100
      309)   IO501 + CR501 + CO501 + IR501 <=   100
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      310)    IO502 + CR502 + CO502 + IR502 <=    100
      311)    IO503 + CR503 + CO503 + IR503 <=    100
      312)    IO504 + CR504 + CO504 + IR504 <=    100
      313)    IO505 + CR505 + CO505 + IR505 <=    150
      314)    IO509 + CR509 + CO509 + IR509 <=    100
      315)    IO601 + CR601 + CO601 + IR601 <=    100
      316)    IO602 + CR602 + CO602 + IR602 <=    100
      317)    IO603 + CR603 + CO603 + IR603 <=    100
      318)    IO604 + CR604 + CO604 + IR604 <=    100
      319)    IO605 + CR605 + CO605 + IR605 <=    150
      320)    IO610 + CR610 + CO610 + IR610 <=    100
      321)    IO705 + CR705 + CO705 + IR705 <=    120
      322)    IO710 + CR710 + CO710 + IR710 <=    100
      323)    IO712 + CR712 + CO712 + IR712 <=    100
      324)    IO810 + CR810 + CO810 + IR810 <=    100
      325)    IO811 + CR811 + CO811 + IR811 <=    100
--MORE--
      326)    IO812 + CR812 + CO812 + IR812 <=    100
      327)    IO911 + CR911 + CO911 + IR911 <=    100
      328) - IO301 - IR301 + IE301 <=    0
      329) - IO401 - IR401 + IE401 <=    0
      330) - IO501 - IR501 + IE501 <=    0
      331) - IO601 - IR601 + IE601 <=    0
      332) - IO402 - IR402 + IE402 <=    0
      333) - IO502 - IR502 + IE502 <=    0
      334) - IO602 - IR602 + IE602 <=    0
      335) - IO403 - IR403 + IE403 <=    0
      336) - IO503 - IR503 + IE503 <=    0
      337) - IO603 - IR603 + IE603 <=    0
      338) - IO404 - IR404 + IE404 <=    0
      339) - IO504 - IR504 + IE504 <=    0
      340) - IO604 - IR604 + IE604 <=    0
      341) - IO405 - IR405 + IE405 <=    0
      342) - IO505 - IR505 + IE505 <=    0
      343) - IO605 - IR605 + IE605 <=    0
      344) - IO705 - IR705 + IE705 <=    0
      345) - IO106 - IR106 + IE106 <=    0
      346) - IO206 - IR206 + IE206 <=    0
      347) - IO306 - IR306 + IE306 <=    0
      348) - IO207 - IR207 + IE207 <=    0
      349) - IO307 - IR307 + IE307 <=    0
--MORE--
      350) - IO208 - IR208 + IE208 <=    0
      351) - IO308 - IR308 + IE308 <=    0
      352) - IO408 - IR408 + IE408 <=    0
      353) - IO409 - IR409 + IE409 <=    0
      354) - IO509 - IR509 + IE509 <=    0
      355) - IO610 - IR610 + IE610 <=    0
      356) - IO710 - IR710 + IE710 <=    0
      357) - IO810 - IR810 + IE810 <=    0
      358) - IO811 - IR811 + IE811 <=    0
      359) - IO911 - IR911 + IE911 <=    0
      360) - IO712 - IR712 + IE712 <=    0
      361) - IO812 - IR812 + IE812 <=    0
      362) - CR301 - CO301 + CE301 <=    0
      363) - CR401 - CO401 + CE401 <=    0
      364) - CR501 - CO501 + CE501 <=    0
      365) - CR601 - CO601 + CE601 <=    0
      366) - CR402 - CO402 + CE402 <=    0
      367) - CR502 - CO502 + CE502 <=    0
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      368) - CR602 - CO602 + CE602 <=    0
      369) - CR403 - CO403 + CE403 <=    0
      370) - CR503 - CO503 + CE503 <=    0
      371) - CR603 - CO603 + CE603 <=    0
      372) - CR404 - CO404 + CE404 <=    0
      373) - CR504 - CO504 + CE504 <=    0
--MORE--
      374) - CR604 - CO604 + CE604 <=    0
      375) - CR405 - CO405 + CE405 <=    0
      376) - CR505 - CO505 + CE505 <=    0
      377) - CR605 - CO605 + CE605 <=    0
      378) - CR705 - CO705 + CE705 <=    0
      379) - CR106 - CO106 + CE106 <=    0
      380) - CR206 - CO206 + CE206 <=    0
      381) - CR306 - CO306 + CE306 <=    0
      382) - CR207 - CO207 + CE207 <=    0
      383) - CR307 - CO307 + CE307 <=    0
      384) - CR208 - CO208 + CE208 <=    0
      385) - CR308 - CO308 + CE308 <=    0
      386) - CR408 - CO408 + CE408 <=    0
      387) - CR409 - CO409 + CE409 <=    0
      388) - CR509 - CO509 + CE509 <=    0
      389) - CR610 - CO610 + CE610 <=    0
      390) - CR710 - CO710 + CE710 <=    0
      391) - CR810 - CO810 + CE810 <=    0
      392) - CR811 - CO811 + CE811 <=    0
      393) - CR911 - CO911 + CE911 <=    0
      394) - CR712 - CO712 + CE712 <=    0
      395) - CR812 - CO812 + CE812 <=    0
 END
-  ORE--

:
```

look all LINDO MODEL VERSION 2

```
 MIN      55 IO106 + 55 IO205 + 55 IO206 + 55 IO207 + 55 IO208 + 55 IO301
       + 55 IO305 + 55 IO306 + 55 IO307 + 55 IO308 + 55 IO401 + 55 IO402
       + 55 IO403 + 55 IO404 + 55 IO405 + 55 IO408 + 55 IO409 + 55 IO501
       + 55 IO502 + 55 IO503 + 55 IO504 + 55 IO505 + 55 IO509 + 55 IO601
       + 55 IO602 + 55 IO603 + 55 IO604 + 55 IO605 + 55 IO610 + 55 IO705
       + 55 IO710 + 55 IO712 + 55 IO810 + 55 IO811 + 55 IO812 + 55 IO911
       + 50 CR106 + 50 CR205 + 50 CR206 + 50 CR207 + 50 CR208 + 50 CR301
       + 50 CR305 + 50 CR306 + 50 CR307 + 50 CR308 + 50 CR401 + 50 CR402
       + 50 CR403 + 50 CR404 + 50 CR405 + 50 CR408 + 50 CR409 + 50 CR501
       + 50 CR502 + 50 CR503 + 50 CR504 + 50 CR505 + 50 CR509 + 50 CR601
       + 50 CR602 + 50 CR603 + 50 CR604 + 50 CR605 + 50 CR610 + 50 CR705
       + 50 CR710 + 50 CR712 + 50 CR810 + 50 CR811 + 50 CR812 + 50 CR911
       + 72 CO106 + 72 CO205 + 72 CO206 + 72 CO207 + 72 CO208 + 72 CO301
       + 72 CO305 + 72 CO306 + 72 CO307 + 72 CO308 + 72 CO401 + 72 CO402
       + 72 CO403 + 72 CO404 + 72 CO405 + 72 CO408 + 72 CO409 + 72 CO501
       + 72 CO502 + 72 CO503 + 72 CO504 + 72 CO505 + 72 CO509 + 72 CO601
       + 72 CO602 + 72 CO603 + 72 CO604 + 72 CO605 + 72 CO610 + 72 CO705
       + 72 CO710 + 72 CO712 + 72 CO810 + 72 CO811 + 72 CO812 + 72 CO911
 SUBJECT TO
        2)   IO301 + IO401 + IO501 + IO601 + CR301 + CR401 + CR501 + CR601
       + CO301 + CO401 + CO501 + CO601 + IR301 + IR401 + IR501 + IR601
       >=   350
        3)   IO402 + IO502 + IO602 + CR402 + CR502 + CR602 + CO402 + CO502
       + CO602 + IR402 + IR502 + IR602 >=   130
--MORE--
        4)   IO403 + IO503 + IO603 + CR403 + CR503 + CR603 + CO403 + CO503
       + CO603 + IR403 + IR503 + IR603 >=   200
        5)   IO404 + IO504 + IO604 + CR404 + CR504 + CR604 + CO404 + CO504
       + CO604 + IR404 + IR504 + IR604 >=   160
        6)   IO205 + IO305 + IO405 + IO505 + IO605 + IO705 + CR205 + CR305
       + CR405 + CR505 + CR605 + CR705 + CO205 + CO305 + CO405 + CO505
       + CO605 + CO705 + IR205 + IR305 + IR405 + IR505 + IR605 + IR705
       >=   800
        7)   IO106 + IO206 + IO306 + CR106 + CR206 + CR306 + CO106 + CO206
       + CO306 + IR106 + IR206 + IR306 >=   200
        8)   IO207 + IO307 + CR207 + CR307 + CO207 + CO307 + IR207 + IR307
       >=   100
        9)   IO208 + IO308 + IO408 + CR208 + CR308 + CR408 + CO208 + CO308
       + CO408 + IR208 + IR308 + IR408 >=   200
       10)   IO409 + IO509 + CR409 + CR509 + CO409 + CO509 + IR409 + IR509
       >=   100
       11)   IO610 + IO710 + IO810 + CR610 + CR710 + CR810 + CO610 + CO710
       + CO810 + IR610 + IR710 + IR810 >=   200
       12)   IO811 + IO911 + CR811 + CR911 + CO811 + CO911 + IR811 + IR911
       >=   100
       13)   IO712 + IO812 + CR712 + CR812 + CO712 + CO812 + IR712 + IR812
       >=   150
       14)   IE301 + CE301 + IE401 + CE401 + IE501 + CE501 + IE601 + CE601
       >=   200
--MORE--
       15)   IE402 + CE402 + IE502 + CE502 + IE602 + CE602 >=    80
       16)   IE403 + CE403 + IE503 + CE503 + IE603 + CE603 >=    10
       17)   IE404 + CE404 + IE504 + CE504 + IE604 + CE604 >=    40
       18)   IE405 + CE405 + IE505 + CE505 + IE605 + CE605 + IE705 + CE705
       >=   200
       19)   IE106 + CE106 + IE206 + CE206 + IE306 + CE306 >=    40
       20)   IE207 + CE207 + IE307 + CE307 >=    25
       21)   IE208 + CE208 + IE308 + CE308 + IE408 + CE408 >=    40
```

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      22)   IE409 + CE409 + IE509 + CE509 >=   25
      23)   IE610 + CE610 + IE710 + CE710 + IE810 + CE810 >=   40
      24)   IE811 + CE811 + IE911 + CE911 >=   25
      25)   IE712 + CE712 + IE812 + CE812 >=   40
      26)   IR106 <=   200
      27)   IR205 + IR206 + IR207 + IR208 <=   200
      28)   IR301 + IR305 + IR306 + IR307 + IR308 <=   200
      29)   IR401 + IR402 + IR403 + IR404 + IR405 + IR408 + IR409 <=   200
      30)   IR501 + IR502 + IR503 + IR504 + IR505 + IR509 <=   200
      31)   IR601 + IR602 + IR603 + IR604 + IR605 + IR610 <=   200
      32)   IR705 + IR710 + IR712 <=   200
      33)   IR810 + IR811 + IR812 <=   200
      34)   IR911 <=   200
      35)   IO106 <=   50
      36)   IO205 + IO206 + IO207 + IO208 <=   50
      37)   IO301 + IO305 + IO306 + IO307 + IO308 <=   50
--MORE--
      38)   IO401 + IO402 + IO403 + IO404 + IO405 + IO408 + IO409 <=   50
      39)   IO501 + IO502 + IO503 + IO504 + IO505 + IO509 <=   50
      40)   IO601 + IO602 + IO603 + IO604 + IO605 + IO610 <=   50
      41)   IO705 + IO710 + IO712 <=   50
      42)   IO810 + IO811 + IO812 <=   50
      43)   IO911 <=   50
      44)   CR106 <=   100
      45)   CR205 + CR206 + CR207 + CR208 <=   100
      46)   CR301 + CR305 + CR306 + CR307 + CR308 <=   100
      47)   CR401 + CR402 + CR403 + CR404 + CR405 + CR408 + CR409 <=   100
      48)   CR501 + CR502 + CR503 + CR504 + CR505 + CR509 <=   100
      49)   CR601 + CR602 + CR603 + CR604 + CR605 + CR610 <=   100
      50)   CR705 + CR710 + CR712 <=   100
      51)   CR810 + CR811 + CR812 <=   100
      52)   CR911 <=   100
      53)   CO106 <=   100
      54)   CO205 + CO206 + CO207 + CO208 <=   100
      55)   CO301 + CO305 + CO306 + CO307 + CO308 <=   100
      56)   CO401 + CO402 + CO403 + CO404 + CO405 + CO408 + CO409 <=   100
      57)   CO501 + CO502 + CO503 + CO504 + CO505 + CO509 <=   100
      58)   CO601 + CO602 + CO603 + CO604 + CO605 + CO610 <=   100
      59)   CO705 + CO710 + CO712 <=   100
      60)   CO810 + CO811 + CO812 <=   100
      61)   CO911 <=   100
--MORE--
      62)   IE106 <=   150
      63)   IE206 + IE207 + IE208 <=   150
      64)   IE301 + IE306 + IE307 + IE308 <=   150
      65)   IE401 + IE402 + IE403 + IE404 + IE405 + IE408 + IE409 <=   150
      66)   IE501 + IE502 + IE503 + IE504 + IE505 + IE509 <=   150
      67)   IE601 + IE602 + IE603 + IE604 + IE605 + IE610 <=   150
      68)   IE705 + IE710 + IE712 <=   150
      69)   IE810 + IE811 + IE812 <=   150
      70)   IE911 <=   150
      71)   CE106 <=   80
      72)   CE206 + CE207 + CE208 <=   80
      73)   CE301 + CE306 + CE307 + CE308 <=   80
      74)   CE401 + CE402 + CE403 + CE404 + CE405 + CE408 + CE409 <=   80
      75)   CE501 + CE502 + CE503 + CE504 + CE505 + CE509 <=   80
      76)   CE601 + CE602 + CE603 + CE604 + CE605 + CE610 <=   80
      77)   CE705 + CE710 + CE712 <=   80
      78)   CE810 + CE811 + CE812 <=   80
      79)   CE911 <=   80
```

```
      80)   IR106 <=   80
      81)   IO106 <=   20
      82)   IE106 <=   50
      83)   CR106 <=   50
      84)   CO106 <=   50
      85)   CE106 <=   50
--MORE--
      86)   IR205 <=   120
      87)   IO205 <=   30
      88)   CR205 <=   50
      89)   CO205 <=   50
      90)   IR206 <=   80
      91)   IO206 <=   20
      92)   IE206 <=   50
      93)   CR206 <=   50
      94)   CO206 <=   50
      95)   CE206 <=   50
      96)   IR207 <=   80
      97)   IO207 <=   20
      98)   IE207 <=   50
      99)   CR207 <=   50
     100)   CO207 <=   50
     101)   CE207 <=   50
     102)   IR208 <=   80
     103)   IO208 <=   20
     104)   IE208 <=   50
     105)   CR208 <=   50
     106)   CO208 <=   50
     107)   CE208 <=   50
     108)   IR301 <=   80
     109)   IO301 <=   20
-  ORE--
     110)   IE301 <=   50
     111)   CR301 <=   50
     112)   CO301 <=   50
     113)   CE301 <=   50
     114)   IR305 <=   120
     115)   IO305 <=   30
     116)   CR305 <=   50
     117)   CO305 <=   50
     118)   IR306 <=   80
     119)   IO306 <=   20
     120)   IE306 <=   50
     121)   CR306 <=   50
     122)   CO306 <=   50
     123)   CE306 <=   50
     124)   IR307 <=   80
     125)   IO307 <=   20
     126)   IE307 <=   50
     127)   CR307 <=   50
     128)   CO307 <=   50
     129)   CE307 <=   50
     130)   IR308 <=   80
     131)   IO308 <=   20
     132)   IE308 <=   50
     133)   CR308 <=   50
-  ORE--
     134)   CO308 <=   50
     135)   CE308 <=   50
     136)   IR401 <=   80
```

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     137)   IO401 <=   20
     138)   IE401 <=   50
     139)   CR401 <=   50
     140)   CO401 <=   50
     141)   CE401 <=   50
     142)   IR402 <=   80
     143)   IO402 <=   20
     144)   IE402 <=   50
     145)   CR402 <=   50
     146)   CO402 <=   50
     147)   CE402 <=   50
     148)   IR403 <=   80
     149)   IO403 <=   20
     150)   IE403 <=   50
     151)   CR403 <=   50
     152)   CO403 <=   50
     153)   CE403 <=   50
     154)   IR404 <=   80
     155)   IO404 <=   20
     156)   IE404 <=   50
     157)   CR404 <=   50
--MORE--
     158)   CO404 <=   50
     159)   CE404 <=   50
     160)   IR405 <=   120
     161)   IO405 <=   30
     162)   IE405 <=   100
     163)   CR405 <=   50
     164)   CO405 <=   50
     165)   CE405 <=   50
     166)   IR408 <=   80
     167)   IO408 <=   20
     168)   IE408 <=   50
     169)   CR408 <=   50
     170)   CO408 <=   50
     171)   CE408 <=   50
     172)   IR409 <=   80
     173)   IO409 <=   20
     174)   IE409 <=   50
     175)   CR409 <=   50
     176)   CO409 <=   50
     177)   CE409 <=   50
     178)   IR501 <=   80
     179)   IO501 <=   20
     180)   IE501 <=   50
     181)   CR501 <=   50
--MORE--
     182)   CO501 <=   50
     183)   CE501 <=   50
     184)   IR502 <=   80
     185)   IO502 <=   20
     186)   IE502 <=   50
     187)   CR502 <=   50
     188)   CO502 <=   50
     189)   CE502 <=   50
     190)   IR503 <=   80
     191)   IO503 <=   20
     192)   IE503 <=   50
     193)   CR503 <=   50
     194)   CO503 <=   50
```

```
      195)   CE503 <=   50
      196)   IR504 <=   80
      197)   IO504 <=   20
      198)   IE504 <=   50
      199)   CR504 <=   50
      200)   CO504 <=   50
      201)   CE504 <=   50
      202)   IR505 <=   120
      203)   IO505 <=   30
      204)   IE505 <=   100
      205)   CR505 <=   50
--MORE--
      206)   CO505 <=   50
      207)   CE505 <=   50
      208)   IR509 <=   80
      209)   IO509 <=   20
      210)   IE509 <=   50
      211)   CR509 <=   50
      212)   CO509 <=   50
      213)   CE509 <=   50
      214)   IR601 <=   80
      215)   IO601 <=   20
      216)   IE601 <=   50
      217)   CR601 <=   50
      218)   CO601 <=   50
      219)   CE601 <=   50
      220)   IR602 <=   80
      221)   IO602 <=   20
      222)   IE602 <=   50
      223)   CR602 <=   50
      224)   CO602 <=   50
      225)   CE602 <=   50
      226)   IR603 <=   80
      227)   IO603 <=   20
      228)   IE603 <=   50
      229)   CR603 <=   50
--MORE--
      230)   CO603 <=   50
      231)   CE603 <=   50
      232)   IR604 <=   80
      233)   IO604 <=   20
      234)   IE604 <=   50
      235)   CR604 <=   50
      236)   CO604 <=   50
      237)   CE604 <=   50
      238)   IR605 <=   120
      239)   IO605 <=   30
      240)   IE605 <=   100
      241)   CR605 <=   50
      242)   CO605 <=   50
      243)   CE605 <=   50
      244)   IR610 <=   80
      245)   IO610 <=   20
      246)   IE610 <=   50
      247)   CR610 <=   50
      248)   CO610 <=   50
      249)   CE610 <=   50
      250)   IR705 <=   120
      251)   IO705 <=   30
      252)   IE705 <=   100
```

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      253)   CR705 <=    50
--MORE--
      254)   CO705 <=    50
      255)   CE705 <=    50
      256)   IR710 <=    80
      257)   IO710 <=    20
      258)   IE710 <=    50
      259)   CR710 <=    50
      260)   CO710 <=    50
      261)   CE710 <=    50
      262)   IR712 <=    80
      263)   IO712 <=    20
      264)   IE712 <=    50
      265)   CR712 <=    50
      266)   CO712 <=    50
      267)   CE712 <=    50
      268)   IR810 <=    80
      269)   IO810 <=    20
      270)   IE810 <=    50
      271)   CR810 <=    50
      272)   CO810 <=    50
      273)   CE810 <=    50
      274)   IR811 <=    80
      275)   IO811 <=    20
      276)   IE811 <=    50
      277)   CR811 <=    50
--MORE--
      278)   CO811 <=    50
      279)   CE811 <=    50
      280)   IR812 <=    80
      281)   IO812 <=    20
      282)   IE812 <=    50
      283)   CR812 <=    50
      284)   CO812 <=    50
      285)   CE812 <=    50
      286)   IR911 <=    80
      287)   IO911 <=    20
      288)   IE911 <=    50
      289)   CR911 <=    50
      290)   CO911 <=    50
      291)   CE911 <=    50
      292)   IO106 + CR106 + CO106 + IR106 <=    100
      293)   IO205 + CR205 + CO205 + IR205 <=    150
      294)   IO206 + CR206 + CO206 + IR206 <=    100
      295)   IO207 + CR207 + CO207 + IR207 <=    100
      296)   IO208 + CR208 + CO208 + IR208 <=    100
      297)   IO301 + CR301 + CO301 + IR301 <=    100
      298)   IO305 + CR305 + CO305 + IR305 <=    150
      299)   IO306 + CR306 + CO306 + IR306 <=    100
      300)   IO307 + CR307 + CO307 + IR307 <=    100
      301)   IO308 + CR308 + CO308 + IR308 <=    100
--MORE--
      302)   IO401 + CR401 + CO401 + IR401 <=    100
      303)   IO402 + CR402 + CO402 + IR402 <=    100
      304)   IO403 + CR403 + CO403 + IR403 <=    100
      305)   IO404 + CR404 + CO404 + IR404 <=    100
      306)   IO405 + CR405 + CO405 + IR405 <=    150
      307)   IO408 + CR408 + CO408 + IR408 <=    100
      308)   IO409 + CR409 + CO409 + IR409 <=    100
      309)   IO501 + CR501 + CO501 + IR501 <=    100
```

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      310)   IO502 + CR502 + CO502 + IR502 <=   100
      311)   IO503 + CR503 + CO503 + IR503 <=   100
      312)   IO504 + CR504 + CO504 + IR504 <=   100
      313)   IO505 + CR505 + CO505 + IR505 <=   150
      314)   IO509 + CR509 + CO509 + IR509 <=   100
      315)   IO601 + CR601 + CO601 + IR601 <=   100
      316)   IO602 + CR602 + CO602 + IR602 <=   100
      317)   IO603 + CR603 + CO603 + IR603 <=   100
      318)   IO604 + CR604 + CO604 + IR604 <=   100
      319)   IO605 + CR605 + CO605 + IR605 <=   150
      320)   IO610 + CR610 + CO610 + IR610 <=   100
      321)   IO705 + CR705 + CO705 + IR705 <=   120
      322)   IO710 + CR710 + CO710 + IR710 <=   100
      323)   IO712 + CR712 + CO712 + IR712 <=   100
      324)   IO810 + CR810 + CO810 + IR810 <=   100
      325)   IO811 + CR811 + CO811 + IR811 <=   100
--MORE--
      326)   IO812 + CR812 + CO812 + IR812 <=   100
      327)   IO911 + CR911 + CO911 + IR911 <=   100
      328) - IO301 - IR301 + IE301 <=   0
      329) - IO401 - IR401 + IE401 <=   0
      330) - IO501 - IR501 + IE501 <=   0
      331) - IO601 - IR601 + IE601 <=   0
      332) - IO402 - IR402 + IE402 <=   0
      333) - IO502 - IR502 + IE502 <=   0
      334) - IO602 - IR602 + IE602 <=   0
      335) - IO403 - IR403 + IE403 <=   0
      336) - IO503 - IR503 + IE503 <=   0
      337) - IO603 - IR603 + IE603 <=   0
      338) - IO404 - IR404 + IE404 <=   0
      339) - IO504 - IR504 + IE504 <=   0
      340) - IO604 - IR604 + IE604 <=   0
      341) - IO405 - IR405 + IE405 <=   0
      342) - IO505 - IR505 + IE505 <=   0
      343) - IO605 - IR605 + IE605 <=   0
      344) - IO705 - IR705 + IE705 <=   0
      345) - IO106 - IR106 + IE106 <=   0
      346) - IO206 - IR206 + IE206 <=   0
      347) - IO306 - IR306 + IE306 <=   0
      348) - IO207 - IR207 + IE207 <=   0
      349) - IO307 - IR307 + IE307 <=   0
--MORE--
      350) - IO208 - IR208 + IE208 <=   0
      351) - IO308 - IR308 + IE308 <=   0
      352) - IO408 - IR408 + IE408 <=   0
      353) - IO409 - IR409 + IE409 <=   0
      354) - IO509 - IR509 + IE509 <=   0
      355) - IO610 - IR610 + IE610 <=   0
      356) - IO710 - IR710 + IE710 <=   0
      357) - IO810 - IR810 + IE810 <=   0
      358) - IO811 - IR811 + IE811 <=   0
      359) - IO911 - IR911 + IE911 <=   0
      360) - IO712 - IR712 + IE712 <=   0
      361) - IO812 - IR812 + IE812 <=   0
      362) - CR301 - CO301 + CE301 <=   0
      363) - CR401 - CO401 + CE401 <=   0
      364) - CR501 - CO501 + CE501 <=   0
      365) - CR601 - CO601 + CE601 <=   0
      366) - CR402 - CO402 + CE402 <=   0
      367) - CR502 - CO502 + CE502 <=   0
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      368) - CR602 - CO602 + CE602 <=    0
      369) - CR403 - CO403 + CE403 <=    0
      370) - CR503 - CO503 + CE503 <=    0
      371) - CR603 - CO603 + CE603 <=    0
      372) - CR404 - CO404 + CE404 <=    0
      373) - CR504 - CO504 + CE504 <=    0
--MORE--
      374) - CR604 - CO604 + CE604 <=    0
      375) - CR405 - CO405 + CE405 <=    0
      376) - CR505 - CO505 + CE505 <=    0
      377) - CR605 - CO605 + CE605 <=    0
      378) - CR705 - CO705 + CE705 <=    0
      379) - CR106 - CO106 + CE106 <=    0
      380) - CR206 - CO206 + CE206 <=    0
      381) - CR306 - CO306 + CE306 <=    0
      382) - CR207 - CO207 + CE207 <=    0
      383) - CR307 - CO307 + CE307 <=    0
      384) - CR208 - CO208 + CE208 <=    0
      385) - CR308 - CO308 + CE308 <=    0
      386) - CR408 - CO408 + CE408 <=    0
      387) - CR409 - CO409 + CE409 <=    0
      388) - CR509 - CO509 + CE509 <=    0
      389) - CR610 - CO610 + CE610 <=    0
      390) - CR710 - CO710 + CE710 <=    0
      391) - CR810 - CO810 + CE810 <=    0
      392) - CR811 - CO811 + CE811 <=    0
      393) - CR911 - CO911 + CE911 <=    0
      394) - CR712 - CO712 + CE712 <=    0
      395) - CR812 - CO812 + CE812 <=    0
 END
-   )RE--

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LINDO OUTPUT VERSION 1

LP OPTIMUM FOUND AT STEP 142

OBJECTIVE FUNCTION VALUE

1) 61640.000

VARIABLE	VALUE	REDUCED COST
IO106	20.000000	.000000
IO205	.000000	.000000
IO206	20.000000	.000000
IO207	20.000000	.000000
IO208	10.000000	.000000
IO301	10.000000	.000000
IO305	30.000000	.000000
IO306	10.000000	.000000
IO307	.000000	.000000
IO308	.000000	.000000
IO401	.000000	.000000
IO402	20.000000	.000000
IO403	.000000	.000000
IO404	.000000	.000000
IO405	30.000000	.000000
IO408	.000000	.000000
IO409	.000000	.000000
IO501	.000000	.000000
IO502	.000000	.000000
IO503	20.000000	.000000
IO504	20.000000	.000000
IO505	10.000000	.000000
IO509	.000000	.000000
IO601	20.000000	.000000
IO602	.000000	.000000
IO603	.000000	.000000
IO604	.000000	.000000
IO605	30.000000	.000000
IO610	.000000	22.000000
IO705	10.000000	.000000
IO710	20.000000	.000000
IO712	20.000000	.000000
IO810	20.000000	.000000
IO811	.000000	45.000000
IO812	20.000000	.000000
IO911	.000000	45.000000
CR106	.000000	5.000000
CR205	50.000000	.000000
CR206	.000000	.000000
CR207	.000000	.000000
CR208	50.000000	.000000
CR301	50.000000	.000000
CR305	.000000	.000000
CR306	.000000	.000000
CR307	50.000000	.000000
CR308	.000000	.000000
CR401	50.000000	.000000
CR402	10.000000	.000000
CR403	.000000	.000000
CR404	.000000	.000000
CR405	.000000	.000000
CR408	40.000000	.000000
CR409	.000000	.000000

CR501	50.000000	.000000
CR502	.000000	.000000
CR503	.000000	.000000
CR504	.000000	.000000
CR505	50.000000	.000000
CR509	.000000	.000000
CR601	.000000	.000000
CR602	.000000	.000000
CR603	50.000000	.000000
CR604	.000000	.000000
CR605	50.000000	.000000
CR610	.000000	22.000000
CR705	.000000	.000000
CR710	.000000	.000000
CR712	20.000000	.000000
CR810	.000000	5.000000
CR811	.000000	50.000000
CR812	.000000	5.000000
CR911	.000000	50.000000
CO106	.000000	27.000000
CO205	.000000	.000000
CO206	.000000	.000000
CO207	.000000	.000000
CO208	.000000	.000000
CO301	.000000	.000000
CO305	40.000000	.000000
CO306	.000000	.000000
CO307	.000000	.000000
CO308	20.000000	.000000
CO401	.000000	.000000
CO402	.000000	.000000
CO403	.000000	.000000
CO404	.000000	.000000
CO405	20.000000	.000000
CO408	.000000	.000000
CO409	.000000	.000000
CO501	.000000	.000000
CO502	.000000	.000000
CO503	50.000000	.000000
CO504	.000000	.000000
CO505	.000000	.000000
CO509	40.000000	.000000
CO601	.000000	.000000
CO602	.000000	.000000
CO603	50.000000	.000000
CO604	50.000000	.000000
CO605	.000000	.000000
CO610	.000000	22.000000
CO705	.000000	22.000000
CO710	.000000	22.000000
CO712	.000000	22.000000
CO810	.000000	27.000000
CO811	.000000	72.000000
CO812	.000000	27.000000
CO911	.000000	72.000000
IR301	40.000000	.000000
IR401	50.000000	.000000
IR501	50.000000	.000000
IR601	30.000000	.000000
IR402	.000000	.000000

IR502	50.000000	.000000
IR602	50.000000	.000000
IR403	.000000	.000000
IR503	30.000000	.000000
IR603	.000000	.000000
IR404	40.000000	.000000
IR504	.000000	.000000
IR604	50.000000	.000000
IR205	100.000000	.000000
IR305	80.000000	.000000
IR405	100.000000	.000000
IR505	20.000000	.000000
IR605	70.000000	.000000
IR705	110.000000	.000000
IR106	80.000000	.000000
IR206	70.000000	.000000
IR306	.000000	.000000
IR207	30.000000	.000000
IR307	.000000	.000000
IR208	.000000	.000000
IR308	80.000000	.000000
IR408	.000000	.000000
IR409	10.000000	.000000
IR509	50.000000	.000000
IR610	.000000	22.000000
IR710	80.000000	.000000
IR810	80.000000	.000000
IR811	40.000000	.000000
IR911	60.000000	.000000
IR712	10.000000	.000000
IR812	80.000000	.000000
IE301	50.000000	.000000
CE301	50.000000	.000000
IE401	50.000000	.000000
CE401	50.000000	.000000
IE501	50.000000	.000000
CE501	.000000	.000000
IE601	50.000000	.000000
CE601	.000000	.000000
IE402	20.000000	.000000
CE402	10.000000	.000000
IE502	50.000000	.000000
CE502	.000000	.000000
IE602	.000000	.000000
CE602	.000000	.000000
IE403	.000000	.000000
CE403	.000000	.000000
IE503	50.000000	.000000
CE503	.000000	.000000
IE603	.000000	.000000
CE603	.000000	.000000
IE404	40.000000	.000000
CE404	.000000	.000000
IE504	.000000	.000000
CE504	.000000	.000000
IE604	.000000	.000000
CE604	.000000	.000000
IE405	30.000000	.000000
CE405	20.000000	.000000
IE505	.000000	.000000

CE505	50.000000	.000000
IE605	100.000000	.000000
CE605	.000000	.000000
IE705	.000000	.000000
CE705	.000000	.000000
IE106	.000000	.000000
CE106	.000000	.000000
IE206	50.000000	.000000
CE206	.000000	.000000
IE306	.000000	.000000
CE306	.000000	.000000
IE207	50.000000	.000000
CE207	.000000	.000000
IE307	.000000	.000000
CE307	.000000	.000000
IE208	.000000	.000000
CE208	.000000	.000000
IE308	50.000000	.000000
CE308	20.000000	.000000
IE408	.000000	.000000
CE408	.000000	.000000
IE409	10.000000	.000000
CE409	.000000	.000000
IE509	.000000	.000000
CE509	15.000000	.000000
IE610	.000000	.000000
CE610	.000000	.000000
IE710	50.000000	.000000
CE710	.000000	.000000
IE810	.000000	.000000
CE810	.000000	.000000
IE811	40.000000	.000000
CE811	.000000	.000000
IE911	.000000	.000000
CE911	.000000	.000000
IE712	.000000	.000000
CE712	.000000	.000000
IE812	50.000000	.000000
CE812	.000000	.000000

ROW	SLACK OR SURPLUS	DUAL PRICES
2)	.000000	-72.000000
3)	.000000	-72.000000
4)	.000000	-72.000000
5)	.000000	-72.000000
6)	.000000	-72.000000
7)	.000000	-72.000000
8)	.000000	-72.000000
9)	.000000	-72.000000
10)	.000000	-72.000000
11)	.000000	-50.000000
12)	.000000	.000000
13)	.000000	-50.000000
14)	100.000000	.000000
15)	.000000	.000000
16)	40.000000	.000000
17)	.000000	.000000
18)	.000000	.000000
19)	10.000000	.000000

20)	25.000000	.000000
21)	30.000000	.000000
22)	.000000	.000000
23)	10.000000	.000000
24)	15.000000	.000000
25)	10.000000	.000000
26)	120.000000	.000000
27)	.000000	72.000000
28)	.000000	72.000000
29)	.000000	72.000000
30)	.000000	72.000000
31)	.000000	72.000000
32)	.000000	50.000000
33)	.000000	.000000
34)	140.000000	.000000
35)	30.000000	.000000
36)	.000000	27.000000
37)	.000000	27.000000
38)	.000000	27.000000
39)	.000000	27.000000
40)	.000000	27.000000
41)	.000000	5.000000
42)	10.000000	.000000
43)	50.000000	.000000
44)	100.000000	.000000
45)	.000000	22.000000
46)	.000000	22.000000
47)	.000000	22.000000
48)	.000000	22.000000
49)	.000000	22.000000
50)	80.000000	.000000
51)	100.000000	.000000
52)	100.000000	.000000
53)	100.000000	.000000
54)	100.000000	.000000
55)	40.000000	.000000
56)	80.000000	.000000
57)	10.000000	.000000
58)	.000000	.000000
59)	100.000000	.000000
60)	100.000000	.000000
61)	100.000000	.000000
62)	150.000000	.000000
63)	50.000000	.000000
64)	50.000000	.000000
65)	.000000	.000000
66)	.000000	.000000
67)	.000000	.000000
68)	100.000000	.000000
69)	60.000000	.000000
70)	150.000000	.000000
71)	80.000000	.000000
72)	80.000000	.000000
73)	10.000000	.000000
74)	.000000	.000000
75)	15.000000	.000000
76)	80.000000	.000000
77)	80.000000	.000000
78)	80.000000	.000000
79)	80.000000	.000000

80)	.000000	45.000000
81)	.000000	.000000
82)	50.000000	.000000
83)	50.000000	.000000
84)	50.000000	.000000
85)	50.000000	.000000
86)	20.000000	.000000
87)	30.000000	.000000
88)	.000000	.000000
89)	50.000000	.000000
90)	10.000000	.000000
91)	.000000	.000000
92)	.000000	.000000
93)	50.000000	.000000
94)	50.000000	.000000
95)	50.000000	.000000
96)	50.000000	.000000
97)	.000000	.000000
98)	.000000	.000000
99)	50.000000	.000000
100)	50.000000	.000000
101)	50.000000	.000000
102)	80.000000	.000000
103)	10.000000	.000000
104)	50.000000	.000000
105)	.000000	.000000
106)	50.000000	.000000
107)	50.000000	.000000
108)	40.000000	.000000
109)	10.000000	.000000
110)	.000000	.000000
111)	.000000	.000000
112)	50.000000	.000000
113)	.000000	.000000
114)	40.000000	.000000
115)	.000000	.000000
116)	50.000000	.000000
117)	10.000000	.000000
118)	80.000000	.000000
119)	10.000000	.000000
120)	50.000000	.000000
121)	50.000000	.000000
122)	50.000000	.000000
123)	50.000000	.000000
124)	80.000000	.000000
125)	20.000000	.000000
126)	50.000000	.000000
127)	.000000	.000000
128)	50.000000	.000000
129)	50.000000	.000000
130)	.000000	.000000
131)	20.000000	.000000
132)	.000000	.000000
133)	50.000000	.000000
134)	30.000000	.000000
135)	30.000000	.000000
136)	30.000000	.000000
137)	20.000000	.000000
138)	.000000	.000000
139)	.000000	.000000

140)	50.000000	.000000
141)	.000000	.000000
142)	80.000000	.000000
143)	.000000	.000000
144)	30.000000	.000000
145)	40.000000	.000000
146)	50.000000	.000000
147)	40.000000	.000000
148)	80.000000	.000000
149)	20.000000	.000000
150)	50.000000	.000000
151)	50.000000	.000000
152)	50.000000	.000000
153)	50.000000	.000000
154)	40.000000	.000000
155)	20.000000	.000000
156)	10.000000	.000000
157)	50.000000	.000000
158)	50.000000	.000000
159)	50.000000	.000000
160)	20.000000	.000000
161)	.000000	.000000
162)	70.000000	.000000
163)	50.000000	.000000
164)	30.000000	.000000
165)	30.000000	.000000
166)	80.000000	.000000
167)	20.000000	.000000
168)	50.000000	.000000
169)	10.000000	.000000
170)	50.000000	.000000
171)	50.000000	.000000
172)	70.000000	.000000
173)	20.000000	.000000
174)	40.000000	.000000
175)	50.000000	.000000
176)	50.000000	.000000
177)	50.000000	.000000
178)	30.000000	.000000
179)	20.000000	.000000
180)	.000000	.000000
181)	.000000	.000000
182)	50.000000	.000000
183)	50.000000	.000000
184)	30.000000	.000000
185)	20.000000	.000000
186)	.000000	.000000
187)	50.000000	.000000
188)	50.000000	.000000
189)	50.000000	.000000
190)	50.000000	.000000
191)	.000000	.000000
192)	.000000	.000000
193)	50.000000	.000000
194)	.000000	.000000
195)	50.000000	.000000
196)	80.000000	.000000
197)	.000000	.000000
198)	50.000000	.000000
199)	50.000000	.000000

200)	50.000000	.000000
201)	50.000000	.000000
202)	100.000000	.000000
203)	20.000000	.000000
204)	100.000000	.000000
205)	.000000	.000000
206)	50.000000	.000000
207)	.000000	.000000
208)	30.000000	.000000
209)	20.000000	.000000
210)	50.000000	.000000
211)	50.000000	.000000
212)	10.000000	.000000
213)	35.000000	.000000
214)	50.000000	.000000
215)	.000000	.000000
216)	.000000	.000000
217)	50.000000	.000000
218)	50.000000	.000000
219)	50.000000	.000000
220)	30.000000	.000000
221)	20.000000	.000000
222)	50.000000	.000000
223)	50.000000	.000000
224)	50.000000	.000000
225)	50.000000	.000000
226)	80.000000	.000000
227)	20.000000	.000000
228)	50.000000	.000000
229)	.000000	.000000
230)	.000000	.000000
231)	50.000000	.000000
232)	30.000000	.000000
233)	20.000000	.000000
234)	50.000000	.000000
235)	50.000000	.000000
236)	.000000	.000000
237)	50.000000	.000000
238)	50.000000	.000000
239)	.000000	.000000
240)	.000000	.000000
241)	.000000	.000000
242)	50.000000	.000000
243)	50.000000	.000000
244)	80.000000	.000000
245)	20.000000	.000000
246)	50.000000	.000000
247)	50.000000	.000000
248)	50.000000	.000000
249)	50.000000	.000000
250)	10.000000	.000000
251)	20.000000	.000000
252)	100.000000	.000000
253)	50.000000	.000000
254)	50.000000	.000000
255)	50.000000	.000000
256)	.000000	.000000
257)	.000000	.000000
258)	.000000	.000000
259)	50.000000	.000000

260)	50.000000	.000000
261)	50.000000	.000000
262)	70.000000	.000000
263)	.000000	.000000
264)	50.000000	.000000
265)	30.000000	.000000
266)	50.000000	.000000
267)	50.000000	.000000
268)	.000000	45.000000
269)	.000000	.000000
270)	50.000000	.000000
271)	50.000000	.000000
272)	50.000000	.000000
273)	50.000000	.000000
274)	40.000000	.000000
275)	20.000000	.000000
276)	10.000000	.000000
277)	50.000000	.000000
278)	50.000000	.000000
279)	50.000000	.000000
280)	.000000	45.000000
281)	.000000	.000000
282)	.000000	.000000
283)	50.000000	.000000
284)	50.000000	.000000
285)	50.000000	.000000
286)	20.000000	.000000
287)	20.000000	.000000
288)	50.000000	.000000
289)	50.000000	.000000
290)	50.000000	.000000
291)	50.000000	.000000
292)	.000000	27.000000
293)	.000000	.000000
294)	10.000000	.000000
295)	50.000000	.000000
296)	40.000000	.000000
297)	.000000	.000000
298)	.000000	.000000
299)	90.000000	.000000
300)	50.000000	.000000
301)	.000000	.000000
302)	.000000	.000000
303)	70.000000	.000000
304)	100.000000	.000000
305)	60.000000	.000000
306)	.000000	.000000
307)	60.000000	.000000
308)	90.000000	.000000
309)	.000000	.000000
310)	50.000000	.000000
311)	.000000	.000000
312)	80.000000	.000000
313)	70.000000	.000000
314)	10.000000	.000000
315)	50.000000	.000000
316)	50.000000	.000000
317)	.000000	.000000
318)	.000000	.000000
319)	.000000	.000000

320)	100.000000	.000000
321)	.000000	22.000000
322)	.000000	.000000
323)	50.000000	.000000
324)	.000000	5.000000
325)	60.000000	.000000
326)	.000000	5.000000
327)	40.000000	.000000
328)	.000000	.000000
329)	.000000	.000000
330)	.000000	.000000
331)	.000000	.000000
332)	.000000	.000000
333)	.000000	.000000
334)	50.000000	.000000
335)	.000000	.000000
336)	.000000	.000000
337)	.000000	.000000
338)	.000000	.000000
339)	20.000000	.000000
340)	50.000000	.000000
341)	100.000000	.000000
342)	30.000000	.000000
343)	.000000	.000000
344)	120.000000	.000000
345)	100.000000	.000000
346)	40.000000	.000000
347)	10.000000	.000000
348)	.000000	.000000
349)	.000000	.000000
350)	10.000000	.000000
351)	30.000000	.000000
352)	.000000	.000000
353)	.000000	.000000
354)	50.000000	.000000
355)	.000000	.000000
356)	50.000000	.000000
357)	100.000000	.000000
358)	.000000	.000000
359)	60.000000	.000000
360)	30.000000	.000000
361)	50.000000	.000000
362)	.000000	.000000
363)	.000000	.000000
364)	50.000000	.000000
365)	.000000	.000000
366)	.000000	.000000
367)	.000000	.000000
368)	.000000	.000000
369)	.000000	.000000
370)	50.000000	.000000
371)	100.000000	.000000
372)	.000000	.000000
373)	.000000	.000000
374)	50.000000	.000000
375)	.000000	.000000
376)	.000000	.000000
377)	50.000000	.000000
378)	.000000	.000000
379)	.000000	.000000

380)	.000000	.000000
381)	.000000	.000000
382)	.000000	.000000
383)	50.000000	.000000
384)	50.000000	.000000
385)	.000000	.000000
386)	40.000000	.000000
387)	.000000	.000000
388)	25.000000	.000000
389)	.000000	.000000
390)	.000000	.000000
391)	.000000	.000000
392)	.000000	.000000
393)	.000000	.000000
394)	20.000000	.000000
395)	.000000	.000000

NO. ITERATIONS= 142

RANGES IN WHICH THE BASIS IS UNCHANGED:

	OBJ COEFFICIENT RANGES		
VARIABLE	CURRENT COEF	ALLOWABLE INCREASE	ALLOWABLE DECREASE
IO106	45.000000	5.000000	45.000000
IO205	45.000000	INFINITY	.000000
IO206	45.000000	.000000	INFINITY
IO207	45.000000	.000000	INFINITY
IO208	45.000000	.000000	.000000
IO301	45.000000	.000000	.000000
IO305	45.000000	.000000	INFINITY
IO306	45.000000	.000000	.000000
IO307	45.000000	INFINITY	.000000
IO308	45.000000	INFINITY	.000000
IO401	45.000000	INFINITY	.000000
IO402	45.000000	.000000	INFINITY
IO403	45.000000	INFINITY	.000000
IO404	45.000000	INFINITY	.000000
IO405	45.000000	.000000	INFINITY
IO408	45.000000	INFINITY	.000000
IO409	45.000000	.000000	.000000
IO501	45.000000	INFINITY	.000000
IO502	45.000000	INFINITY	.000000
IO503	45.000000	.000000	INFINITY
IO504	45.000000	.000000	INFINITY
IO505	45.000000	.000000	.000000
IO509	45.000000	INFINITY	.000000
IO601	45.000000	.000000	INFINITY
IO602	45.000000	.000000	.000000
IO603	45.000000	INFINITY	.000000
IO604	45.000000	INFINITY	.000000
IO605	45.000000	.000000	INFINITY
IO610	45.000000	INFINITY	22.000000
IO705	45.000000	5.000000	.000000
IO710	45.000000	.000000	INFINITY
IO712	45.000000	.000000	INFINITY
IO810	45.000000	5.000000	45.000000
IO811	45.000000	INFINITY	45.000000
IO812	45.000000	5.000000	45.000000
IO911	45.000000	INFINITY	45.000000

CR106	50.000000	INFINITY	5.000000
CR205	50.000000	.000000	INFINITY
CR206	50.000000	INFINITY	.000000
CR207	50.000000	.000000	.000000
CR208	50.000000	.000000	INFINITY
CR301	50.000000	.000000	.000000
CR305	50.000000	.000000	.000000
CR306	50.000000	INFINITY	.000000
CR307	50.000000	.000000	.000000
CR308	50.000000	INFINITY	.000000
CR401	50.000000	.000000	.000000
CR402	50.000000	.000000	.000000
CR403	50.000000	INFINITY	.000000
CR404	50.000000	INFINITY	.000000
CR405	50.000000	INFINITY	.000000
CR408	50.000000	.000000	.000000
CR409	50.000000	INFINITY	.000000
CR501	50.000000	.000000	.000000
CR502	50.000000	.000000	.000000
CR503	50.000000	INFINITY	.000000
CR504	50.000000	INFINITY	.000000
CR505	50.000000	.000000	.000000
CR509	50.000000	INFINITY	.000000
CR601	50.000000	INFINITY	.000000
CR602	50.000000	.000000	.000000
CR603	50.000000	.000000	INFINITY
CR604	50.000000	INFINITY	.000000
CR605	50.000000	.000000	.000000
CR610	50.000000	INFINITY	22.000000
CR705	50.000000	22.000000	.000000
CR710	50.000000	INFINITY	.000000
CR712	50.000000	.000000	5.000000
CR810	50.000000	INFINITY	5.000000
CR811	50.000000	INFINITY	50.000000
CR812	50.000000	INFINITY	5.000000
CR911	50.000000	INFINITY	50.000000
CO106	72.000000	INFINITY	27.000000
CO205	72.000000	INFINITY	.000000
CO206	72.000000	INFINITY	.000000
CO207	72.000000	INFINITY	.000000
CO208	72.000000	INFINITY	.000000
CO301	72.000000	INFINITY	.000000
CO305	72.000000	.000000	.000000
CO306	72.000000	INFINITY	.000000
CO307	72.000000	INFINITY	.000000
CO308	72.000000	.000000	.000000
CO401	72.000000	INFINITY	.000000
CO402	72.000000	INFINITY	.000000
CO403	72.000000	INFINITY	.000000
CO404	72.000000	INFINITY	.000000
CO405	72.000000	.000000	.000000
CO408	72.000000	INFINITY	.000000
CO409	72.000000	INFINITY	.000000
CO501	72.000000	INFINITY	.000000
CO502	72.000000	INFINITY	.000000
CO503	72.000000	.000000	.000000
CO504	72.000000	INFINITY	.000000
CO505	72.000000	INFINITY	.000000
CO509	72.000000	.000000	.000000
CO601	72.000000	INFINITY	.000000

CO602	72.000000	INFINITY	.000000
CO603	72.000000	.000000	.000000
CO604	72.000000	.000000	INFINITY
CO605	72.000000	INFINITY	.000000
CO610	72.000000	INFINITY	22.000000
CO705	72.000000	INFINITY	22.000000
CO710	72.000000	INFINITY	22.000000
CO712	72.000000	INFINITY	22.000000
CO810	72.000000	INFINITY	27.000000
CO811	72.000000	INFINITY	72.000000
CO812	72.000000	INFINITY	27.000000
CO911	72.000000	INFINITY	72.000000
IR301	.000000	.000000	.000000
IR401	.000000	.000000	.000000
IR501	.000000	.000000	.000000
IR601	.000000	.000000	.000000
IR402	.000000	INFINITY	.000000
IR502	.000000	.000000	.000000
IR602	.000000	.000000	.000000
IR403	.000000	INFINITY	.000000
IR503	.000000	.000000	.000000
IR603	.000000	INFINITY	.000000
IR404	.000000	.000000	.000000
IR504	.000000	INFINITY	.000000
IR604	.000000	.000000	.000000
IR205	.000000	.000000	.000000
IR305	.000000	.000000	.000000
IR405	.000000	.000000	.000000
IR505	.000000	.000000	.000000
IR605	.000000	.000000	.000000
IR705	.000000	.000000	5.000000
IR106	.000000	45.000000	INFINITY
IR206	.000000	.000000	.000000
IR306	.000000	INFINITY	.000000
IR207	.000000	.000000	.000000
IR307	.000000	INFINITY	.000000
IR208	.000000	INFINITY	.000000
IR308	.000000	.000000	INFINITY
IR408	.000000	INFINITY	.000000
IR409	.000000	.000000	.000000
IR509	.000000	.000000	.000000
IR610	.000000	INFINITY	22.000000
IR710	.000000	.000000	.000000
IR810	.000000	45.000000	INFINITY
IR811	.000000	.000000	45.000000
IR911	.000000	45.000000	.000000
IR712	.000000	5.000000	.000000
IR812	.000000	45.000000	INFINITY
IE301	.000000	.000000	.000000
CE301	.000000	.000000	INFINITY
IE401	.000000	.000000	INFINITY
CE401	.000000	.000000	.000000
IE501	.000000	.000000	INFINITY
CE501	.000000	INFINITY	.000000
IE601	.000000	.000000	.000000
CE601	.000000	.000000	.000000
IE402	.000000	.000000	.000000
CE402	.000000	.000000	.000000
IE502	.000000	.000000	INFINITY
CE502	.000000	INFINITY	.000000

IE602	.000000	INFINITY	.000000
CE602	.000000	INFINITY	.000000
IE403	.000000	INFINITY	.000000
CE403	.000000	INFINITY	.000000
IE503	.000000	.000000	INFINITY
CE503	.000000	INFINITY	.000000
IE603	.000000	INFINITY	.000000
CE603	.000000	INFINITY	.000000
IE404	.000000	.000000	.000000
CE404	.000000	INFINITY	.000000
IE504	.000000	INFINITY	.000000
CE504	.000000	INFINITY	.000000
IE604	.000000	INFINITY	.000000
CE604	.000000	INFINITY	.000000
IE405	.000000	.000000	.000000
CE405	.000000	.000000	.000000
IE505	.000000	INFINITY	.000000
CE505	.000000	.000000	INFINITY
IE605	.000000	.000000	INFINITY
CE605	.000000	INFINITY	.000000
IE705	.000000	INFINITY	.000000
CE705	.000000	INFINITY	.000000
IE106	.000000	INFINITY	.000000
CE106	.000000	INFINITY	.000000
IE206	.000000	.000000	INFINITY
CE206	.000000	.000000	.000000
IE306	.000000	INFINITY	.000000
CE306	.000000	INFINITY	.000000
IE207	.000000	.000000	INFINITY
CE207	.000000	INFINITY	.000000
IE307	.000000	INFINITY	.000000
CE307	.000000	INFINITY	.000000
IE208	.000000	INFINITY	.000000
CE208	.000000	INFINITY	.000000
IE308	.000000	.000000	INFINITY
CE308	.000000	.000000	.000000
IE408	.000000	INFINITY	.000000
CE408	.000000	INFINITY	.000000
IE409	.000000	.000000	.000000
CE409	.000000	INFINITY	.000000
IE509	.000000	INFINITY	.000000
CE509	.000000	.000000	.000000
IE610	.000000	INFINITY	.000000
CE610	.000000	INFINITY	.000000
IE710	.000000	.000000	INFINITY
CE710	.000000	.000000	.000000
IE810	.000000	INFINITY	.000000
CE810	.000000	INFINITY	.000000
IE811	.000000	.000000	45.000000
CE811	.000000	INFINITY	.000000
IE911	.000000	INFINITY	.000000
CE911	.000000	INFINITY	.000000
IE712	.000000	INFINITY	.000000
CE712	.000000	INFINITY	.000000
IE812	.000000	.000000	INFINITY
CE812	.000000	.000000	5.000000

RIGHTHAND SIDE RANGES

ROW	CURRENT RHS	ALLOWABLE INCREASE	ALLOWABLE DECREASE

2	350.000000	10.000000	.000000
3	130.000000	10.000000	.000000
4	200.000000	.000000	50.000000
5	160.000000	10.000000	.000000
6	800.000000	10.000000	20.000000
7	200.000000	10.000000	10.000000
8	100.000000	.000000	40.000000
9	200.000000	10.000000	.000000
10	100.000000	10.000000	25.000000
11	200.000000	.000000	20.000000
12	100.000000	20.000000	60.000000
13	150.000000	30.000000	20.000000
14	200.000000	100.000000	INFINITY
15	80.000000	40.000000	.000000
16	10.000000	40.000000	INFINITY
17	40.000000	.000000	INFINITY
18	200.000000	.000000	15.000000
19	40.000000	10.000000	INFINITY
20	25.000000	25.000000	INFINITY
21	40.000000	30.000000	INFINITY
22	25.000000	15.000000	15.000000
23	40.000000	10.000000	INFINITY
24	25.000000	15.000000	INFINITY
25	40.000000	10.000000	INFINITY
26	200.000000	INFINITY	120.000000
27	200.000000	10.000000	10.000000
28	200.000000	40.000000	10.000000
29	200.000000	.000000	10.000000
30	200.000000	25.000000	10.000000
31	200.000000	.000000	10.000000
32	200.000000	20.000000	10.000000
33	200.000000	10.000000	15.000000
34	200.000000	INFINITY	140.000000
35	50.000000	INFINITY	30.000000
36	50.000000	.000000	10.000000
37	50.000000	10.000000	10.000000
38	50.000000	.000000	.000000
39	50.000000	20.000000	10.000000
40	50.000000	.000000	.000000
41	50.000000	20.000000	10.000000
42	50.000000	INFINITY	10.000000
43	50.000000	INFINITY	50.000000
44	100.000000	INFINITY	100.000000
45	100.000000	40.000000	.000000
46	100.000000	40.000000	.000000
47	100.000000	.000000	10.000000
48	100.000000	.000000	.000000
49	100.000000	.000000	10.000000
50	100.000000	INFINITY	80.000000
51	100.000000	INFINITY	100.000000
52	100.000000	INFINITY	100.000000
53	100.000000	INFINITY	100.000000
54	100.000000	INFINITY	100.000000
55	100.000000	INFINITY	40.000000
56	100.000000	INFINITY	80.000000
57	100.000000	INFINITY	10.000000
58	100.000000	INFINITY	.000000
59	100.000000	INFINITY	100.000000
60	100.000000	INFINITY	100.000000
61	100.000000	INFINITY	100.000000

62	150.000000	INFINITY	150.000000
63	150.000000	INFINITY	50.000000
64	150.000000	INFINITY	50.000000
65	150.000000	15.000000	.000000
66	150.000000	INFINITY	.000000
67	150.000000	.000000	50.000000
68	150.000000	INFINITY	100.000000
69	150.000000	INFINITY	60.000000
70	150.000000	INFINITY	150.000000
71	80.000000	INFINITY	80.000000
72	80.000000	INFINITY	80.000000
73	80.000000	INFINITY	10.000000
74	80.000000	15.000000	10.000000
75	80.000000	INFINITY	15.000000
76	80.000000	INFINITY	80.000000
77	80.000000	INFINITY	80.000000
78	80.000000	INFINITY	80.000000
79	80.000000	INFINITY	80.000000
80	80.000000	20.000000	.000000
81	20.000000	INFINITY	.000000
82	50.000000	INFINITY	50.000000
83	50.000000	INFINITY	50.000000
84	50.000000	INFINITY	50.000000
85	50.000000	INFINITY	50.000000
86	120.000000	INFINITY	20.000000
87	30.000000	INFINITY	30.000000
88	50.000000	.000000	10.000000
89	50.000000	INFINITY	50.000000
90	80.000000	INFINITY	10.000000
91	20.000000	10.000000	.000000
92	50.000000	40.000000	10.000000
93	50.000000	INFINITY	50.000000
94	50.000000	INFINITY	50.000000
95	50.000000	INFINITY	50.000000
96	80.000000	INFINITY	50.000000
97	20.000000	10.000000	.000000
98	50.000000	10.000000	.000000
99	50.000000	INFINITY	50.000000
100	50.000000	INFINITY	50.000000
101	50.000000	INFINITY	50.000000
102	80.000000	INFINITY	80.000000
103	20.000000	INFINITY	10.000000
104	50.000000	INFINITY	50.000000
105	50.000000	.000000	10.000000
106	50.000000	INFINITY	50.000000
107	50.000000	INFINITY	50.000000
108	80.000000	INFINITY	40.000000
109	20.000000	INFINITY	10.000000
110	50.000000	INFINITY	.000000
111	50.000000	INFINITY	.000000
112	50.000000	INFINITY	50.000000
113	50.000000	.000000	.000000
114	120.000000	INFINITY	40.000000
115	30.000000	10.000000	10.000000
116	50.000000	INFINITY	50.000000
117	50.000000	INFINITY	10.000000
118	80.000000	INFINITY	80.000000
119	20.000000	INFINITY	10.000000
120	50.000000	INFINITY	50.000000
121	50.000000	INFINITY	50.000000

122	50.000000	INFINITY	50.000000
123	50.000000	INFINITY	50.000000
124	80.000000	INFINITY	80.000000
125	20.000000	INFINITY	20.000000
126	50.000000	INFINITY	50.000000
127	50.000000	INFINITY	.000000
128	50.000000	INFINITY	50.000000
129	50.000000	INFINITY	50.000000
130	80.000000	10.000000	10.000000
131	20.000000	INFINITY	20.000000
132	50.000000	30.000000	30.000000
133	50.000000	INFINITY	50.000000
134	50.000000	INFINITY	30.000000
135	50.000000	INFINITY	30.000000
136	80.000000	INFINITY	30.000000
137	20.000000	INFINITY	20.000000
138	50.000000	.000000	10.000000
139	50.000000	INFINITY	.000000
140	50.000000	INFINITY	50.000000
141	50.000000	INFINITY	.000000
142	80.000000	INFINITY	80.000000
143	20.000000	.000000	10.000000
144	50.000000	INFINITY	30.000000
145	50.000000	INFINITY	40.000000
146	50.000000	INFINITY	50.000000
147	50.000000	INFINITY	40.000000
148	80.000000	INFINITY	80.000000
149	20.000000	INFINITY	20.000000
150	50.000000	INFINITY	50.000000
151	50.000000	INFINITY	50.000000
152	50.000000	INFINITY	50.000000
153	50.000000	INFINITY	50.000000
154	80.000000	INFINITY	40.000000
155	20.000000	INFINITY	20.000000
156	50.000000	INFINITY	10.000000
157	50.000000	INFINITY	50.000000
158	50.000000	INFINITY	50.000000
159	50.000000	INFINITY	50.000000
160	120.000000	INFINITY	20.000000
161	30.000000	.000000	10.000000
162	100.000000	INFINITY	70.000000
163	50.000000	INFINITY	50.000000
164	50.000000	INFINITY	30.000000
165	50.000000	INFINITY	30.000000
166	80.000000	INFINITY	80.000000
167	20.000000	INFINITY	20.000000
168	50.000000	INFINITY	50.000000
169	50.000000	INFINITY	10.000000
170	50.000000	INFINITY	50.000000
171	50.000000	INFINITY	50.000000
172	80.000000	INFINITY	70.000000
173	20.000000	INFINITY	20.000000
174	50.000000	INFINITY	40.000000
175	50.000000	INFINITY	50.000000
176	50.000000	INFINITY	50.000000
177	50.000000	INFINITY	50.000000
178	80.000000	INFINITY	30.000000
179	20.000000	INFINITY	20.000000
180	50.000000	.000000	.000000
181	50.000000	INFINITY	.000000

182	50.000000	INFINITY	50.000000
183	50.000000	INFINITY	50.000000
184	80.000000	INFINITY	30.000000
185	20.000000	INFINITY	20.000000
186	50.000000	.000000	10.000000
187	50.000000	INFINITY	50.000000
188	50.000000	INFINITY	50.000000
189	50.000000	INFINITY	50.000000
190	80.000000	INFINITY	50.000000
191	20.000000	10.000000	20.000000
192	50.000000	.000000	.000000
193	50.000000	INFINITY	50.000000
194	50.000000	INFINITY	.000000
195	50.000000	INFINITY	50.000000
196	80.000000	INFINITY	80.000000
197	20.000000	.000000	10.000000
198	50.000000	INFINITY	50.000000
199	50.000000	INFINITY	50.000000
200	50.000000	INFINITY	50.000000
201	50.000000	INFINITY	50.000000
202	120.000000	INFINITY	100.000000
203	30.000000	INFINITY	20.000000
204	100.000000	INFINITY	100.000000
205	50.000000	INFINITY	.000000
206	50.000000	INFINITY	50.000000
207	50.000000	.000000	.000000
208	80.000000	INFINITY	30.000000
209	20.000000	INFINITY	20.000000
210	50.000000	INFINITY	50.000000
211	50.000000	INFINITY	50.000000
212	50.000000	INFINITY	10.000000
213	50.000000	INFINITY	35.000000
214	80.000000	INFINITY	50.000000
215	20.000000	.000000	20.000000
216	50.000000	INFINITY	.000000
217	50.000000	INFINITY	50.000000
218	50.000000	INFINITY	50.000000
219	50.000000	INFINITY	50.000000
220	80.000000	INFINITY	30.000000
221	20.000000	INFINITY	20.000000
222	50.000000	INFINITY	50.000000
223	50.000000	INFINITY	50.000000
224	50.000000	INFINITY	50.000000
225	50.000000	INFINITY	50.000000
226	80.000000	INFINITY	80.000000
227	20.000000	INFINITY	20.000000
228	50.000000	INFINITY	50.000000
229	50.000000	10.000000	.000000
230	50.000000	INFINITY	.000000
231	50.000000	INFINITY	50.000000
232	80.000000	INFINITY	30.000000
233	20.000000	INFINITY	20.000000
234	50.000000	INFINITY	50.000000
235	50.000000	INFINITY	50.000000
236	50.000000	.000000	10.000000
237	50.000000	INFINITY	50.000000
238	120.000000	INFINITY	50.000000
239	30.000000	.000000	20.000000
240	100.000000	.000000	.000000
241	50.000000	INFINITY	.000000

242	50.000000	INFINITY	50.000000
243	50.000000	INFINITY	50.000000
244	80.000000	INFINITY	80.000000
245	20.000000	INFINITY	20.000000
246	50.000000	INFINITY	50.000000
247	50.000000	INFINITY	50.000000
248	50.000000	INFINITY	50.000000
249	50.000000	INFINITY	50.000000
250	120.000000	INFINITY	10.000000
251	30.000000	INFINITY	20.000000
252	100.000000	INFINITY	100.000000
253	50.000000	INFINITY	50.000000
254	50.000000	INFINITY	50.000000
255	50.000000	INFINITY	50.000000
256	80.000000	INFINITY	.000000
257	20.000000	10.000000	.000000
258	50.000000	50.000000	10.000000
259	50.000000	INFINITY	50.000000
260	50.000000	INFINITY	50.000000
261	50.000000	INFINITY	50.000000
262	80.000000	INFINITY	70.000000
263	20.000000	10.000000	20.000000
264	50.000000	INFINITY	50.000000
265	50.000000	INFINITY	30.000000
266	50.000000	INFINITY	50.000000
267	50.000000	INFINITY	50.000000
268	80.000000	15.000000	.000000
269	20.000000	INFINITY	.000000
270	50.000000	INFINITY	50.000000
271	50.000000	INFINITY	50.000000
272	50.000000	INFINITY	50.000000
273	50.000000	INFINITY	50.000000
274	80.000000	INFINITY	40.000000
275	20.000000	INFINITY	20.000000
276	50.000000	INFINITY	10.000000
277	50.000000	INFINITY	50.000000
278	50.000000	INFINITY	50.000000
279	50.000000	INFINITY	50.000000
280	80.000000	15.000000	.000000
281	20.000000	INFINITY	.000000
282	50.000000	50.000000	10.000000
283	50.000000	INFINITY	50.000000
284	50.000000	INFINITY	50.000000
285	50.000000	INFINITY	50.000000
286	80.000000	INFINITY	20.000000
287	20.000000	INFINITY	20.000000
288	50.000000	INFINITY	50.000000
289	50.000000	INFINITY	50.000000
290	50.000000	INFINITY	50.000000
291	50.000000	INFINITY	50.000000
292	100.000000	.000000	10.000000
293	150.000000	10.000000	10.000000
294	100.000000	INFINITY	10.000000
295	100.000000	INFINITY	50.000000
296	100.000000	INFINITY	40.000000
297	100.000000	.000000	10.000000
298	150.000000	10.000000	10.000000
299	100.000000	INFINITY	90.000000
300	100.000000	INFINITY	50.000000
301	100.000000	.000000	10.000000

302	100.000000	INFINITY	.000000
303	100.000000	INFINITY	70.000000
304	100.000000	INFINITY	100.000000
305	100.000000	INFINITY	60.000000
306	150.000000	INFINITY	.000000
307	100.000000	INFINITY	60.000000
308	100.000000	INFINITY	90.000000
309	100.000000	.000000	50.000000
310	100.000000	INFINITY	50.000000
311	100.000000	.000000	.000000
312	100.000000	INFINITY	80.000000
313	150.000000	INFINITY	70.000000
314	100.000000	INFINITY	10.000000
315	100.000000	INFINITY	50.000000
316	100.000000	INFINITY	50.000000
317	100.000000	INFINITY	.000000
318	100.000000	INFINITY	.000000
319	150.000000	INFINITY	.000000
320	100.000000	INFINITY	100.000000
321	120.000000	10.000000	10.000000
322	100.000000	INFINITY	.000000
323	100.000000	INFINITY	50.000000
324	100.000000	.000000	.000000
325	100.000000	INFINITY	60.000000
326	100.000000	.000000	20.000000
327	100.000000	INFINITY	40.000000
328	.000000	.000000	50.000000
329	.000000	.000000	.000000
330	.000000	.000000	.000000
331	.000000	INFINITY	.000000
332	.000000	.000000	15.000000
333	.000000	10.000000	.000000
334	.000000	INFINITY	50.000000
335	.000000	INFINITY	.000000
336	.000000	.000000	10.000000
337	.000000	INFINITY	.000000
338	.000000	.000000	.000000
339	.000000	INFINITY	20.000000
340	.000000	INFINITY	50.000000
341	.000000	INFINITY	100.000000
342	.000000	INFINITY	30.000000
343	.000000	.000000	.000000
344	.000000	INFINITY	120.000000
345	.000000	INFINITY	100.000000
346	.000000	INFINITY	40.000000
347	.000000	INFINITY	10.000000
348	.000000	.000000	10.000000
349	.000000	INFINITY	.000000
350	.000000	INFINITY	10.000000
351	.000000	INFINITY	30.000000
352	.000000	INFINITY	.000000
353	.000000	.000000	50.000000
354	.000000	INFINITY	50.000000
355	.000000	INFINITY	.000000
356	.000000	INFINITY	50.000000
357	.000000	INFINITY	100.000000
358	.000000	10.000000	15.000000
359	.000000	INFINITY	60.000000
360	.000000	INFINITY	30.000000
361	.000000	INFINITY	50.000000

362	.000000	.000000	.000000
363	.000000	.000000	15.000000
364	.000000	INFINITY	50.000000
365	.000000	50.000000	.000000
366	.000000	.000000	15.000000
367	.000000	INFINITY	.000000
368	.000000	.000000	.000000
369	.000000	INFINITY	.000000
370	.000000	INFINITY	50.000000
371	.000000	INFINITY	100.000000
372	.000000	INFINITY	.000000
373	.000000	INFINITY	.000000
374	.000000	INFINITY	50.000000
375	.000000	10.000000	.000000
376	.000000	.000000	.000000
377	.000000	INFINITY	50.000000
378	.000000	.000000	20.000000
379	.000000	INFINITY	.000000
380	.000000	50.000000	.000000
381	.000000	INFINITY	.000000
382	.000000	INFINITY	.000000
383	.000000	INFINITY	50.000000
384	.000000	INFINITY	50.000000
385	.000000	10.000000	20.000000
386	.000000	INFINITY	40.000000
387	.000000	INFINITY	.000000
388	.000000	INFINITY	25.000000
389	.000000	INFINITY	.000000
390	.000000	50.000000	.000000
391	.000000	INFINITY	.000000
392	.000000	INFINITY	.000000
393	.000000	INFINITY	.000000
394	.000000	INFINITY	20.000000
395	.000000	50.000000	.000000

LINDO OUTPUT VERSION 2

LP OPTIMUM FOUND AT STEP 139

OBJECTIVE FUNCTION VALUE

1) 64690.000

VARIABLE	VALUE	REDUCED COST
IO106	.000000	5.000000
IO205	.000000	.000000
IO206	10.000000	.000000
IO207	20.000000	.000000
IO208	20.000000	.000000
IO301	.000000	.000000
IO305	30.000000	.000000
IO306	20.000000	.000000
IO307	.000000	.000000
IO308	.000000	.000000
IO401	20.000000	.000000
IO402	.000000	.000000
IO403	.000000	.000000
IO404	.000000	.000000
IO405	30.000000	.000000
IO408	.000000	.000000
IO409	.000000	.000000

IO501	20.000000	.000000
IO502	.000000	.000000
IO503	10.000000	.000000
IO504	20.000000	.000000
IO505	.000000	.000000
IO509	.000000	.000000
IO601	20.000000	.000000
IO602	.000000	.000000
IO603	.000000	.000000
IO604	.000000	.000000
IO605	30.000000	.000000
IO610	.000000	22.000000
IO705	.000000	5.000000
IO710	.000000	5.000000
IO712	.000000	5.000000
IO810	.000000	5.000000
IO811	.000000	55.000000
IO812	.000000	5.000000
IO911	.000000	55.000000
CR106	20.000000	.000000
CR205	50.000000	.000000
CR206	.000000	.000000
CR207	.000000	.000000
CR208	50.000000	.000000
CR301	.000000	.000000
CR305	50.000000	.000000
CR306	.000000	.000000
CR307	50.000000	.000000
CR308	.000000	.000000
CR401	50.000000	.000000
CR402	.000000	.000000
CR403	.000000	.000000
CR404	40.000000	.000000
CR405	10.000000	.000000
CR408	.000000	.000000
CR409	.000000	.000000
CR501	.000000	.000000
CR502	50.000000	.000000
CR503	.000000	.000000
CR504	.000000	.000000
CR505	50.000000	.000000
CR509	.000000	.000000
CR601	.000000	.000000
CR602	50.000000	.000000
CR603	.000000	.000000
CR604	.000000	.000000
CR605	50.000000	.000000
CR610	.000000	22.000000
CR705	.000000	.000000
CR710	20.000000	.000000
CR712	50.000000	.000000
CR810	20.000000	.000000
CR811	.000000	50.000000
CR812	20.000000	.000000
CR911	.000000	50.000000
CO106	.000000	22.000000
CO205	.000000	.000000
CO206	.000000	.000000
CO207	.000000	.000000
CO208	.000000	.000000

CO301	.000000	.000000
CO305	.000000	.000000
CO306	.000000	.000000
CO307	.000000	.000000
CO308	20.000000	.000000
CO401	.000000	.000000
CO402	5.000000	.000000
CO403	50.000000	.000000
CO404	.000000	.000000
CO405	15.000000	.000000
CO408	30.000000	.000000
CO409	.000000	.000000
CO501	.000000	.000000
CO502	.000000	.000000
CO503	50.000000	.000000
CO504	.000000	.000000
CO505	.000000	.000000
CO509	50.000000	.000000
CO601	.000000	.000000
CO602	.000000	.000000
CO603	50.000000	.000000
CO604	.000000	.000000
CO605	.000000	.000000
CO610	.000000	22.000000
CO705	.000000	22.000000
CO710	.000000	22.000000
CO712	.000000	22.000000
CO810	.000000	22.000000
CO811	.000000	72.000000
CO812	.000000	22.000000
CO911	.000000	72.000000
IR301	50.000000	.000000
IR401	30.000000	.000000
IR501	80.000000	.000000
IR601	80.000000	.000000
IR402	.000000	.000000
IR502	25.000000	.000000
IR602	.000000	.000000
IR403	.000000	.000000
IR503	40.000000	.000000
IR603	.000000	.000000
IR404	50.000000	.000000
IR504	.000000	.000000
IR604	50.000000	.000000
IR205	100.000000	.000000
IR305	70.000000	.000000
IR405	95.000000	.000000
IR505	30.000000	.000000
IR605	70.000000	.000000
IR705	120.000000	.000000
IR106	80.000000	.000000
IR206	70.000000	.000000
IR306	.000000	.000000
IR207	30.000000	.000000
IR307	.000000	.000000
IR208	.000000	.000000
IR308	80.000000	.000000
IR408	.000000	.000000
IR409	25.000000	.000000
IR509	25.000000	.000000

IR610	.000000	22.000000
IR710	80.000000	.000000
IR810	80.000000	.000000
IR811	40.000000	.000000
IR911	60.000000	.000000
IR712	.000000	.000000
IR812	80.000000	.000000
IE301	50.000000	.000000
CE301	.000000	.000000
IE401	50.000000	.000000
CE401	50.000000	.000000
IE501	50.000000	.000000
CE501	.000000	.000000
IE601	50.000000	.000000
CE601	.000000	.000000
IE402	.000000	.000000
CE402	5.000000	.000000
IE502	25.000000	.000000
CE502	.000000	.000000
IE602	.000000	.000000
CE602	50.000000	.000000
IE403	.000000	.000000
CE403	.000000	.000000
IE503	50.000000	.000000
CE503	.000000	.000000
IE603	.000000	.000000
CE603	.000000	.000000
IE404	50.000000	.000000
CE404	.000000	.000000
IE504	.000000	.000000
CE504	.000000	.000000
IE604	.000000	.000000
CE604	.000000	.000000
IE405	25.000000	.000000
CE405	25.000000	.000000
IE505	.000000	.000000
CE505	50.000000	.000000
IE605	100.000000	.000000
CE605	.000000	.000000
IE705	.000000	.000000
CE705	.000000	.000000
IE106	.000000	.000000
CE106	.000000	.000000
IE206	50.000000	.000000
CE206	.000000	.000000
IE306	.000000	.000000
CE306	.000000	.000000
IE207	50.000000	.000000
CE207	.000000	.000000
IE307	.000000	.000000
CE307	.000000	.000000
IE208	.000000	.000000
CE208	.000000	.000000
IE308	50.000000	.000000
CE308	20.000000	.000000
IE408	.000000	.000000
CE408	.000000	.000000
IE409	25.000000	.000000
CE409	.000000	.000000
IE509	.000000	.000000

CE509	.000000	.000000
IE610	.000000	.000000
CE610	.000000	.000000
IE710	50.000000	.000000
CE710	20.000000	.000000
IE810	.000000	.000000
CE810	.000000	.000000
IE811	40.000000	.000000
CE811	.000000	.000000
IE911	.000000	.000000
CE911	.000000	.000000
IE712	.000000	.000000
CE712	.000000	.000000
IE812	50.000000	.000000
CE812	20.000000	.000000

ROW	SLACK OR SURPLUS	DUAL PRICES
2)	.000000	-72.000000
3)	.000000	-72.000000
4)	.000000	-72.000000
5)	.000000	-72.000000
6)	.000000	-72.000000
7)	.000000	-72.000000
8)	.000000	-72.000000
9)	.000000	-72.000000
10)	.000000	-72.000000
11)	.000000	-50.000000
12)	.000000	.000000
13)	.000000	-50.000000
14)	50.000000	.000000
15)	.000000	.000000
16)	40.000000	.000000
17)	10.000000	.000000
18)	.000000	.000000
19)	10.000000	.000000
20)	25.000000	.000000
21)	30.000000	.000000
22)	.000000	.000000
23)	30.000000	.000000
24)	15.000000	.000000
25)	30.000000	.000000
26)	120.000000	.000000
27)	.000000	72.000000
28)	.000000	72.000000
29)	.000000	72.000000
30)	.000000	72.000000
31)	.000000	72.000000
32)	.000000	50.000000
33)	.000000	.000000
34)	140.000000	.000000
35)	50.000000	.000000
36)	.000000	17.000000
37)	.000000	17.000000
38)	.000000	17.000000
39)	.000000	17.000000
40)	.000000	17.000000
41)	50.000000	.000000
42)	50.000000	.000000
43)	50.000000	.000000

44)	80.000000	.000000
45)	.000000	22.000000
46)	.000000	22.000000
47)	.000000	22.000000
48)	.000000	22.000000
49)	.000000	22.000000
50)	30.000000	.000000
51)	60.000000	.000000
52)	100.000000	.000000
53)	100.000000	.000000
54)	100.000000	.000000
55)	80.000000	.000000
56)	.000000	.000000
57)	.000000	.000000
58)	50.000000	.000000
59)	100.000000	.000000
60)	100.000000	.000000
61)	100.000000	.000000
62)	150.000000	.000000
63)	50.000000	.000000
64)	50.000000	.000000
65)	.000000	.000000
66)	25.000000	.000000
67)	.000000	.000000
68)	100.000000	.000000
69)	60.000000	.000000
70)	150.000000	.000000
71)	80.000000	.000000
72)	80.000000	.000000
73)	60.000000	.000000
74)	.000000	.000000
75)	30.000000	.000000
76)	30.000000	.000000
77)	60.000000	.000000
78)	60.000000	.000000
79)	80.000000	.000000
80)	.000000	50.000000
81)	20.000000	.000000
82)	50.000000	.000000
83)	30.000000	.000000
84)	50.000000	.000000
85)	50.000000	.000000
86)	20.000000	.000000
87)	30.000000	.000000
88)	.000000	.000000
89)	50.000000	.000000
90)	10.000000	.000000
91)	10.000000	.000000
92)	.000000	.000000
93)	50.000000	.000000
94)	50.000000	.000000
95)	50.000000	.000000
96)	50.000000	.000000
97)	.000000	.000000
98)	.000000	.000000
99)	50.000000	.000000
100)	50.000000	.000000
101)	50.000000	.000000
102)	80.000000	.000000
103)	.000000	.000000

104)	50.000000	.000000
105)	.000000	.000000
106)	50.000000	.000000
107)	50.000000	.000000
108)	30.000000	.000000
109)	20.000000	.000000
110)	.000000	.000000
111)	50.000000	.000000
112)	50.000000	.000000
113)	50.000000	.000000
114)	50.000000	.000000
115)	.000000	.000000
116)	.000000	.000000
117)	50.000000	.000000
118)	80.000000	.000000
119)	.000000	.000000
120)	50.000000	.000000
121)	50.000000	.000000
122)	50.000000	.000000
123)	50.000000	.000000
124)	80.000000	.000000
125)	20.000000	.000000
126)	50.000000	.000000
127)	.000000	.000000
128)	50.000000	.000000
129)	50.000000	.000000
130)	.000000	.000000
131)	20.000000	.000000
132)	.000000	.000000
133)	50.000000	.000000
134)	30.000000	.000000
135)	30.000000	.000000
136)	50.000000	.000000
137)	.000000	.000000
138)	.000000	.000000
139)	.000000	.000000
140)	50.000000	.000000
141)	.000000	.000000
142)	80.000000	.000000
143)	20.000000	.000000
144)	50.000000	.000000
145)	50.000000	.000000
146)	45.000000	.000000
147)	45.000000	.000000
148)	80.000000	.000000
149)	20.000000	.000000
150)	50.000000	.000000
151)	50.000000	.000000
152)	.000000	.000000
153)	50.000000	.000000
154)	30.000000	.000000
155)	20.000000	.000000
156)	.000000	.000000
157)	10.000000	.000000
158)	50.000000	.000000
159)	50.000000	.000000
160)	25.000000	.000000
161)	.000000	.000000
162)	75.000000	.000000
163)	40.000000	.000000

164)	35.000000	.000000
165)	25.000000	.000000
166)	80.000000	.000000
167)	20.000000	.000000
168)	50.000000	.000000
169)	50.000000	.000000
170)	20.000000	.000000
171)	50.000000	.000000
172)	55.000000	.000000
173)	20.000000	.000000
174)	25.000000	.000000
175)	50.000000	.000000
176)	50.000000	.000000
177)	50.000000	.000000
178)	.000000	.000000
179)	.000000	.000000
180)	.000000	.000000
181)	50.000000	.000000
182)	50.000000	.000000
183)	50.000000	.000000
184)	55.000000	.000000
185)	20.000000	.000000
186)	25.000000	.000000
187)	.000000	.000000
188)	50.000000	.000000
189)	50.000000	.000000
190)	40.000000	.000000
191)	10.000000	.000000
192)	.000000	.000000
193)	50.000000	.000000
194)	.000000	.000000
195)	50.000000	.000000
196)	80.000000	.000000
197)	.000000	.000000
198)	50.000000	.000000
199)	50.000000	.000000
200)	50.000000	.000000
201)	50.000000	.000000
202)	90.000000	.000000
203)	30.000000	.000000
204)	100.000000	.000000
205)	.000000	.000000
206)	50.000000	.000000
207)	.000000	.000000
208)	55.000000	.000000
209)	20.000000	.000000
210)	50.000000	.000000
211)	50.000000	.000000
212)	.000000	.000000
213)	50.000000	.000000
214)	.000000	.000000
215)	.000000	.000000
216)	.000000	.000000
217)	50.000000	.000000
218)	50.000000	.000000
219)	50.000000	.000000
220)	80.000000	.000000
221)	20.000000	.000000
222)	50.000000	.000000
223)	.000000	.000000

224)	50.000000	.000000
225)	.000000	.000000
226)	80.000000	.000000
227)	20.000000	.000000
228)	50.000000	.000000
229)	50.000000	.000000
230)	.000000	.000000
231)	50.000000	.000000
232)	30.000000	.000000
233)	20.000000	.000000
234)	50.000000	.000000
235)	50.000000	.000000
236)	50.000000	.000000
237)	50.000000	.000000
238)	50.000000	.000000
239)	.000000	.000000
240)	.000000	.000000
241)	.000000	.000000
242)	50.000000	.000000
243)	50.000000	.000000
244)	80.000000	.000000
245)	20.000000	.000000
246)	50.000000	.000000
247)	50.000000	.000000
248)	50.000000	.000000
249)	50.000000	.000000
250)	.000000	.000000
251)	30.000000	.000000
252)	100.000000	.000000
253)	50.000000	.000000
254)	50.000000	.000000
255)	50.000000	.000000
256)	.000000	.000000
257)	20.000000	.000000
258)	.000000	.000000
259)	30.000000	.000000
260)	50.000000	.000000
261)	30.000000	.000000
262)	80.000000	.000000
263)	20.000000	.000000
264)	50.000000	.000000
265)	.000000	.000000
266)	50.000000	.000000
267)	50.000000	.000000
268)	.000000	50.000000
269)	20.000000	.000000
270)	50.000000	.000000
271)	30.000000	.000000
272)	50.000000	.000000
273)	50.000000	.000000
274)	40.000000	.000000
275)	20.000000	.000000
276)	10.000000	.000000
277)	50.000000	.000000
278)	50.000000	.000000
279)	50.000000	.000000
280)	.000000	50.000000
281)	20.000000	.000000
282)	.000000	.000000
283)	30.000000	.000000

284)	50.000000	.000000
285)	30.000000	.000000
286)	20.000000	.000000
287)	20.000000	.000000
288)	50.000000	.000000
289)	50.000000	.000000
290)	50.000000	.000000
291)	50.000000	.000000
292)	.000000	22.000000
293)	.000000	.000000
294)	20.000000	.000000
295)	50.000000	.000000
296)	30.000000	.000000
297)	50.000000	.000000
298)	.000000	.000000
299)	80.000000	.000000
300)	50.000000	.000000
301)	.000000	.000000
302)	.000000	.000000
303)	95.000000	.000000
304)	50.000000	.000000
305)	10.000000	.000000
306)	.000000	.000000
307)	70.000000	.000000
308)	75.000000	.000000
309)	.000000	.000000
310)	25.000000	.000000
311)	.000000	.000000
312)	80.000000	.000000
313)	70.000000	.000000
314)	25.000000	.000000
315)	.000000	.000000
316)	50.000000	.000000
317)	50.000000	.000000
318)	50.000000	.000000
319)	.000000	.000000
320)	100.000000	.000000
321)	.000000	22.000000
322)	.000000	.000000
323)	50.000000	.000000
324)	.000000	.000000
325)	60.000000	.000000
326)	.000000	.000000
327)	40.000000	.000000
328)	.000000	.000000
329)	.000000	.000000
330)	50.000000	.000000
331)	50.000000	.000000
332)	.000000	.000000
333)	.000000	.000000
334)	.000000	.000000
335)	.000000	.000000
336)	.000000	.000000
337)	.000000	.000000
338)	.000000	.000000
339)	20.000000	.000000
340)	50.000000	.000000
341)	100.000000	.000000
342)	30.000000	.000000
343)	.000000	.000000

344)	120.000000	.000000
345)	80.000000	.000000
346)	30.000000	.000000
347)	20.000000	.000000
348)	.000000	.000000
349)	.000000	.000000
350)	20.000000	.000000
351)	30.000000	.000000
352)	.000000	.000000
353)	.000000	.000000
354)	25.000000	.000000
355)	.000000	.000000
356)	30.000000	.000000
357)	80.000000	.000000
358)	.000000	.000000
359)	60.000000	.000000
360)	.000000	.000000
361)	30.000000	.000000
362)	.000000	.000000
363)	.000000	.000000
364)	.000000	.000000
365)	.000000	.000000
366)	.000000	.000000
367)	50.000000	.000000
368)	.000000	.000000
369)	50.000000	.000000
370)	50.000000	.000000
371)	50.000000	.000000
372)	40.000000	.000000
373)	.000000	.000000
374)	.000000	.000000
375)	.000000	.000000
376)	.000000	.000000
377)	50.000000	.000000
378)	.000000	.000000
379)	20.000000	.000000
380)	.000000	.000000
381)	.000000	.000000
382)	.000000	.000000
383)	50.000000	.000000
384)	50.000000	.000000
385)	.000000	.000000
386)	30.000000	.000000
387)	.000000	.000000
388)	50.000000	.000000
389)	.000000	.000000
390)	.000000	.000000
391)	20.000000	.000000
392)	.000000	.000000
393)	.000000	.000000
394)	50.000000	.000000
395)	.000000	.000000

NO. ITERATIONS= 139

RANGES IN WHICH THE BASIS IS UNCHANGED:

	OBJ COEFFICIENT RANGES		
VARIABLE	CURRENT COEF	ALLOWABLE INCREASE	ALLOWABLE DECREASE

IO106	55.000000	INFINITY	5.000000
IO205	55.000000	INFINITY	.000000
IO206	55.000000	.000000	.000000
IO207	55.000000	.000000	INFINITY
IO208	55.000000	.000000	INFINITY
IO301	55.000000	.000000	.000000
IO305	55.000000	.000000	INFINITY
IO306	55.000000	.000000	.000000
IO307	55.000000	INFINITY	.000000
IO308	55.000000	INFINITY	.000000
IO401	55.000000	.000000	INFINITY
IO402	55.000000	INFINITY	.000000
IO403	55.000000	INFINITY	.000000
IO404	55.000000	.000000	.000000
IO405	55.000000	.000000	INFINITY
IO408	55.000000	INFINITY	.000000
IO409	55.000000	INFINITY	.000000
IO501	55.000000	.000000	.000000
IO502	55.000000	INFINITY	.000000
IO503	55.000000	.000000	.000000
IO504	55.000000	.000000	INFINITY
IO505	55.000000	INFINITY	.000000
IO509	55.000000	INFINITY	.000000
IO601	55.000000	.000000	.000000
IO602	55.000000	.000000	.000000
IO603	55.000000	INFINITY	.000000
IO604	55.000000	INFINITY	.000000
IO605	55.000000	.000000	INFINITY
IO610	55.000000	INFINITY	22.000000
IO705	55.000000	INFINITY	5.000000
IO710	55.000000	INFINITY	5.000000
IO712	55.000000	INFINITY	5.000000
IO810	55.000000	INFINITY	5.000000
IO811	55.000000	INFINITY	55.000000
IO812	55.000000	INFINITY	5.000000
IO911	55.000000	INFINITY	55.000000
CR106	50.000000	5.000000	50.000000
CR205	50.000000	.000000	INFINITY
CR206	50.000000	INFINITY	.000000
CR207	50.000000	.000000	.000000
CR208	50.000000	.000000	INFINITY
CR301	50.000000	INFINITY	.000000
CR305	50.000000	.000000	.000000
CR306	50.000000	INFINITY	.000000
CR307	50.000000	.000000	.000000
CR308	50.000000	INFINITY	.000000
CR401	50.000000	.000000	.000000
CR402	50.000000	INFINITY	.000000
CR403	50.000000	.000000	.000000
CR404	50.000000	.000000	.000000
CR405	50.000000	.000000	.000000
CR408	50.000000	INFINITY	.000000
CR409	50.000000	INFINITY	.000000
CR501	50.000000	INFINITY	.000000
CR502	50.000000	.000000	.000000
CR503	50.000000	INFINITY	.000000
CR504	50.000000	INFINITY	.000000
CR505	50.000000	.000000	.000000
CR509	50.000000	INFINITY	.000000
CR601	50.000000	INFINITY	.000000

CR602	50.000000	.000000	.000000
CR603	50.000000	.000000	.000000
CR604	50.000000	INFINITY	.000000
CR605	50.000000	.000000	INFINITY
CR610	50.000000	INFINITY	22.000000
CR705	50.000000	.000000	.000000
CR710	50.000000	.000000	.000000
CR712	50.000000	.000000	.000000
CR810	50.000000	5.000000	.000000
CR811	50.000000	INFINITY	50.000000
CR812	50.000000	.000000	50.000000
CR911	50.000000	INFINITY	50.000000
CO106	72.000000	INFINITY	22.000000
CO205	72.000000	INFINITY	.000000
CO206	72.000000	INFINITY	.000000
CO207	72.000000	INFINITY	.000000
CO208	72.000000	INFINITY	.000000
CO301	72.000000	INFINITY	.000000
CO305	72.000000	INFINITY	.000000
CO306	72.000000	INFINITY	.000000
CO307	72.000000	INFINITY	.000000
CO308	72.000000	.000000	.000000
CO401	72.000000	INFINITY	.000000
CO402	72.000000	.000000	.000000
CO403	72.000000	.000000	INFINITY
CO404	72.000000	INFINITY	.000000
CO405	72.000000	.000000	.000000
CO408	72.000000	.000000	.000000
CO409	72.000000	INFINITY	.000000
CO501	72.000000	INFINITY	.000000
CO502	72.000000	INFINITY	.000000
CO503	72.000000	.000000	.000000
CO504	72.000000	INFINITY	.000000
CO505	72.000000	INFINITY	.000000
CO509	72.000000	.000000	INFINITY
CO601	72.000000	INFINITY	.000000
CO602	72.000000	INFINITY	.000000
CO603	72.000000	.000000	.000000
CO604	72.000000	INFINITY	.000000
CO605	72.000000	.000000	.000000
CO610	72.000000	INFINITY	22.000000
CO705	72.000000	INFINITY	22.000000
CO710	72.000000	INFINITY	22.000000
CO712	72.000000	INFINITY	22.000000
CO810	72.000000	INFINITY	22.000000
CO811	72.000000	INFINITY	72.000000
CO812	72.000000	INFINITY	22.000000
CO911	72.000000	INFINITY	72.000000
IR301	.000000	.000000	.000000
IR401	.000000	.000000	.000000
IR501	.000000	.000000	INFINITY
IR601	.000000	.000000	INFINITY
IR402	.000000	INFINITY	.000000
IR502	.000000	.000000	.000000
IR602	.000000	.000000	.000000
IR403	.000000	INFINITY	.000000
IR503	.000000	.000000	.000000
IR603	.000000	INFINITY	.000000
IR404	.000000	.000000	.000000
IR504	.000000	INFINITY	.000000

IR604	.000000	.000000	.000000
IR205	.000000	.000000	.000000
IR305	.000000	.000000	.000000
IR405	.000000	.000000	.000000
IR505	.000000	.000000	.000000
IR605	.000000	.000000	.000000
IR705	.000000	.000000	.000000
IR106	.000000	50.000000	INFINITY
IR206	.000000	.000000	.000000
IR306	.000000	INFINITY	.000000
IR207	.000000	.000000	.000000
IR307	.000000	INFINITY	.000000
IR208	.000000	INFINITY	.000000
IR308	.000000	.000000	INFINITY
IR408	.000000	INFINITY	.000000
IR409	.000000	.000000	.000000
IR509	.000000	.000000	.000000
IR610	.000000	INFINITY	22.000000
IR710	.000000	.000000	INFINITY
IR810	.000000	50.000000	INFINITY
IR811	.000000	.000000	50.000000
IR911	.000000	50.000000	.000000
IR712	.000000	.000000	.000000
IR812	.000000	50.000000	INFINITY
IE301	.000000	.000000	INFINITY
CE301	.000000	.000000	.000000
IE401	.000000	.000000	INFINITY
CE401	.000000	.000000	.000000
IE501	.000000	.000000	INFINITY
CE501	.000000	.000000	.000000
IE601	.000000	.000000	INFINITY
CE601	.000000	.000000	.000000
IE402	.000000	INFINITY	.000000
CE402	.000000	.000000	.000000
IE502	.000000	.000000	.000000
CE502	.000000	INFINITY	.000000
IE602	.000000	INFINITY	.000000
CE602	.000000	.000000	.000000
IE403	.000000	INFINITY	.000000
CE403	.000000	INFINITY	.000000
IE503	.000000	.000000	INFINITY
CE503	.000000	INFINITY	.000000
IE603	.000000	INFINITY	.000000
CE603	.000000	INFINITY	.000000
IE404	.000000	.000000	INFINITY
CE404	.000000	INFINITY	.000000
IE504	.000000	INFINITY	.000000
CE504	.000000	INFINITY	.000000
IE604	.000000	INFINITY	.000000
CE604	.000000	INFINITY	.000000
IE405	.000000	.000000	.000000
CE405	.000000	.000000	.000000
IE505	.000000	INFINITY	.000000
CE505	.000000	.000000	INFINITY
IE605	.000000	.000000	.000000
CE605	.000000	INFINITY	.000000
IE705	.000000	INFINITY	.000000
CE705	.000000	.000000	.000000
IE106	.000000	INFINITY	.000000
CE106	.000000	INFINITY	.000000

IE206	.000000	.000000	INFINITY
CE206	.000000	.000000	.000000
IE306	.000000	INFINITY	.000000
CE306	.000000	INFINITY	.000000
IE207	.000000	.000000	INFINITY
CE207	.000000	INFINITY	.000000
IE307	.000000	INFINITY	.000000
CE307	.000000	INFINITY	.000000
IE208	.000000	INFINITY	.000000
CE208	.000000	INFINITY	.000000
IE308	.000000	.000000	INFINITY
CE308	.000000	.000000	.000000
IE408	.000000	INFINITY	.000000
CE408	.000000	INFINITY	.000000
IE409	.000000	.000000	.000000
CE409	.000000	INFINITY	.000000
IE509	.000000	INFINITY	.000000
CE509	.000000	INFINITY	.000000
IE610	.000000	INFINITY	.000000
CE610	.000000	INFINITY	.000000
IE710	.000000	.000000	INFINITY
CE710	.000000	.000000	.000000
IE810	.000000	INFINITY	.000000
CE810	.000000	INFINITY	.000000
IE811	.000000	.000000	50.000000
CE811	.000000	INFINITY	.000000
IE911	.000000	INFINITY	.000000
CE911	.000000	INFINITY	.000000
IE712	.000000	INFINITY	.000000
CE712	.000000	INFINITY	.000000
IE812	.000000	.000000	INFINITY
CE812	.000000	.000000	50.000000

RIGHTHAND SIDE RANGES

ROW	CURRENT RHS	ALLOWABLE INCREASE	ALLOWABLE DECREASE
2	350.000000	.000000	10.000000
3	130.000000	.000000	.000000
4	200.000000	.000000	50.000000
5	160.000000	.000000	40.000000
6	800.000000	.000000	25.000000
7	200.000000	.000000	10.000000
8	100.000000	.000000	.000000
9	200.000000	.000000	10.000000
10	100.000000	.000000	25.000000
11	200.000000	.000000	20.000000
12	100.000000	20.000000	60.000000
13	150.000000	.000000	50.000000
14	200.000000	50.000000	INFINITY
15	80.000000	.000000	.000000
16	10.000000	40.000000	INFINITY
17	40.000000	10.000000	INFINITY
18	200.000000	50.000000	.000000
19	40.000000	10.000000	INFINITY
20	25.000000	25.000000	INFINITY
21	40.000000	30.000000	INFINITY
22	25.000000	5.000000	15.000000
23	40.000000	30.000000	INFINITY
24	25.000000	15.000000	INFINITY
25	40.000000	30.000000	INFINITY

26	200.000000	INFINITY	120.000000
27	200.000000	10.000000	.000000
28	200.000000	10.000000	.000000
29	200.000000	15.000000	.000000
30	200.000000	25.000000	.000000
31	200.000000	30.000000	.000000
32	200.000000	50.000000	.000000
33	200.000000	10.000000	15.000000
34	200.000000	INFINITY	140.000000
35	50.000000	INFINITY	50.000000
36	50.000000	10.000000	.000000
37	50.000000	10.000000	.000000
38	50.000000	15.000000	.000000
39	50.000000	10.000000	.000000
40	50.000000	.000000	.000000
41	50.000000	INFINITY	50.000000
42	50.000000	INFINITY	50.000000
43	50.000000	INFINITY	50.000000
44	100.000000	INFINITY	80.000000
45	100.000000	.000000	.000000
46	100.000000	.000000	.000000
47	100.000000	50.000000	.000000
48	100.000000	.000000	.000000
49	100.000000	50.000000	.000000
50	100.000000	INFINITY	30.000000
51	100.000000	INFINITY	60.000000
52	100.000000	INFINITY	100.000000
53	100.000000	INFINITY	100.000000
54	100.000000	INFINITY	100.000000
55	100.000000	INFINITY	80.000000
56	100.000000	10.000000	.000000
57	100.000000	INFINITY	.000000
58	100.000000	INFINITY	50.000000
59	100.000000	INFINITY	100.000000
60	100.000000	INFINITY	100.000000
61	100.000000	INFINITY	100.000000
62	150.000000	INFINITY	150.000000
63	150.000000	INFINITY	50.000000
64	150.000000	INFINITY	50.000000
65	150.000000	.000000	25.000000
66	150.000000	INFINITY	25.000000
67	150.000000	.000000	30.000000
68	150.000000	INFINITY	100.000000
69	150.000000	INFINITY	60.000000
70	150.000000	INFINITY	150.000000
71	80.000000	INFINITY	80.000000
72	80.000000	INFINITY	80.000000
73	80.000000	INFINITY	60.000000
74	80.000000	.000000	.000000
75	80.000000	INFINITY	30.000000
76	80.000000	INFINITY	30.000000
77	80.000000	INFINITY	60.000000
78	80.000000	INFINITY	60.000000
79	80.000000	INFINITY	80.000000
80	80.000000	20.000000	30.000000
81	20.000000	INFINITY	20.000000
82	50.000000	INFINITY	50.000000
83	50.000000	INFINITY	30.000000
84	50.000000	INFINITY	50.000000
85	50.000000	INFINITY	50.000000

86	120.000000	INFINITY	20.000000
87	30.000000	INFINITY	30.000000
88	50.000000	.000000	.000000
89	50.000000	INFINITY	50.000000
90	80.000000	INFINITY	10.000000
91	20.000000	INFINITY	10.000000
92	50.000000	30.000000	10.000000
93	50.000000	INFINITY	50.000000
94	50.000000	INFINITY	50.000000
95	50.000000	INFINITY	50.000000
96	80.000000	INFINITY	50.000000
97	20.000000	10.000000	10.000000
98	50.000000	.000000	.000000
99	50.000000	INFINITY	50.000000
100	50.000000	INFINITY	50.000000
101	50.000000	INFINITY	50.000000
102	80.000000	INFINITY	80.000000
103	20.000000	.000000	.000000
104	50.000000	INFINITY	50.000000
105	50.000000	.000000	.000000
106	50.000000	INFINITY	50.000000
107	50.000000	INFINITY	50.000000
108	80.000000	INFINITY	30.000000
109	20.000000	INFINITY	20.000000
110	50.000000	.000000	50.000000
111	50.000000	INFINITY	50.000000
112	50.000000	INFINITY	50.000000
113	50.000000	INFINITY	50.000000
114	120.000000	INFINITY	50.000000
115	30.000000	.000000	20.000000
116	50.000000	INFINITY	.000000
117	50.000000	INFINITY	50.000000
118	80.000000	INFINITY	80.000000
119	20.000000	INFINITY	.000000
120	50.000000	INFINITY	50.000000
121	50.000000	INFINITY	50.000000
122	50.000000	INFINITY	50.000000
123	50.000000	INFINITY	50.000000
124	80.000000	INFINITY	80.000000
125	20.000000	INFINITY	20.000000
126	50.000000	INFINITY	50.000000
127	50.000000	INFINITY	.000000
128	50.000000	INFINITY	50.000000
129	50.000000	INFINITY	50.000000
130	80.000000	.000000	10.000000
131	20.000000	INFINITY	20.000000
132	50.000000	30.000000	30.000000
133	50.000000	INFINITY	50.000000
134	50.000000	INFINITY	30.000000
135	50.000000	INFINITY	30.000000
136	80.000000	INFINITY	50.000000
137	20.000000	.000000	20.000000
138	50.000000	25.000000	.000000
139	50.000000	INFINITY	.000000
140	50.000000	INFINITY	50.000000
141	50.000000	INFINITY	.000000
142	80.000000	INFINITY	80.000000
143	20.000000	INFINITY	20.000000
144	50.000000	INFINITY	50.000000
145	50.000000	INFINITY	50.000000

146	50.000000	INFINITY	45.000000
147	50.000000	INFINITY	45.000000
148	80.000000	INFINITY	80.000000
149	20.000000	INFINITY	20.000000
150	50.000000	INFINITY	50.000000
151	50.000000	INFINITY	50.000000
152	50.000000	.000000	10.000000
153	50.000000	INFINITY	50.000000
154	80.000000	INFINITY	30.000000
155	20.000000	INFINITY	20.000000
156	50.000000	.000000	.000000
157	50.000000	INFINITY	10.000000
158	50.000000	INFINITY	50.000000
159	50.000000	INFINITY	50.000000
160	120.000000	INFINITY	25.000000
161	30.000000	.000000	20.000000
162	100.000000	INFINITY	75.000000
163	50.000000	INFINITY	40.000000
164	50.000000	INFINITY	35.000000
165	50.000000	INFINITY	25.000000
166	80.000000	INFINITY	80.000000
167	20.000000	INFINITY	20.000000
168	50.000000	INFINITY	50.000000
169	50.000000	INFINITY	50.000000
170	50.000000	INFINITY	20.000000
171	50.000000	INFINITY	50.000000
172	80.000000	INFINITY	55.000000
173	20.000000	INFINITY	20.000000
174	50.000000	INFINITY	25.000000
175	50.000000	INFINITY	50.000000
176	50.000000	INFINITY	50.000000
177	50.000000	INFINITY	50.000000
178	80.000000	10.000000	.000000
179	20.000000	INFINITY	.000000
180	50.000000	25.000000	50.000000
181	50.000000	INFINITY	50.000000
182	50.000000	INFINITY	50.000000
183	50.000000	INFINITY	50.000000
184	80.000000	INFINITY	55.000000
185	20.000000	INFINITY	20.000000
186	50.000000	INFINITY	25.000000
187	50.000000	INFINITY	.000000
188	50.000000	INFINITY	50.000000
189	50.000000	INFINITY	50.000000
190	80.000000	INFINITY	40.000000
191	20.000000	INFINITY	10.000000
192	50.000000	.000000	.000000
193	50.000000	INFINITY	50.000000
194	50.000000	INFINITY	.000000
195	50.000000	INFINITY	50.000000
196	80.000000	INFINITY	80.000000
197	20.000000	.000000	.000000
198	50.000000	INFINITY	50.000000
199	50.000000	INFINITY	50.000000
200	50.000000	INFINITY	50.000000
201	50.000000	INFINITY	50.000000
202	120.000000	INFINITY	90.000000
203	30.000000	INFINITY	30.000000
204	100.000000	INFINITY	100.000000
205	50.000000	INFINITY	.000000

206	50.000000	INFINITY	50.000000
207	50.000000	.000000	.000000
208	80.000000	INFINITY	55.000000
209	20.000000	INFINITY	20.000000
210	50.000000	INFINITY	50.000000
211	50.000000	INFINITY	50.000000
212	50.000000	.000000	.000000
213	50.000000	INFINITY	50.000000
214	80.000000	.000000	.000000
215	20.000000	INFINITY	.000000
216	50.000000	30.000000	.000000
217	50.000000	INFINITY	50.000000
218	50.000000	INFINITY	50.000000
219	50.000000	INFINITY	50.000000
220	80.000000	INFINITY	80.000000
221	20.000000	INFINITY	20.000000
222	50.000000	INFINITY	50.000000
223	50.000000	INFINITY	.000000
224	50.000000	INFINITY	50.000000
225	50.000000	INFINITY	.000000
226	80.000000	INFINITY	80.000000
227	20.000000	INFINITY	20.000000
228	50.000000	INFINITY	50.000000
229	50.000000	INFINITY	50.000000
230	50.000000	INFINITY	.000000
231	50.000000	INFINITY	50.000000
232	80.000000	INFINITY	30.000000
233	20.000000	INFINITY	20.000000
234	50.000000	INFINITY	50.000000
235	50.000000	INFINITY	50.000000
236	50.000000	INFINITY	50.000000
237	50.000000	INFINITY	50.000000
238	120.000000	INFINITY	50.000000
239	30.000000	.000000	.000000
240	100.000000	INFINITY	.000000
241	50.000000	.000000	50.000000
242	50.000000	INFINITY	50.000000
243	50.000000	INFINITY	50.000000
244	80.000000	INFINITY	80.000000
245	20.000000	INFINITY	20.000000
246	50.000000	INFINITY	50.000000
247	50.000000	INFINITY	50.000000
248	50.000000	INFINITY	50.000000
249	50.000000	INFINITY	50.000000
250	120.000000	INFINITY	.000000
251	30.000000	INFINITY	30.000000
252	100.000000	INFINITY	100.000000
253	50.000000	INFINITY	50.000000
254	50.000000	INFINITY	50.000000
255	50.000000	INFINITY	50.000000
256	80.000000	.000000	30.000000
257	20.000000	INFINITY	20.000000
258	50.000000	30.000000	30.000000
259	50.000000	INFINITY	30.000000
260	50.000000	INFINITY	50.000000
261	50.000000	INFINITY	30.000000
262	80.000000	INFINITY	80.000000
263	20.000000	INFINITY	20.000000
264	50.000000	INFINITY	50.000000
265	50.000000	INFINITY	.000000

266	50.000000	INFINITY	50.000000
267	50.000000	INFINITY	50.000000
268	80.000000	15.000000	10.000000
269	20.000000	INFINITY	20.000000
270	50.000000	INFINITY	50.000000
271	50.000000	INFINITY	30.000000
272	50.000000	INFINITY	50.000000
273	50.000000	INFINITY	50.000000
274	80.000000	INFINITY	40.000000
275	20.000000	INFINITY	20.000000
276	50.000000	INFINITY	10.000000
277	50.000000	INFINITY	50.000000
278	50.000000	INFINITY	50.000000
279	50.000000	INFINITY	50.000000
280	80.000000	15.000000	10.000000
281	20.000000	INFINITY	20.000000
282	50.000000	30.000000	30.000000
283	50.000000	INFINITY	30.000000
284	50.000000	INFINITY	50.000000
285	50.000000	INFINITY	30.000000
286	80.000000	INFINITY	20.000000
287	20.000000	INFINITY	20.000000
288	50.000000	INFINITY	50.000000
289	50.000000	INFINITY	50.000000
290	50.000000	INFINITY	50.000000
291	50.000000	INFINITY	50.000000
292	100.000000	10.000000	.000000
293	150.000000	.000000	10.000000
294	100.000000	INFINITY	20.000000
295	100.000000	INFINITY	50.000000
296	100.000000	INFINITY	30.000000
297	100.000000	INFINITY	50.000000
298	150.000000	.000000	10.000000
299	100.000000	INFINITY	80.000000
300	100.000000	INFINITY	50.000000
301	100.000000	10.000000	.000000
302	100.000000	.000000	.000000
303	100.000000	INFINITY	95.000000
304	100.000000	INFINITY	50.000000
305	100.000000	INFINITY	10.000000
306	150.000000	.000000	15.000000
307	100.000000	INFINITY	70.000000
308	100.000000	INFINITY	75.000000
309	100.000000	INFINITY	.000000
310	100.000000	INFINITY	25.000000
311	100.000000	.000000	.000000
312	100.000000	INFINITY	80.000000
313	150.000000	INFINITY	70.000000
314	100.000000	INFINITY	25.000000
315	100.000000	.000000	.000000
316	100.000000	INFINITY	50.000000
317	100.000000	INFINITY	50.000000
318	100.000000	INFINITY	50.000000
319	150.000000	25.000000	.000000
320	100.000000	INFINITY	100.000000
321	120.000000	.000000	.000000
322	100.000000	20.000000	.000000
323	100.000000	INFINITY	50.000000
324	100.000000	INFINITY	.000000
325	100.000000	INFINITY	60.000000

326	100.000000	30.000000	.000000
327	100.000000	INFINITY	40.000000
328	.000000	INFINITY	.000000
329	.000000	.000000	.000000
330	.000000	INFINITY	50.000000
331	.000000	INFINITY	50.000000
332	.000000	INFINITY	.000000
333	.000000	.000000	.000000
334	.000000	INFINITY	.000000
335	.000000	INFINITY	.000000
336	.000000	.000000	.000000
337	.000000	INFINITY	.000000
338	.000000	.000000	.000000
339	.000000	INFINITY	20.000000
340	.000000	INFINITY	50.000000
341	.000000	INFINITY	100.000000
342	.000000	INFINITY	30.000000
343	.000000	30.000000	.000000
344	.000000	INFINITY	120.000000
345	.000000	INFINITY	80.000000
346	.000000	INFINITY	30.000000
347	.000000	INFINITY	20.000000
348	.000000	.000000	.000000
349	.000000	INFINITY	.000000
350	.000000	INFINITY	20.000000
351	.000000	INFINITY	30.000000
352	.000000	INFINITY	.000000
353	.000000	15.000000	.000000
354	.000000	INFINITY	25.000000
355	.000000	INFINITY	.000000
356	.000000	INFINITY	30.000000
357	.000000	INFINITY	80.000000
358	.000000	10.000000	15.000000
359	.000000	INFINITY	60.000000
360	.000000	INFINITY	.000000
361	.000000	INFINITY	30.000000
362	.000000	50.000000	.000000
363	.000000	.000000	.000000
364	.000000	30.000000	.000000
365	.000000	30.000000	.000000
366	.000000	5.000000	.000000
367	.000000	INFINITY	50.000000
368	.000000	.000000	.000000
369	.000000	INFINITY	50.000000
370	.000000	INFINITY	50.000000
371	.000000	INFINITY	50.000000
372	.000000	INFINITY	40.000000
373	.000000	INFINITY	.000000
374	.000000	INFINITY	.000000
375	.000000	.000000	.000000
376	.000000	.000000	.000000
377	.000000	INFINITY	50.000000
378	.000000	.000000	50.000000
379	.000000	INFINITY	20.000000
380	.000000	50.000000	.000000
381	.000000	INFINITY	.000000
382	.000000	INFINITY	.000000
383	.000000	INFINITY	50.000000
384	.000000	INFINITY	50.000000
385	.000000	30.000000	20.000000

386	.000000	INFINITY	30.000000
387	.000000	INFINITY	.000000
388	.000000	INFINITY	50.000000
389	.000000	INFINITY	.000000
390	.000000	30.000000	20.000000
391	.000000	INFINITY	20.000000
392	.000000	INFINITY	.000000
393	.000000	INFINITY	.000000
394	.000000	INFINITY	50.000000
395	.000000	30.000000	20.000000

			Version 1	Version 2
LP OPTIMUM FOUND AT STEP:			142	139
OBJECTIVE FUNCTION VALUE:			61640	64690
Results				
			Version 1	Version 2
	Version 1	Version 2	REDUCED	REDUCED
VARIABLE	VALUE	VALUE	COST	COST
IR106	80	80	0	0
IR205	100	100	0	0
IR206	70	70	0	0
IR207	30	30	0	0
IR208	0	0	0	0
IR301	40	50	0	0
IR305	80	70	0	0
IR306	0	0	0	0
IR307	0	0	0	0
IR308	80	80	0	0
IR401	50	30	0	0
IR402	0	0	0	0
IR403	0	0	0	0
IR404	40	50	0	0
IR405	100	95	0	0
IR408	0	0	0	0
IR409	10	25	0	0
IR501	50	80	0	0
IR502	50	25	0	0
IR503	30	40	0	0
IR504	0	0	0	0
IR505	20	30	0	0
IR509	50	25	0	0
IR601	30	80	0	0
IR602	50	0	0	0
IR603	0	0	0	0
IR604	50	50	0	0
IR605	70	70	0	0
IR610	0	0	22	22
IR705	110	120	0	0
IR710	80	80	0	0
IR712	10	0	0	0
IR810	80	80	0	0
IR811	40	40	0	0
IR812	80	80	0	0
IR911	60	60	0	0
IO106	20	0	0	5
IO205	0	0	0	0
IO206	20	10	0	0
IO207	20	20	0	0
IO208	10	20	0	0
IO301	10	0	0	0
IO305	30	30	0	0
IO306	10	20	0	0

			Version 1	Version 2
	Version 1	Version 2	REDUCED	REDUCED
VARIABLE	VALUE	VALUE	COST	COST
IO307	0	0	0	0
IO308	0	0	0	0
IO401	0	20	0	0
IO402	20	0	0	0
IO403	0	0	0	0
IO404	0	0	0	0
IO405	30	30	0	0
IO408	0	0	0	0
IO409	0	0	0	0
IO501	0	20	0	0
IO502	0	0	0	0
IO503	20	10	0	0
IO504	20	20	0	0
IO505	10	0	0	0
IO509	0	0	0	0
IO601	20	20	0	0
IO602	0	0	0	0
IO603	0	0	0	0
IO604	0	0	0	0
IO605	30	30	0	0
IO610	0	0	22	22
IO705	10	0	0	5
IO710	20	0	0	5
IO712	20	0	0	5
IO810	20	0	0	5
IO811	0	0	45	55
IO812	20	0	0	5
IO911	0	0	45	55
CR106	0	20	5	0
CR205	50	50	0	0
CR206	0	0	0	0
CR207	0	0	0	0
CR208	50	50	0	0
CR301	50	0	0	0
CR305	0	50	0	0
CR306	0	0	0	0
CR307	50	50	0	0
CR308	0	0	0	0
CR401	50	50	0	0
CR402	10	0	0	0
CR403	0	0	0	0
CR404	0	40	0	0
CR405	0	10	0	0
CR408	40	0	0	0
CR409	0	0	0	0
CR501	50	0	0	0
CR502	0	50	0	0
CR503	0	0	0	0

			Version 1	Version 2
	Version 1	Version 2	REDUCED	REDUCED
VARIABLE	VALUE	VALUE	COST	COST
CR504	0	0	0	0
CR505	50	50	0	0
CR509	0	0	0	0
CR601	0	0	0	0
CR602	0	50	0	0
CR603	50	0	0	0
CR604	0	0	0	0
CR605	50	50	0	0
CR610	0	0	22	22
CR705	0	0	0	0
CR710	0	20	0	0
CR712	20	50	0	0
CR810	0	20	5	0
CR811	0	0	50	50
CR812	0	20	5	0
CR911	0	0	50	50
CO106	0	0	27	22
CO205	0	0	0	0
CO206	0	0	0	0
CO207	0	0	0	0
CO208	0	0	0	0
CO301	0	0	0	0
CO305	40	0	0	0
CO306	0	0	0	0
CO307	0	0	0	0
CO308	20	20	0	0
CO401	0	0	0	0
CO402	0	5	0	0
CO403	0	50	0	0
CO404	0	0	0	0
CO405	20	15	0	0
CO408	0	30	0	0
CO409	0	0	0	0
CO501	0	0	0	0
CO502	0	0	0	0
CO503	50	50	0	0
CO504	0	0	0	0
CO505	0	0	0	0
CO509	40	50	0	0
CO601	0	0	0	0
CO602	0	0	0	0
CO603	50	50	0	0
CO604	50	0	0	0
CO605	0	0	0	0
CO610	0	0	22	22
CO705	0	0	22	22
CO710	0	0	22	22
CO712	0	0	22	22

			Version 1	Version 2
	Version 1	Version 2	REDUCED	REDUCED
VARIABLE	VALUE	VALUE	COST	COST
CO810	0	0	27	22
CO811	0	0	72	72
CO812	0	0	27	22
CO911	0	0	72	72
IE106	0	0	0	0
IE206	50	50	0	0
IE207	50	50	0	0
IE208	0	0	0	0
IE301	50	50	0	0
IE306	0	0	0	0
IE307	0	0	0	0
IE308	50	50	0	0
IE401	50	50	0	0
IE402	20	0	0	0
IE403	0	0	0	0
IE404	40	50	0	0
IE405	30	25	0	0
IE408	0	0	0	0
IE409	10	25	0	0
IE501	50	50	0	0
IE502	50	25	0	0
IE503	50	50	0	0
IE504	0	0	0	0
IE505	0	0	0	0
IE509	0	0	0	0
IE601	50	50	0	0
IE602	0	0	0	0
IE603	0	0	0	0
IE604	0	0	0	0
IE605	100	100	0	0
IE610	0	0	0	0
IE705	0	0	0	0
IE710	50	50	0	0
IE712	0	0	0	0
IE810	0	0	0	0
IE811	40	40	0	0
IE812	50	50	0	0
IE911	0	0	0	0
CE106	0	0	0	0
CE206	0	0	0	0
CE207	0	0	0	0
CE208	0	0	0	0
CE301	50	0	0	0
CE306	0	0	0	0
CE307	0	0	0	0
CE308	20	20	0	0
CE401	50	50	0	0
CE402	10	5	0	0

			Version 1	Version 2
	Version 1	Version 2	REDUCED	REDUCED
VARIABLE	VALUE	VALUE	COST	COST
CE403	0	0	0	0
CE404	0	0	0	0
CE405	20	25	0	0
CE408	0	0	0	0
CE409	0	0	0	0
CE501	0	0	0	0
CE502	0	0	0	0
CE503	0	0	0	0
CE504	0	0	0	0
CE505	50	50	0	0
CE509	15	0	0	0
CE601	0	0	0	0
CE602	0	50	0	0
CE603	0	0	0	0
CE604	0	0	0	0
CE605	0	0	0	0
CE610	0	0	0	0
CE705	0	0	0	0
CE710	0	20	0	0
CE712	0	0	0	0
CE810	0	0	0	0
CE811	0	0	0	0
CE812	0	20	0	0
CE911	0	0	0	0

	Version 1		Version 2	
	Slack or	Dual	Slack or	Dual
ROW	Surplus	Prices	Surplus	Prices
2)	0	-72	0	-72
3)	0	-72	0	-72
4)	0	-72	0	-72
5)	0	-72	0	-72
6)	0	-72	0	-72
7)	0	-72	0	-72
8)	0	-72	0	-72
9)	0	-72	0	-72
10)	0	-72	0	-72
11)	0	-50	0	-50
12)	0	0	0	0
13)	0	-50	0	-50
14)	100	0	50	0
15)	0	0	0	0
16)	40	0	40	0
17)	0	0	10	0
18)	0	0	0	0
19)	10	0	10	0
20)	25	0	25	0
21)	30	0	30	0
22)	0	0	0	0
23)	10	0	30	0
24)	15	0	15	0
25)	10	0	30	0
26)	120	0	120	0
27)	0	72	0	72
28)	0	72	0	72
29)	0	72	0	72
30)	0	72	0	72
31)	0	72	0	72
32)	0	50	0	50
33)	0	0	0	0
34)	140	0	140	0
35)	30	0	50	0
36)	0	27	0	17
37)	0	27	0	17
38)	0	27	0	17
39)	0	27	0	17
40)	0	27	0	17
41)	0	5	50	0
42)	10	0	50	0
43)	50	0	50	0
44)	100	0	80	0
45)	0	22	0	22
46)	0	22	0	22
47)	0	22	0	22
48)	0	22	0	22
49)	0	22	0	22

	Version 1		Version 2	
	Slack or	Dual	Slack or	Dual
ROW	Surplus	Prices	Surplus	Prices
50)	80	0	30	0
51)	100	0	60	0
52)	100	0	100	0
53)	100	0	100	0
54)	100	0	100	0
55)	40	0	80	0
56)	80	0	0	0
57)	10	0	0	0
58)	0	0	50	0
59)	100	0	100	0
60)	100	0	100	0
61)	100	0	100	0
62)	150	0	150	0
63)	50	0	50	0
64)	50	0	50	0
65)	0	0	0	0
66)	0	0	25	0
67)	0	0	0	0
68)	100	0	100	0
69)	60	0	60	0
70)	150	0	150	0
71)	80	0	80	0
72)	80	0	80	0
73)	10	0	60	0
74)	0	0	0	0
75)	15	0	30	0
76)	80	0	30	0
77)	80	0	60	0
78)	80	0	60	0
79)	80	0	80	0
80)	0	45	0	50
81)	0	0	20	0
82)	50	0	50	0
83)	50	0	30	0
84)	50	0	50	0
85)	50	0	50	0
86)	20	0	20	0
87)	30	0	30	0
88)	0	0	0	0
89)	50	0	50	0
90)	10	0	10	0
91)	0	0	10	0
92)	0	0	0	0
93)	50	0	50	0
94)	50	0	50	0
95)	50	0	50	0
96)	50	0	50	0
97)	0	0	0	0

	Version 1		Version 2	
	Slack or	Dual	Slack or	Dual
ROW	Surplus	Prices	Surplus	Prices
98)	0	0	0	0
99)	50	0	50	0
100)	50	0	50	0
101)	50	0	50	0
102)	80	0	80	0
103)	10	0	0	0
104)	50	0	50	0
105)	0	0	0	0
106)	50	0	50	0
107)	50	0	50	0
108)	40	0	30	0
109)	10	0	20	0
110)	0	0	0	0
111)	0	0	50	0
112)	50	0	50	0
113)	0	0	50	0
114)	40	0	50	0
115)	0	0	0	0
116)	50	0	0	0
117)	10	0	50	0
118)	80	0	80	0
119)	10	0	0	0
120)	50	0	50	0
121)	50	0	50	0
122)	50	0	50	0
123)	50	0	50	0
124)	80	0	80	0
125)	20	0	20	0
126)	50	0	50	0
127)	0	0	0	0
128)	50	0	50	0
129)	50	0	50	0
130)	0	0	0	0
131)	20	0	20	0
132)	0	0	0	0
133)	50	0	50	0
134)	30	0	30	0
135)	30	0	30	0
136)	30	0	50	0
137)	20	0	0	0
138)	0	0	0	0
139)	0	0	0	0
140)	50	0	50	0
141)	0	0	0	0
142)	80	0	80	0
143)	0	0	20	0
144)	30	0	50	0
145)	40	0	50	0

	Version 1		Version 2	
	Slack or	Dual	Slack or	Dual
ROW	Surplus	Prices	Surplus	Prices
146)	50	0	45	0
147)	40	0	45	0
148)	80	0	80	0
149)	20	0	20	0
150)	50	0	50	0
151)	50	0	50	0
152)	50	0	0	0
153)	50	0	50	0
154)	40	0	30	0
155)	20	0	20	0
156)	10	0	0	0
157)	50	0	10	0
158)	50	0	50	0
159)	50	0	50	0
160)	20	0	25	0
161)	0	0	0	0
162)	70	0	75	0
163)	50	0	40	0
164)	30	0	35	0
165)	30	0	25	0
166)	80	0	80	0
167)	20	0	20	0
168)	50	0	50	0
169)	10	0	50	0
170)	50	0	20	0
171)	50	0	50	0
172)	70	0	55	0
173)	20	0	20	0
174)	40	0	25	0
175)	50	0	50	0
176)	50	0	50	0
177)	50	0	50	0
178)	30	0	0	0
179)	20	0	0	0
180)	0	0	0	0
181)	0	0	50	0
182)	50	0	50	0
183)	50	0	50	0
184)	30	0	55	0
185)	20	0	20	0
186)	0	0	25	0
187)	50	0	0	0
188)	50	0	50	0
189)	50	0	50	0
190)	50	0	40	0
191)	0	0	10	0
192)	0	0	0	0
193)	50	0	50	0

	Version 1		Version 2	
	Slack or	Dual	Slack or	Dual
ROW	Surplus	Prices	Surplus	Prices
194)	0	0	0	0
195)	50	0	50	0
196)	80	0	80	0
197)	0	0	0	0
198)	50	0	50	0
199)	50	0	50	0
200)	50	0	50	0
201)	50	0	50	0
202)	100	0	90	0
203)	20	0	30	0
204)	100	0	100	0
205)	0	0	0	0
206)	50	0	50	0
207)	0	0	0	0
208)	30	0	55	0
209)	20	0	20	0
210)	50	0	50	0
211)	50	0	50	0
212)	10	0	0	0
213)	35	0	50	0
214)	50	0	0	0
215)	0	0	0	0
216)	0	0	0	0
217)	50	0	50	0
218)	50	0	50	0
219)	50	0	50	0
220)	30	0	80	0
221)	20	0	20	0
222)	50	0	50	0
223)	50	0	0	0
224)	50	0	50	0
225)	50	0	0	0
226)	80	0	80	0
227)	20	0	20	0
228)	50	0	50	0
229)	0	0	50	0
230)	0	0	0	0
231)	50	0	50	0
232)	30	0	30	0
233)	20	0	20	0
234)	50	0	50	0
235)	50	0	50	0
236)	0	0	50	0
237)	50	0	50	0
238)	50	0	50	0
239)	0	0	0	0
240)	0	0	0	0
241)	0	0	0	0

	Version 1		Version 2	
	Slack or	Dual	Slack or	Dual
ROW	Surplus	Prices	Surplus	Prices
242)	50	0	50	0
243)	50	0	50	0
244)	80	0	80	0
245)	20	0	20	0
246)	50	0	50	0
247)	50	0	50	0
248)	50	0	50	0
249)	50	0	50	0
250)	10	0	0	0
251)	20	0	30	0
252)	100	0	100	0
253)	50	0	50	0
254)	50	0	50	0
255)	50	0	50	0
256)	0	0	0	0
257)	0	0	20	0
258)	0	0	0	0
259)	50	0	30	0
260)	50	0	50	0
261)	50	0	30	0
262)	70	0	80	0
263)	0	0	20	0
264)	50	0	50	0
265)	30	0	0	0
266)	50	0	50	0
267)	50	0	50	0
268)	0	45	0	50
269)	0	0	20	0
270)	50	0	50	0
271)	50	0	30	0
272)	50	0	50	0
273)	50	0	50	0
274)	40	0	40	0
275)	20	0	20	0
276)	10	0	10	0
277)	50	0	50	0
278)	50	0	50	0
279)	50	0	50	0
280)	0	45	0	50
281)	0	0	20	0
282)	0	0	0	0
283)	50	0	30	0
284)	50	0	50	0
285)	50	0	30	0
286)	20	0	20	0
287)	20	0	20	0
288)	50	0	50	0
289)	50	0	50	0

	Version 1		Version 2	
	Slack or	Dual	Slack or	Dual
ROW	Surplus	Prices	Surplus	Prices
290)	50	0	50	0
291)	50	0	50	0
292)	0	27	0	22
293)	0	0	0	0
294)	10	0	20	0
295)	50	0	50	0
296)	40	0	30	0
297)	0	0	50	0
298)	0	0	0	0
299)	90	0	80	0
300)	50	0	50	0
301)	0	0	0	0
302)	0	0	0	0
303)	70	0	95	0
304)	100	0	50	0
305)	60	0	10	0
306)	0	0	0	0
307)	60	0	70	0
308)	90	0	75	0
309)	0	0	0	0
310)	50	0	25	0
311)	0	0	0	0
312)	80	0	80	0
313)	70	0	70	0
314)	10	0	25	0
315)	50	0	0	0
316)	50	0	50	0
317)	0	0	50	0
318)	0	0	50	0
319)	0	0	0	0
320)	100	0	100	0
321)	0	22	0	22
322)	0	0	0	0
323)	50	0	50	0
324)	0	5	0	0
325)	60	0	60	0
326)	0	5	0	0
327)	40	0	40	0
328)	0	0	0	0
329)	0	0	0	0
330)	0	0	50	0
331)	0	0	50	0
332)	0	0	0	0
333)	0	0	0	0
334)	50	0	0	0
335)	0	0	0	0
336)	0	0	0	0
337)	0	0	0	0

	Version 1		Version 2	
	Slack or	Dual	Slack or	Dual
ROW	Surplus	Prices	Surplus	Prices
338)	0	0	0	0
339)	20	0	20	0
340)	50	0	50	0
341)	100	0	100	0
342)	30	0	30	0
343)	0	0	0	0
344)	120	0	120	0
345)	100	0	80	0
346)	40	0	30	0
347)	10	0	20	0
348)	0	0	0	0
349)	0	0	0	0
350)	10	0	20	0
351)	30	0	30	0
352)	0	0	0	0
353)	0	0	0	0
354)	50	0	25	0
355)	0	0	0	0
356)	50	0	30	0
357)	100	0	80	0
358)	0	0	0	0
359)	60	0	60	0
360)	30	0	0	0
361)	50	0	30	0
362)	0	0	0	0
363)	0	0	0	0
364)	50	0	0	0
365)	0	0	0	0
366)	0	0	0	0
367)	0	0	50	0
368)	0	0	0	0
369)	0	0	50	0
370)	50	0	50	0
371)	100	0	50	0
372)	0	0	40	0
373)	0	0	0	0
374)	50	0	0	0
375)	0	0	0	0
376)	0	0	0	0
377)	50	0	50	0
378)	0	0	0	0
379)	0	0	20	0
380)	0	0	0	0
381)	0	0	0	0
382)	0	0	0	0
383)	50	0	50	0
384)	50	0	50	0
385)	0	0	0	0

	Version 1		Version 2	
	Slack or	Dual	Slack or	Dual
ROW	Surplus	Prices	Surplus	Prices
386)	40	0	30	0
387)	0	0	0	0
388)	25	0	50	0
389)	0	0	0	0
390)	0	0	0	0
391)	0	0	20	0
392)	0	0	0	0
393)	0	0	0	0
394)	20	0	50	0
395)	0	0	0	0

Objective Function Coefficient						
	Current	Version 1		Current	Version 2	
VARIABLE	Coefficient	MIN	MAX	Coefficient	MIN	MAX
IR106	0	-INFINITY	45	0	-INFINITY	50
IR205	0	0	0	0	0	0
IR206	0	0	0	0	0	0
IR207	0	0	0	0	0	0
IR208	0	0	INFINITY	0	0	INFINITY
IR301	0	0	0	0	0	0
IR305	0	0	0	0	0	0
IR306	0	0	INFINITY	0	0	INFINITY
IR307	0	0	INFINITY	0	0	INFINITY
IR308	0	-INFINITY	0	0	-INFINITY	0
IR401	0	0	0	0	0	0
IR402	0	0	INFINITY	0	0	INFINITY
IR403	0	0	INFINITY	0	0	INFINITY
IR404	0	0	0	0	0	0
IR405	0	0	0	0	0	0
IR408	0	0	INFINITY	0	0	INFINITY
IR409	0	0	0	0	0	0
IR501	0	0	0	0	-INFINITY	0
IR502	0	0	0	0	0	0
IR503	0	0	0	0	0	0
IR504	0	0	INFINITY	0	0	INFINITY
IR505	0	0	0	0	0	0
IR509	0	0	0	0	0	0
IR601	0	0	0	0	-INFINITY	0
IR602	0	0	0	0	0	0
IR603	0	0	INFINITY	0	0	INFINITY
IR604	0	0	0	0	0	0
IR605	0	0	0	0	0	0
IR610	0	-22	INFINITY	0	-22	INFINITY
IR705	0	-5	0	0	0	0
IR710	0	0	0	0	-INFINITY	0
IR712	0	0	5	0	0	0
IR810	0	-INFINITY	45	0	-INFINITY	50
IR811	0	-45	0	0	-50	0
IR812	0	-INFINITY	45	0	-INFINITY	50
IR911	0	0	45	0	0	50
IO106	45	0	50	55	50	INFINITY
IO205	45	45	INFINITY	55	55	INFINITY
IO206	45	-INFINITY	45	55	55	55
IO207	45	-INFINITY	45	55	-INFINITY	55
IO208	45	45	45	55	-INFINITY	55
IO301	45	45	45	55	55	55
IO305	45	-INFINITY	45	55	-INFINITY	55
IO306	45	45	45	55	55	55
IO307	45	45	INFINITY	55	55	INFINITY
IO308	45	45	INFINITY	55	55	INFINITY
IO401	45	45	INFINITY	55	-INFINITY	55
IO402	45	-INFINITY	45	55	55	INFINITY

Objective Function Coefficient						
	Current	Version 1		Current	Version 2	
VARIABLE	Coefficient	MIN	MAX	Coefficient	MIN	MAX
IO403	45	45	INFINITY	55	55	INFINITY
IO404	45	45	INFINITY	55	55	55
IO405	45	-INFINITY	45	55	-INFINITY	55
IO408	45	45	INFINITY	55	55	INFINITY
IO409	45	45	45	55	55	INFINITY
IO501	45	45	INFINITY	55	55	55
IO502	45	45	INFINITY	55	55	INFINITY
IO503	45	-INFINITY	45	55	55	55
IO504	45	-INFINITY	45	55	-INFINITY	55
IO505	45	45	45	55	55	INFINITY
IO509	45	45	INFINITY	55	55	INFINITY
IO601	45	-INFINITY	45	55	55	55
IO602	45	45	45	55	55	55
IO603	45	45	INFINITY	55	55	INFINITY
IO604	45	45	INFINITY	55	55	INFINITY
IO605	45	-INFINITY	45	55	-INFINITY	55
IO610	45	23	INFINITY	55	33	INFINITY
IO705	45	45	50	55	50	INFINITY
IO710	45	-INFINITY	45	55	50	INFINITY
IO712	45	-INFINITY	45	55	50	INFINITY
IO810	45	0	50	55	50	INFINITY
IO811	45	0	INFINITY	55	0	INFINITY
IO812	45	0	50	55	50	INFINITY
IO911	45	0	INFINITY	55	0	INFINITY
CR106	50	45	INFINITY	50	0	55
CR205	50	-INFINITY	50	50	-INFINITY	50
CR206	50	50	INFINITY	50	50	INFINITY
CR207	50	50	50	50	50	50
CR208	50	-INFINITY	50	50	-INFINITY	50
CR301	50	50	50	50	50	INFINITY
CR305	50	50	50	50	50	50
CR306	50	50	INFINITY	50	50	INFINITY
CR307	50	50	50	50	50	50
CR308	50	50	INFINITY	50	50	INFINITY
CR401	50	50	50	50	50	50
CR402	50	50	50	50	50	INFINITY
CR403	50	50	INFINITY	50	50	50
CR404	50	50	INFINITY	50	50	50
CR405	50	50	INFINITY	50	50	50
CR408	50	50	50	50	50	INFINITY
CR409	50	50	INFINITY	50	50	INFINITY
CR501	50	50	50	50	50	INFINITY
CR502	50	50	50	50	50	50
CR503	50	50	INFINITY	50	50	INFINITY
CR504	50	50	INFINITY	50	50	INFINITY
CR505	50	50	50	50	50	50
CR509	50	50	INFINITY	50	50	INFINITY
CR601	50	50	INFINITY	50	50	INFINITY

Objective Function Coefficient						
	Current	Version 1		Current	Version 2	
VARIABLE	Coefficient	MIN	MAX	Coefficient	MIN	MAX
CR602	50	50	50	50	50	50
CR603	50	-INFINITY	50	50	50	50
CR604	50	50	INFINITY	50	50	INFINITY
CR605	50	50	50	50	-INFINITY	50
CR610	50	28	INFINITY	50	28	INFINITY
CR705	50	50	72	50	50	50
CR710	50	50	INFINITY	50	50	50
CR712	50	45	50	50	50	50
CR810	50	45	INFINITY	50	50	55
CR811	50	0	INFINITY	50	0	INFINITY
CR812	50	45	INFINITY	50	0	50
CR911	50	0	INFINITY	50	0	INFINITY
CO106	72	45	INFINITY	72	50	INFINITY
CO205	72	72	INFINITY	72	72	INFINITY
CO206	72	72	INFINITY	72	72	INFINITY
CO207	72	72	INFINITY	72	72	INFINITY
CO208	72	72	INFINITY	72	72	INFINITY
CO301	72	72	INFINITY	72	72	INFINITY
CO305	72	72	72	72	72	INFINITY
CO306	72	72	INFINITY	72	72	INFINITY
CO307	72	72	INFINITY	72	72	INFINITY
CO308	72	72	72	72	72	72
CO401	72	72	INFINITY	72	72	INFINITY
CO402	72	72	INFINITY	72	72	72
CO403	72	72	INFINITY	72	-INFINITY	72
CO404	72	72	INFINITY	72	72	INFINITY
CO405	72	72	72	72	72	72
CO408	72	72	INFINITY	72	72	72
CO409	72	72	INFINITY	72	72	INFINITY
CO501	72	72	INFINITY	72	72	INFINITY
CO502	72	72	INFINITY	72	72	INFINITY
CO503	72	72	72	72	72	72
CO504	72	72	INFINITY	72	72	INFINITY
CO505	72	72	INFINITY	72	72	INFINITY
CO509	72	72	72	72	-INFINITY	72
CO601	72	72	INFINITY	72	72	INFINITY
CO602	72	72	INFINITY	72	72	INFINITY
CO603	72	72	72	72	72	72
CO604	72	-INFINITY	72	72	72	INFINITY
CO605	72	72	INFINITY	72	72	72
CO610	72	50	INFINITY	72	50	INFINITY
CO705	72	50	INFINITY	72	50	INFINITY
CO710	72	50	INFINITY	72	50	INFINITY
CO712	72	50	INFINITY	72	50	INFINITY
CO810	72	45	INFINITY	72	50	INFINITY
CO811	72	0	INFINITY	72	0	INFINITY
CO812	72	45	INFINITY	72	50	INFINITY
CO911	72	0	INFINITY	72	0	INFINITY

Objective Function Coefficient						
	Current	Version 1		Current	Version 2	
VARIABLE	Coefficient	MIN	MAX	Coefficient	MIN	MAX
IE106	0	0	INFINITY	0	0	INFINITY
IE206	0	-INFINITY	0	0	-INFINITY	0
IE207	0	-INFINITY	0	0	-INFINITY	0
IE208	0	0	INFINITY	0	0	INFINITY
IE301	0	0	0	0	-INFINITY	0
IE306	0	0	INFINITY	0	0	INFINITY
IE307	0	0	INFINITY	0	0	INFINITY
IE308	0	-INFINITY	0	0	-INFINITY	0
IE401	0	-INFINITY	0	0	-INFINITY	0
IE402	0	0	0	0	0	INFINITY
IE403	0	0	INFINITY	0	0	INFINITY
IE404	0	0	0	0	-INFINITY	0
IE405	0	0	0	0	0	0
IE408	0	0	INFINITY	0	0	INFINITY
IE409	0	0	0	0	0	0
IE501	0	-INFINITY	0	0	-INFINITY	0
IE502	0	-INFINITY	0	0	0	0
IE503	0	-INFINITY	0	0	-INFINITY	0
IE504	0	0	INFINITY	0	0	INFINITY
IE505	0	0	INFINITY	0	0	INFINITY
IE509	0	0	INFINITY	0	0	INFINITY
IE601	0	0	0	0	-INFINITY	0
IE602	0	0	INFINITY	0	0	INFINITY
IE603	0	0	INFINITY	0	0	INFINITY
IE604	0	0	INFINITY	0	0	INFINITY
IE605	0	-INFINITY	0	0	0	0
IE610	0	0	INFINITY	0	0	INFINITY
IE705	0	0	INFINITY	0	0	INFINITY
IE710	0	-INFINITY	0	0	-INFINITY	0
IE712	0	0	INFINITY	0	0	INFINITY
IE810	0	0	INFINITY	0	0	INFINITY
IE811	0	-45	0	0	-50	0
IE812	0	-INFINITY	0	0	-INFINITY	0
IE911	0	0	INFINITY	0	0	INFINITY
CE106	0	0	INFINITY	0	0	INFINITY
CE206	0	0	0	0	0	0
CE207	0	0	INFINITY	0	0	INFINITY
CE208	0	0	INFINITY	0	0	INFINITY
CE301	0	-INFINITY	0	0	0	0
CE306	0	0	INFINITY	0	0	INFINITY
CE307	0	0	INFINITY	0	0	INFINITY
CE308	0	0	0	0	0	0
CE401	0	0	0	0	0	0
CE402	0	0	0	0	0	0
CE403	0	0	INFINITY	0	0	INFINITY
CE404	0	0	INFINITY	0	0	INFINITY
CE405	0	0	0	0	0	0
CE408	0	0	INFINITY	0	0	INFINITY

Objective Function Coefficient						
	Current	Version 1		Current	Version 2	
VARIABLE	Coefficient	MIN	MAX	Coefficient	MIN	MAX
CE409	0	0	INFINITY	0	0	INFINITY
CE501	0	0	INFINITY	0	0	0
CE502	0	0	INFINITY	0	0	INFINITY
CE503	0	0	INFINITY	0	0	INFINITY
CE504	0	0	INFINITY	0	0	INFINITY
CE505	0	-INFINITY	0	0	-INFINITY	0
CE509	0	0	0	0	0	INFINITY
CE601	0	0	0	0	0	0
CE602	0	0	INFINITY	0	0	0
CE603	0	0	INFINITY	0	0	INFINITY
CE604	0	0	INFINITY	0	0	INFINITY
CE605	0	0	INFINITY	0	0	INFINITY
CE610	0	0	INFINITY	0	0	INFINITY
CE705	0	0	INFINITY	0	0	0
CE710	0	0	0	0	0	0
CE712	0	0	INFINITY	0	0	INFINITY
CE810	0	0	INFINITY	0	0	INFINITY
CE811	0	0	INFINITY	0	0	INFINITY
CE812	0	-5	0	0	-50	0
CE911	0	0	INFINITY	0	0	INFINITY

Right Hand Side							
		Version 1	Version 1	Version 2	Version 2	Delta	Delta
	CURRENT	RHS	RHS	RHS	RHS	RHS	RHS
ROW	RHS	Min	Max	Min	Max	Min	Max
2	350	350	360	340	350	10	10
3	130	130	140	130	130	0	10
4	200	150	200	150	200	0	0
5	160	160	170	120	160	40	10
6	800	780	810	775	800	5	10
7	200	190	210	190	200	0	10
8	100	60	100	100	100	-40	0
9	200	200	210	190	200	10	10
10	100	75	110	75	100	0	10
11	200	180	200	180	200	0	0
12	100	40	120	40	120	0	0
13	150	130	180	100	150	30	30
14	200	-INFINITY	300	-INFINITY	250	0	50
15	80	80	120	80	80	0	40
16	10	-INFINITY	50	-INFINITY	50	0	0
17	40	-INFINITY	40	-INFINITY	50	0	-10
18	200	185	200	200	250	-15	-50
19	40	-INFINITY	50	-INFINITY	50	0	0
20	25	-INFINITY	50	-INFINITY	50	0	0
21	40	-INFINITY	70	-INFINITY	70	0	0
22	25	10	40	10	30	0	10
23	40	-INFINITY	50	-INFINITY	70	0	-20
24	25	-INFINITY	40	-INFINITY	40	0	0
25	40	-INFINITY	50	-INFINITY	70	0	-20
26	200	80	INFINITY	80	INFINITY	0	0
27	200	190	210	200	210	-10	0
28	200	190	240	200	210	-10	30
29	200	190	200	200	215	-10	-15
30	200	190	225	200	225	-10	0
31	200	190	200	200	230	-10	-30
32	200	190	220	200	250	-10	-30
33	200	185	210	185	210	0	0
34	200	60	INFINITY	60	INFINITY	0	0
35	50	20	INFINITY	0	INFINITY	20	0
36	50	40	50	50	60	-10	-10
37	50	40	60	50	60	-10	0
38	50	50	50	50	65	0	-15
39	50	40	70	50	60	-10	10
40	50	50	50	50	50	0	0
41	50	40	70	0	INFINITY	40	INFINITY
42	50	40	INFINITY	0	INFINITY	40	0
43	50	0	INFINITY	0	INFINITY	0	0
44	100	0	INFINITY	20	INFINITY	-20	0
45	100	100	140	100	100	0	40
46	100	100	140	100	100	0	40
47	100	90	100	100	150	-10	-50
48	100	100	100	100	100	0	0

Right Hand Side							
		Version 1	Version 1	Version 2	Version 2	Delta	Delta
	CURRENT	RHS	RHS	RHS	RHS	RHS	RHS
ROW	RHS	Min	Max	Min	Max	Min	Max
49	100	90	100	100	150	-10	-50
50	100	20	INFINITY	70	INFINITY	-50	0
51	100	0	INFINITY	40	INFINITY	-40	0
52	100	0	INFINITY	0	INFINITY	0	0
53	100	0	INFINITY	0	INFINITY	0	0
54	100	0	INFINITY	0	INFINITY	0	0
55	100	60	INFINITY	20	INFINITY	40	0
56	100	20	INFINITY	100	110	-80	INIFINIT
57	100	90	INFINITY	100	INFINITY	-10	0
58	100	100	INFINITY	50	INFINITY	50	0
59	100	0	INFINITY	0	INFINITY	0	0
60	100	0	INFINITY	0	INFINITY	0	0
61	100	0	INFINITY	0	INFINITY	0	0
62	150	0	INFINITY	0	INFINITY	0	0
63	150	100	INFINITY	100	INFINITY	0	0
64	150	100	INFINITY	100	INFINITY	0	0
65	150	150	165	125	150	25	15
66	150	150	INFINITY	125	INFINITY	25	0
67	150	100	150	120	150	-20	0
68	150	50	INFINITY	50	INFINITY	0	0
69	150	90	INFINITY	90	INFINITY	0	0
70	150	0	INFINITY	0	INFINITY	0	0
71	80	0	INFINITY	0	INFINITY	0	0
72	80	0	INFINITY	0	INFINITY	0	0
73	80	70	INFINITY	20	INFINITY	50	0
74	80	70	95	80	80	-10	15
75	80	65	INFINITY	50	INFINITY	15	0
76	80	0	INFINITY	50	INFINITY	-50	0
77	80	0	INFINITY	20	INFINITY	-20	0
78	80	0	INFINITY	20	INFINITY	-20	0
79	80	0	INFINITY	0	INFINITY	0	0
80	80	80	100	50	100	30	0
81	20	20	INFINITY	0	INFINITY	20	0
82	50	0	INFINITY	0	INFINITY	0	0
83	50	0	INFINITY	20	INFINITY	-20	0
84	50	0	INFINITY	0	INFINITY	0	0
85	50	0	INFINITY	0	INFINITY	0	0
86	120	100	INFINITY	100	INFINITY	0	0
87	30	0	INFINITY	0	INFINITY	0	0
88	50	40	50	50	50	-10	0
89	50	0	INFINITY	0	INFINITY	0	0
90	80	70	INFINITY	70	INFINITY	0	0
91	20	20	30	10	INFINITY	10	INFINITY
92	50	40	90	40	80	0	10
93	50	0	INFINITY	0	INFINITY	0	0
94	50	0	INFINITY	0	INFINITY	0	0
95	50	0	INFINITY	0	INFINITY	0	0

Right Hand Side							
		Version 1	Version 1	Version 2	Version 2	Delta	Delta
	CURRENT	RHS	RHS	RHS	RHS	RHS	RHS
ROW	RHS	Min	Max	Min	Max	Min	Max
96	80	30	INFINITY	30	INFINITY	0	0
97	20	20	30	10	30	10	0
98	50	50	60	50	50	0	10
99	50	0	INFINITY	0	INFINITY	0	0
100	50	0	INFINITY	0	INFINITY	0	0
101	50	0	INFINITY	0	INFINITY	0	0
102	80	0	INFINITY	0	INFINITY	0	0
103	20	10	INFINITY	20	20	-10	INIFINITY
104	50	0	INFINITY	0	INFINITY	0	0
105	50	40	50	50	50	-10	0
106	50	0	INFINITY	0	INFINITY	0	0
107	50	0	INFINITY	0	INFINITY	0	0
108	80	40	INFINITY	50	INFINITY	-10	0
109	20	10	INFINITY	0	INFINITY	10	0
110	50	50	INFINITY	0	50	50	INIFINITY
111	50	50	INFINITY	0	INFINITY	50	0
112	50	0	INFINITY	0	INFINITY	0	0
113	50	50	50	0	INFINITY	50	INFINITY
114	120	80	INFINITY	70	INFINITY	10	0
115	30	20	40	10	30	10	10
116	50	0	INFINITY	50	INFINITY	-50	0
117	50	40	INFINITY	0	INFINITY	40	0
118	80	0	INFINITY	0	INFINITY	0	0
119	20	10	INFINITY	20	INFINITY	-10	0
120	50	0	INFINITY	0	INFINITY	0	0
121	50	0	INFINITY	0	INFINITY	0	0
122	50	0	INFINITY	0	INFINITY	0	0
123	50	0	INFINITY	0	INFINITY	0	0
124	80	0	INFINITY	0	INFINITY	0	0
125	20	0	INFINITY	0	INFINITY	0	0
126	50	0	INFINITY	0	INFINITY	0	0
127	50	50	INFINITY	50	INFINITY	0	0
128	50	0	INFINITY	0	INFINITY	0	0
129	50	0	INFINITY	0	INFINITY	0	0
130	80	70	90	70	80	0	10
131	20	0	INFINITY	0	INFINITY	0	0
132	50	20	80	20	80	0	0
133	50	0	INFINITY	0	INFINITY	0	0
134	50	20	INFINITY	20	INFINITY	0	0
135	50	20	INFINITY	20	INFINITY	0	0
136	80	50	INFINITY	30	INFINITY	20	0
137	20	0	INFINITY	0	20	0	INIFINITY
138	50	40	50	50	75	-10	-25
139	50	50	INFINITY	50	INFINITY	0	0
140	50	0	INFINITY	0	INFINITY	0	0
141	50	50	INFINITY	50	INFINITY	0	0
142	80	0	INFINITY	0	INFINITY	0	0

Right Hand Side							
		Version 1	Version 1	Version 2	Version 2	Delta	Delta
	CURRENT	RHS	RHS	RHS	RHS	RHS	RHS
ROW	RHS	Min	Max	Min	Max	Min	Max
143	20	10	20	0	INFINITY	10	INFINITY
144	50	20	INFINITY	0	INFINITY	20	0
145	50	10	INFINITY	0	INFINITY	10	0
146	50	0	INFINITY	5	INFINITY	-5	0
147	50	10	INFINITY	5	INFINITY	5	0
148	80	0	INFINITY	0	INFINITY	0	0
149	20	0	INFINITY	0	INFINITY	0	0
150	50	0	INFINITY	0	INFINITY	0	0
151	50	0	INFINITY	0	INFINITY	0	0
152	50	0	INFINITY	40	50	-40	INIFINITY
153	50	0	INFINITY	0	INFINITY	0	0
154	80	40	INFINITY	50	INFINITY	-10	0
155	20	0	INFINITY	0	INFINITY	0	0
156	50	40	INFINITY	50	50	-10	INIFINITY
157	50	0	INFINITY	40	INFINITY	-40	0
158	50	0	INFINITY	0	INFINITY	0	0
159	50	0	INFINITY	0	INFINITY	0	0
160	120	100	INFINITY	95	INFINITY	5	0
161	30	20	30	10	30	10	0
162	100	30	INFINITY	25	INFINITY	5	0
163	50	0	INFINITY	10	INFINITY	-10	0
164	50	20	INFINITY	15	INFINITY	5	0
165	50	20	INFINITY	25	INFINITY	-5	0
166	80	0	INFINITY	0	INFINITY	0	0
167	20	0	INFINITY	0	INFINITY	0	0
168	50	0	INFINITY	0	INFINITY	0	0
169	50	40	INFINITY	0	INFINITY	40	0
170	50	0	INFINITY	30	INFINITY	-30	0
171	50	0	INFINITY	0	INFINITY	0	0
172	80	10	INFINITY	25	INFINITY	-15	0
173	20	0	INFINITY	0	INFINITY	0	0
174	50	10	INFINITY	25	INFINITY	-15	0
175	50	0	INFINITY	0	INFINITY	0	0
176	50	0	INFINITY	0	INFINITY	0	0
177	50	0	INFINITY	0	INFINITY	0	0
178	80	50	INFINITY	80	90	-30	INIFINITY
179	20	0	INFINITY	20	INFINITY	-20	0
180	50	50	50	0	75	50	-25
181	50	50	INFINITY	0	INFINITY	50	0
182	50	0	INFINITY	0	INFINITY	0	0
183	50	0	INFINITY	0	INFINITY	0	0
184	80	50	INFINITY	25	INFINITY	25	0
185	20	0	INFINITY	0	INFINITY	0	0
186	50	40	50	25	INFINITY	15	INFINITY
187	50	0	INFINITY	50	INFINITY	-50	0
188	50	0	INFINITY	0	INFINITY	0	0
189	50	0	INFINITY	0	INFINITY	0	0

Right Hand Side							
		Version 1	Version 1	Version 2	Version 2	Delta	Delta
	CURRENT	RHS	RHS	RHS	RHS	RHS	RHS
ROW	RHS	Min	Max	Min	Max	Min	Max
190	80	30	INFINITY	40	INFINITY	-10	0
191	20	0	30	10	INFINITY	-10	INFINITY
192	50	50	50	50	50	0	0
193	50	0	INFINITY	0	INFINITY	0	0
194	50	50	INFINITY	50	INFINITY	0	0
195	50	0	INFINITY	0	INFINITY	0	0
196	80	0	INFINITY	0	INFINITY	0	0
197	20	10	20	20	20	-10	0
198	50	0	INFINITY	0	INFINITY	0	0
199	50	0	INFINITY	0	INFINITY	0	0
200	50	0	INFINITY	0	INFINITY	0	0
201	50	0	INFINITY	0	INFINITY	0	0
202	120	20	INFINITY	30	INFINITY	-10	0
203	30	10	INFINITY	0	INFINITY	10	0
204	100	0	INFINITY	0	INFINITY	0	0
205	50	50	INFINITY	50	INFINITY	0	0
206	50	0	INFINITY	0	INFINITY	0	0
207	50	50	50	50	50	0	0
208	80	50	INFINITY	25	INFINITY	25	0
209	20	0	INFINITY	0	INFINITY	0	0
210	50	0	INFINITY	0	INFINITY	0	0
211	50	0	INFINITY	0	INFINITY	0	0
212	50	40	INFINITY	50	50	-10	INIFINITY
213	50	15	INFINITY	0	INFINITY	15	0
214	80	30	INFINITY	80	80	-50	INIFINITY
215	20	0	20	20	INFINITY	-20	INFINITY
216	50	50	INFINITY	50	80	0	INIFINITY
217	50	0	INFINITY	0	INFINITY	0	0
218	50	0	INFINITY	0	INFINITY	0	0
219	50	0	INFINITY	0	INFINITY	0	0
220	80	50	INFINITY	0	INFINITY	50	0
221	20	0	INFINITY	0	INFINITY	0	0
222	50	0	INFINITY	0	INFINITY	0	0
223	50	0	INFINITY	50	INFINITY	-50	0
224	50	0	INFINITY	0	INFINITY	0	0
225	50	0	INFINITY	50	INFINITY	-50	0
226	80	0	INFINITY	0	INFINITY	0	0
227	20	0	INFINITY	0	INFINITY	0	0
228	50	0	INFINITY	0	INFINITY	0	0
229	50	50	60	0	INFINITY	50	INFINITY
230	50	50	INFINITY	50	INFINITY	0	0
231	50	0	INFINITY	0	INFINITY	0	0
232	80	50	INFINITY	50	INFINITY	0	0
233	20	0	INFINITY	0	INFINITY	0	0
234	50	0	INFINITY	0	INFINITY	0	0
235	50	0	INFINITY	0	INFINITY	0	0
236	50	40	50	0	INFINITY	40	INFINITY

Right Hand Side							
		Version 1	Version 1	Version 2	Version 2	Delta	Delta
	CURRENT	RHS	RHS	RHS	RHS	RHS	RHS
ROW	RHS	Min	Max	Min	Max	Min	Max
237	50	0	INFINITY	0	INFINITY	0	0
238	120	70	INFINITY	70	INFINITY	0	0
239	30	10	30	30	30	-20	0
240	100	100	100	100	INFINITY	0	INFINITY
241	50	50	INFINITY	0	50	50	INIFINITY
242	50	0	INFINITY	0	INFINITY	0	0
243	50	0	INFINITY	0	INFINITY	0	0
244	80	0	INFINITY	0	INFINITY	0	0
245	20	0	INFINITY	0	INFINITY	0	0
246	50	0	INFINITY	0	INFINITY	0	0
247	50	0	INFINITY	0	INFINITY	0	0
248	50	0	INFINITY	0	INFINITY	0	0
249	50	0	INFINITY	0	INFINITY	0	0
250	120	110	INFINITY	120	INFINITY	-10	0
251	30	10	INFINITY	0	INFINITY	10	0
252	100	0	INFINITY	0	INFINITY	0	0
253	50	0	INFINITY	0	INFINITY	0	0
254	50	0	INFINITY	0	INFINITY	0	0
255	50	0	INFINITY	0	INFINITY	0	0
256	80	80	INFINITY	50	80	30	INIFINITY
257	20	20	30	0	INFINITY	20	INFINITY
258	50	40	100	20	80	20	20
259	50	0	INFINITY	20	INFINITY	-20	0
260	50	0	INFINITY	0	INFINITY	0	0
261	50	0	INFINITY	20	INFINITY	-20	0
262	80	10	INFINITY	0	INFINITY	10	0
263	20	0	30	0	INFINITY	0	INFINITY
264	50	0	INFINITY	0	INFINITY	0	0
265	50	20	INFINITY	50	INFINITY	-30	0
266	50	0	INFINITY	0	INFINITY	0	0
267	50	0	INFINITY	0	INFINITY	0	0
268	80	80	95	70	95	10	0
269	20	20	INFINITY	0	INFINITY	20	0
270	50	0	INFINITY	0	INFINITY	0	0
271	50	0	INFINITY	20	INFINITY	-20	0
272	50	0	INFINITY	0	INFINITY	0	0
273	50	0	INFINITY	0	INFINITY	0	0
274	80	40	INFINITY	40	INFINITY	0	0
275	20	0	INFINITY	0	INFINITY	0	0
276	50	40	INFINITY	40	INFINITY	0	0
277	50	0	INFINITY	0	INFINITY	0	0
278	50	0	INFINITY	0	INFINITY	0	0
279	50	0	INFINITY	0	INFINITY	0	0
280	80	80	95	70	95	10	0
281	20	20	INFINITY	0	INFINITY	20	0
282	50	40	100	20	80	20	20
283	50	0	INFINITY	20	INFINITY	-20	0

Right Hand Side							
		Version 1	Version 1	Version 2	Version 2	Delta	Delta
	CURRENT	RHS	RHS	RHS	RHS	RHS	RHS
ROW	RHS	Min	Max	Min	Max	Min	Max
284	50	0	INFINITY	0	INFINITY	0	0
285	50	0	INFINITY	20	INFINITY	-20	0
286	80	60	INFINITY	60	INFINITY	0	0
287	20	0	INFINITY	0	INFINITY	0	0
288	50	0	INFINITY	0	INFINITY	0	0
289	50	0	INFINITY	0	INFINITY	0	0
290	50	0	INFINITY	0	INFINITY	0	0
291	50	0	INFINITY	0	INFINITY	0	0
292	100	90	100	100	110	-10	-10
293	150	140	160	140	150	0	10
294	100	90	INFINITY	80	INFINITY	10	0
295	100	50	INFINITY	50	INFINITY	0	0
296	100	60	INFINITY	70	INFINITY	-10	0
297	100	90	100	50	INFINITY	40	INFINITY
298	150	140	160	140	150	0	10
299	100	10	INFINITY	20	INFINITY	-10	0
300	100	50	INFINITY	50	INFINITY	0	0
301	100	90	100	100	110	-10	-10
302	100	100	INFINITY	100	100	0	INIFINITY
303	100	30	INFINITY	5	INFINITY	25	0
304	100	0	INFINITY	50	INFINITY	-50	0
305	100	40	INFINITY	90	INFINITY	-50	0
306	150	150	INFINITY	135	150	15	INIFINITY
307	100	40	INFINITY	30	INFINITY	10	0
308	100	10	INFINITY	25	INFINITY	-15	0
309	100	50	100	100	INFINITY	-50	INFINITY
310	100	50	INFINITY	75	INFINITY	-25	0
311	100	100	100	100	100	0	0
312	100	20	INFINITY	20	INFINITY	0	0
313	150	80	INFINITY	80	INFINITY	0	0
314	100	90	INFINITY	75	INFINITY	15	0
315	100	50	INFINITY	100	100	-50	INIFINITY
316	100	50	INFINITY	50	INFINITY	0	0
317	100	100	INFINITY	50	INFINITY	50	0
318	100	100	INFINITY	50	INFINITY	50	0
319	150	150	INFINITY	150	175	0	INIFINITY
320	100	0	INFINITY	0	INFINITY	0	0
321	120	110	130	120	120	-10	10
322	100	100	INFINITY	100	120	0	INIFINITY
323	100	50	INFINITY	50	INFINITY	0	0
324	100	100	100	100	INFINITY	0	INFINITY
325	100	40	INFINITY	40	INFINITY	0	0
326	100	80	100	100	130	-20	-30
327	100	60	INFINITY	60	INFINITY	0	0
328	0	-50	0	0	INFINITY	-50	INFINITY
329	0	0	0	0	0	0	0
330	0	0	0	-50	INFINITY	50	INFINITY

Right Hand Side							
		Version 1	Version 1	Version 2	Version 2	Delta	Delta
	CURRENT	RHS	RHS	RHS	RHS	RHS	RHS
ROW	RHS	Min	Max	Min	Max	Min	Max
331	0	0	INFINITY	-50	INFINITY	50	0
332	0	-15	0	0	INFINITY	-15	INFINITY
333	0	0	10	0	0	0	10
334	0	-50	INFINITY	0	INFINITY	-50	0
335	0	0	INFINITY	0	INFINITY	0	0
336	0	-10	0	0	0	-10	0
337	0	0	INFINITY	0	INFINITY	0	0
338	0	0	0	0	0	0	0
339	0	-20	INFINITY	-20	INFINITY	0	0
340	0	-50	INFINITY	-50	INFINITY	0	0
341	0	-100	INFINITY	-100	INFINITY	0	0
342	0	-30	INFINITY	-30	INFINITY	0	0
343	0	0	0	0	30	0	-30
344	0	-120	INFINITY	-120	INFINITY	0	0
345	0	-100	INFINITY	-80	INFINITY	-20	0
346	0	-40	INFINITY	-30	INFINITY	-10	0
347	0	-10	INFINITY	-20	INFINITY	10	0
348	0	-10	0	0	0	-10	0
349	0	0	INFINITY	0	INFINITY	0	0
350	0	-10	INFINITY	-20	INFINITY	10	0
351	0	-30	INFINITY	-30	INFINITY	0	0
352	0	0	INFINITY	0	INFINITY	0	0
353	0	-50	0	0	15	-50	-15
354	0	-50	INFINITY	-25	INFINITY	-25	0
355	0	0	INFINITY	0	INFINITY	0	0
356	0	-50	INFINITY	-30	INFINITY	-20	0
357	0	-100	INFINITY	-80	INFINITY	-20	0
358	0	-15	10	-15	10	0	0
359	0	-60	INFINITY	-60	INFINITY	0	0
360	0	-30	INFINITY	0	INFINITY	-30	0
361	0	-50	INFINITY	-30	INFINITY	-20	0
362	0	0	0	0	50	0	-50
363	0	-15	0	0	0	-15	0
364	0	-50	INFINITY	0	30	-50	INIFINITY
365	0	0	50	0	30	0	20
366	0	-15	0	0	5	-15	-5
367	0	0	INFINITY	-50	INFINITY	50	0
368	0	0	0	0	0	0	0
369	0	0	INFINITY	-50	INFINITY	50	0
370	0	-50	INFINITY	-50	INFINITY	0	0
371	0	-100	INFINITY	-50	INFINITY	-50	0
372	0	0	INFINITY	-40	INFINITY	40	0
373	0	0	INFINITY	0	INFINITY	0	0
374	0	-50	INFINITY	0	INFINITY	-50	0
375	0	0	10	0	0	0	10
376	0	0	0	0	0	0	0
377	0	-50	INFINITY	-50	INFINITY	0	0

Right Hand Side							
		Version 1	Version 1	Version 2	Version 2	Delta	Delta
	CURRENT	RHS	RHS	RHS	RHS	RHS	RHS
ROW	RHS	Min	Max	Min	Max	Min	Max
378	0	-20	0	-50	0	30	0
379	0	0	INFINITY	-20	INFINITY	20	0
380	0	0	50	0	50	0	0
381	0	0	INFINITY	0	INFINITY	0	0
382	0	0	INFINITY	0	INFINITY	0	0
383	0	-50	INFINITY	-50	INFINITY	0	0
384	0	-50	INFINITY	-50	INFINITY	0	0
385	0	-20	10	-20	30	0	-20
386	0	-40	INFINITY	-30	INFINITY	-10	0
387	0	0	INFINITY	0	INFINITY	0	0
388	0	-25	INFINITY	-50	INFINITY	25	0
389	0	0	INFINITY	0	INFINITY	0	0
390	0	0	50	-20	30	20	20
391	0	0	INFINITY	-20	INFINITY	20	0
392	0	0	INFINITY	0	INFINITY	0	0
393	0	0	INFINITY	0	INFINITY	0	0
394	0	-20	INFINITY	-50	INFINITY	30	0
395	0	0	50	-20	30	20	20