UNIT IV QM

For PhD CLASSES

KIU- KAMPALA

LINEAR PROGRAMMING MODELS

AIMS OF THE STUDY

The main aim of this unit is to Understand the basic concepts of Linear Programming models and learn basic methods of solving them on computer.

Introduction

As earlier indicated in unit one, Linear programming (LP) can ease the task of solving a particular type of planning problem. We learned that LP is a mathematical method or set of procedures that help solve and interpret the results of a model of Linear functions that in conjunction represents a phenomenon, generally related to production or industry environments. These practical applications of LP include: Business, Economics, Engineering, Mathematics, Agriculture, Transport, Manufacturing among others.

Structure of a LP Model

To analyse a problem using LP, it must be moulded into a particular structure that at least must contain the following components:

- ✓ Objective – to obtain the best or optimal solution
- ✓ Activities or decision variables – What to do?
- ✓ Constraints or restrictions – Limits on the availability of a resource

Solution of LP problem

Two Mines Company

The Two Mines Company own two different facilities that produce an ore which, after being crushed, is graded into three classes: high, medium and low-grade. The company has contracted to provide a smelting plant with 12 tons of high-grade, 8 tons of medium-grade and 24 tons of low-grade ore per week. The two mines have different operating characteristics as detailed below.

Mine	Cost per day ($)	Mine Production (tons/day)		
		High	Medium	Low
X	180	6	3	4
Y	160	1	1	6

How many days per week should each mine be operated to fulfill the smelting plant contract?

Variables

These represent the "decisions that have to be made" or the "unknowns".

x = number of days per week mine X is operated

y = number of days per week mine Y is operated

Note here that x >= 0 and y >= 0.

Constraints

Ore production constraints - balance the amount produced with the quantity required under the smelting plant contract

OreHigh 6x + y >= 12

Medium 3x + y >= 8

Low 4x + 6y >= 24

Days per week constraint - we cannot work more than a certain maximum number of days a week e.g. for a 5 day week we have

x <= 5

y <= 5

Objective

Again in words our objective is to minimize cost which is given by

Z = 180x + 160y

Hence we have the complete mathematical representation of the problem as:

Minimize Z= 180x + 160y

Subject to

6x + y >= 12

3x + y >= 8

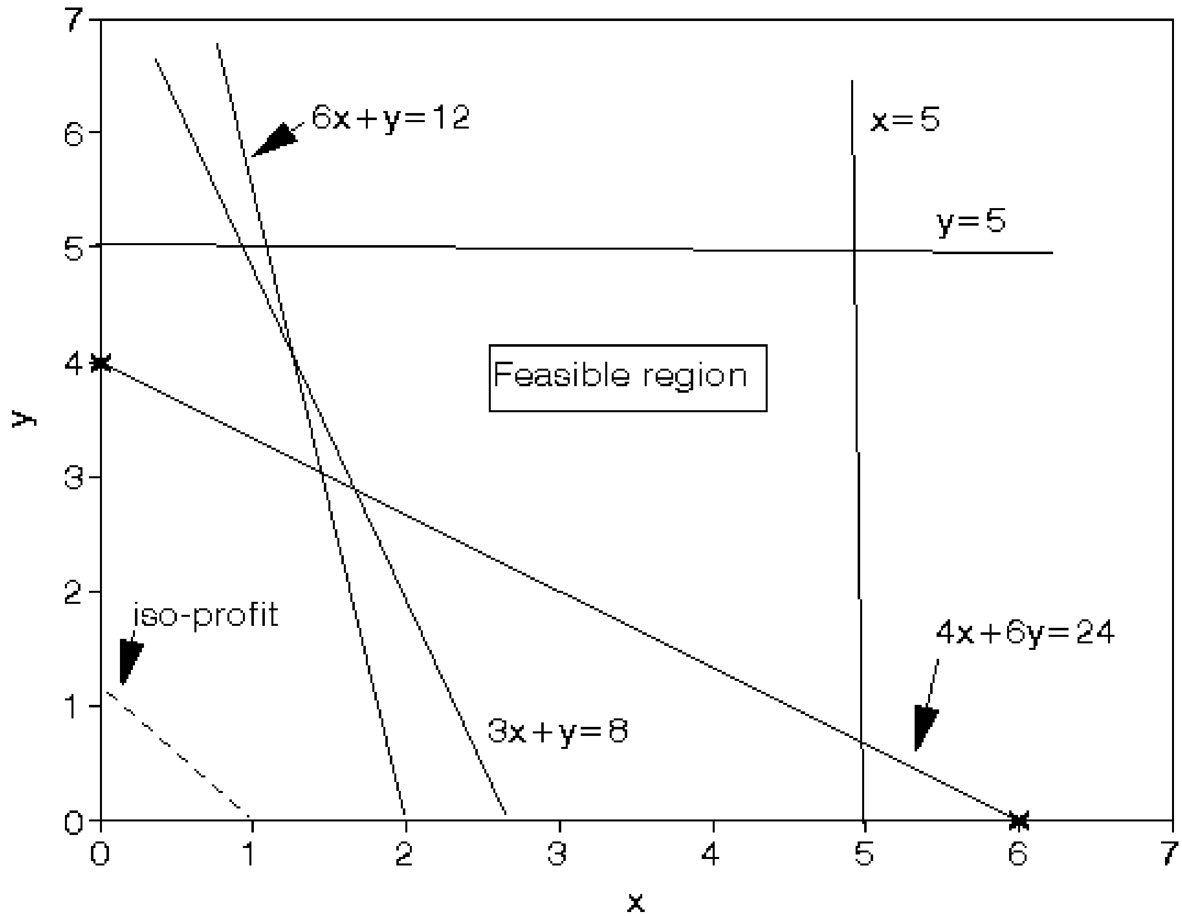
4x + 6y >= 24

x <= 5

y <= 5

x,y >= 0

Symbolic Formulation



Optimal Solution X= 1.71 Y= 2.86 Z = 765.71

Computer Solving of a LP Problem (excel solver)

Microsoft Excel - ASSIGNMENT1 - First problem

HEAVY EQUIPMENT INC.

Solver Solution

	Products				
Resources	**E-4**	**F-4**	**Used**	**Constraint**	**Available**
Machining A	12	15	180	<=	180
Machining B	32	20	320	<=	320
Testing C	30	15	270	>=	150
Customer requirement	1	1	13	>=	8
Maintain market	1	-3	-19	<=	0

Profit / unit	**$ 5,000**	**$ 4,000**
Production per Unit	**5**	**8**

TOTAL PROFIT $ 57,000

Names:

Production_per_Unit= =SolverSolution!$B$16:$C$16

Profit_Unit = SolverSolution!$B$14:$C$14

Function:

Used = SUMAPRODUCTO(Production_per_Unit,B8:C8) in D8 copied in D9 and D10

LP FORMULATION | SolverSolution | GRAPHIC