

Indian Statistical Institute, Bangalore

M.S. (QMS) First Year
Second Semester – Operations Research II

Mid-Semester Exam

Duration: 2 Hrs

Date: March 07, 2015

This paper carries 58 marks. You may answer as many questions as you can, but your maximum score will be limited to 50

1. (a) MAXCO is planning to produce at least 2000 widgets on three machines. The minimum lot size on any machine is 500 widgets. The following table gives the pertinent data of the situation:

machine	Set up cost(\$)	Production cost/unit	Capacity(units)
1	300	2	600
2	100	10	800
3	200	5	1200

Formulate the problem as an ILP (Integer Linear Program) Problem

- (b) Suppose that you have 7 full wine bottles, 7 half full and 7 empty. You would like to divide the 21 bottles among three individuals so that each will receive exactly 7. Additionally, each individual must receive the same quantity of wine. Formulate the problem as an ILP. [6x2=12]

2. XYZ Company, which have only one Aircraft, got a contract from a corporation to transport big crates of machine parts periodically from factory to mineral exploration site.

There are two types of crates, with weight and volumes & Revenue gains as given below;

Type of Crate	Wt.(Kg)	Vol.(m ³)	Revenue(Rs/Crate)
A	3	4	4
B	4	2	3
Aircraft Capacity:	12	9	

The Company wishes to maximize its revenue.

- (i) Formulate this as ILP
(ii) Find the solution by B&B method (graphical solution is accepted). [4+16=20]
3. A vessel will be loaded with 3 different types of items. Each unit of item i ($i = 1, 2, 3$) has a weight w_i (tons) and value v_i (Rupees) as shown in the following table:

i	w_i	v_i
1	2	65
2	3	80
3	1	30

The maximum Vessel Capacity is $W = 5$ tons.

It is required to determine the most valuable cargo load without exceeding the maximum capacity of the vessel.

Find the Optimal Solution using Backward or Forward recursive DP method. [16]

4. A small maintenance project consists of the following ten jobs (activities) whose precedence relationships are identified by their node numbers:

Job name	Alternate (Initial node, Final node)	Estimated duration (Days)
A	(1, 2)	2
B	(2, 3)	3
C	(2, 4)	5
D	(3, 5)	4
E	(3, 6)	1
F	(4, 6)	6
G	(4, 7)	2
H	(5, 8)	8
I	(6, 8)	7
J	(7, 8)	4

- Draw an arrow diagram (network diagram) representing the project.
 - Calculate Earliest & Latest Occurrence time of each event (node)
 - How much Floats (TF) Job (3, 5) have? Job (4, 6)? Job (7, 8)?
 - What is the Critical Path?
 - If job (2, 3) were to take six days instead of three, how would the project finish date be affected?
 - Does any job have Free Float (FF)? If so, which one & how much?
- [12]
