[Total No. of Questions: *12*] [Total No. of Printed Pages: 4]

UNIVERSITY OF PUNE

[4364]-779

B. E. (Computer) Examination - 2013

Operation Research (2008 Course)

[Time: *3* Hours] **[Max. Marks: 100]**

Instructions:

1. ***Answer any 3 questions from each Section.***
2. *Answers to the* ***two sections*** *should be written in* ***separate answer-books****.*
3. *Use of non programmable calculator is allowed.*
4. *Black figures to the right indicate full marks.*
5. *Neat diagrams must be drawn wherever necessary.*
6. *Assume suitable data, if necessary.*

SECTION -I

Q.1 A Formulate the following problem as linear programming problem. 4

A company produces two types of Hats.Each hat of first type requires twice as much labour time as the second type.If all hats are of second type only,the company can produces a total of 500 hats of day.The market limits daily sales of first and second type to 150 and 200 hats. Assume that profits per hat are Rs.8 for first type and Rs.5 for second type.

B Solve the following LP Problem graphically. 8

Maximize Z=3x1 +5x2 subject to restrictions

x1+2x2 $\leq$ 2000, x1+x2 $\leq$1500, x2$\leq$600 and x1,x2 $\geq$0

C Define Slack and surplus variables. 4

OR

Q.2 A Solve following LP Problem using Simplex Method 8

Maximize Z=x1+2x2 +x3 subject to constraints

2x1+x2-x3$\leq$ 2, -2x1 +x2 -5x3 $\geq$ -6 ,4x1 +x2 + x3 $\leq$ 6 and x1 , x2 , x3 $\geq$ 0

B With respect to LPP,What is testing for optimality? How it is carried out? 6

C Define feasible and optimal solution. 2

Q. 3 A What is importance of probability distribution functions?Explain any two types of continuous probability distribution functions. 6

B Find the range of values of 'P' and 'Q'with the entry (2,2) as a saddle point for given matrix representation of a game. 6

	Player B		
Player A	2	4	5
	10	7	Q
	4	P	6

C Differentiate between decision under risk and decision under certainty. 6

OR

Q. 4 A What is the expectation of the number of failure preceding the first success in an infinite series of independent trials with constant probability of success 'P' in each trail? 6

B Consider the following pay-off table. 6

Acts	Events			
	E1	E2	E3	E4
A1	40	200	-200	100
A2	200	0	200	0
A3	0	100	0	150
A4	-50	400	100	0

Probabilities of events are P(E1)=0.2 , P(E2)0.15 , P(E3)= 0.4,P(E4)=0.25.Calculate expected pay-off the expected loss of each action.

C Solve the following game. 6

	B1	B2	B3
A1	1	7	2
A2	0	2	7
A3	5	1	6

Q. 5 A What is queuing system?Explain queuing systems transient state and steady state. 8

B A software tester finds that the time spent on debugging and fixing the error has an exponential distribution with mean 30 min per module. The arrival of modules is Poisson with an average of 10 modules per day of 8 hours. What is expected time per day? How many modules are there on average? 8

OR

Q. 6 A At what average rate must a clerk at a supermarket work in order to ensure a probability of 0.9 that the customer will not have to wait longer than 12 minutes?It is assumed that there is only one counter to which customer arrive in a Poisson fashion at an average rate of 15 per hour.The length of service by the clerk has an exponential distribution. 8

B State and prove the arrival distribution theorem.(Pure birth process). 8

SECTION II

Q. 7 A Find the sequence of jobs that minimizes the total elapsed time to complete the following set of jobs on two machines. 10

Job	1	2	3	4	5	6
Machine A	3	12	5	2	9	11
Machine B	8	10	9	6	3	1

Also calculate the ideal time for both machines.

B Draw the network diagrams for the following set of activities and identify 8 dummy activities.

1.A <B,C;   B<D,E;   C<E;   E<F;   D,F<G;   G<H;

2.Consider the following table.

Activity	A	B	C	D	E	F	G	H	I
Immediate Predecessor	-	-	-	A	B,C	A	C	D,E,F	D

OR

Q. 8 A Find the sequence of jobs that minimizes the total elapsed time to complete the four jobs on five machines. 8

	Machines				
Job	M1	M2	M3	M4	M5
A	7	5	2	3	9
B	6	6	4	5	10
C	5	4	5	6	8
D	8	3	3	2	6

B Consider a project consists of series of tasks labeled A to I with following relationship and constraints. Construct network diagram , Network analysis table and identify critical path. 10

A<D,E;   B,D >F;   C<G;   B<H;   F,G<I

Find also the optimum time of completion of project ,the time of completion of each task is as follows.

Task	A	B	C	D	E	F	G	H	I
Time	23	8	20	16	24	18	19	4	10

Q. 9 A Find the maximum or minimum of the function 8

$f(x)=X_1^2+X_2^2+X_3^2-4X_1-8X_2-12X_3+56$

B Discuss Lagrangian multiplier method to provide necessary condition for an optimum when constraints are equations. 8

OR

Q. 10 A Formulate following description as non-linear programming problem 8

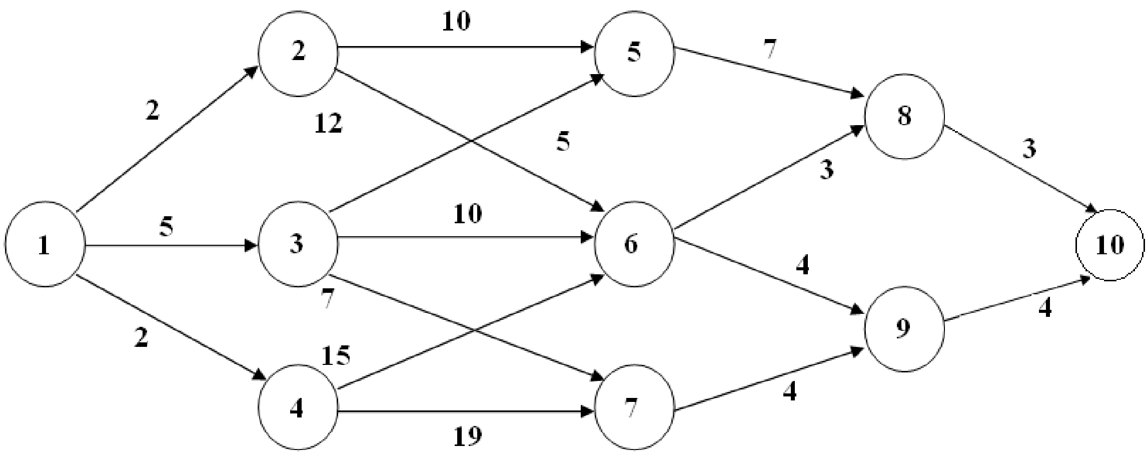
A company manufactures two products A and B.A takes 30 minutes while B 15 minutes for each unit.Maximum machine time available is 35 hours per week.Products A and B requires 2 kg and 3 kg of raw material per unit respectively.Available quantity of raw material is 180 kg per week. Product A and B have unlimited marked potential sell for 200 Rs and 500 Rs respectively. Manufacturing cost for A and B are $2x^2$ and $3y^2$ Respectively. Find how much of each product should be produces per week?[X is quantity of product A and Y is quantity B]

B Use separable programming algorithm to convert following specification to non-linear problem. 8

Max $z = X^1 + X_2^4$,subject to constraints $3x_1 + 2X_2^2 \leq 9$, $X_1, X_2 \geq 0$

[Note:NLP problem formulation only,do not solve formulated NLP problem]

Q. 11	A	What is dynamic programming?State and explain Bellman's principle of optimality in dynamic programming.	8
	B	Solve the following minimum path problem instance using dynamic programming for path node 1 to node 10.	8



OR

Q. 12	A	Explain single additive constraints,additively separable return model of dynamic programming.	8
	B	Using dynamic programming solve minimize $z = y_1^2 + y_2^2 + y_3^2$ subject to constraints $y_1 + y_2 + y_3 \geq 15$, y_1 , $y_2,$,$y_3 \geq 0$	8