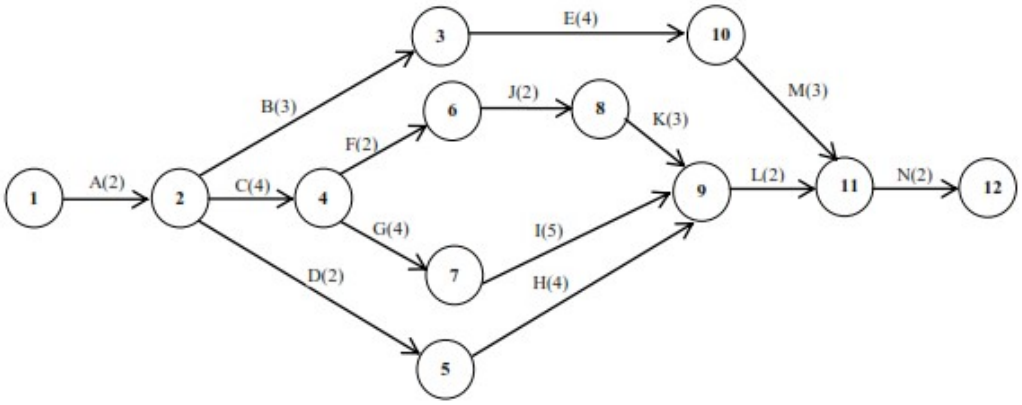
UNIVERSITY OF PETROLEUM AND ENERGY STUDIES
End Semester Examination, April/May 2018

Course: Operations Research(IPES351) **Semester: VI**
Program: B.Tech Production
Time: 03 hrs. **Max. Marks: 100**

Instructions:

SECTION A

S. No.		Marks	CO
Q1	Explain, how will you convert an unbalanced assignment problem to a balanced assignment problem, with an appropriate example.	**4**	**CO1**
Q2	A project consists of 14 activities, A to N. The duration of these activities (in days) are shown in brackets on the network diagram. The latest finish time (in days) for node 10 is _____ 	**4**	**CO3**
Q3	1. Consider the following liner programming problem. Minimize $Z = X_1 - X_2$ Subject to $X_1 + X_2 \geq 2$ $X_1 + 2X_2 \leq 8$ $X_1 \geq 0, \quad X_2 \geq 0,$ Identify the feasible region on a graphical representation of the problem and answer the following question: (a) What is the optimal solution (i) To the given problem?	**4**	**CO1**

<table>
<tr><td></td><td>(ii) When the objective function is maximize $Z = X_1 + X_2$?
(iii) When X_1 and X_2 are unrestricted in sign?
How should the first constraint be altered so that a feasible unbounded solution would exist for condition (iii) above for both cases (i) and (ii)?</td><td></td><td></td></tr>
<tr><td>Q4</td><td>Derive from the first principle the expression for P_o and L_q for a M/M/1/∞/∞ model.</td><td>4</td><td>CO1</td></tr>
<tr><td>Q5</td><td>Write the standard form of LPP for the following LPP:

Max $Z= 3X_1 + 5X_2$

Subjected to

$X_1 + X_2 \geq 2$
$X_1 + 2X_2 \leq 8$

$X_1 \geq 0, \quad X_2 \geq 0$</td><td>4</td><td>CO2</td></tr>
<tr><td colspan="4">SECTION-B
(Do either 2nd or 3rd question)</td></tr>
<tr><td>Q 1</td><td>The Omega data processing company performs three types of activity: pay rolls, account receivables, and inventories. The profit and time requirements for key punch computation and office printing for a standard job are show in the following table :

Omega guarantees overnight completion of the job. Any job schedule during the day can be completed during the day or night. Any job scheduled during the night, however, must be completed during the night. The capacity for both day and night are show in the following table:

<table><tr><td>Capacity(Min.)</td><td>Key punch</td><td>Computation</td><td>Print</td></tr><tr><td>Day</td><td>4,200</td><td>150</td><td>400</td></tr><tr><td>Night</td><td>9,200</td><td>250</td><td>650</td></tr></table>
Formulate the linear programming problem in order to determine the ‘mixture’ of standard jobs that should be accepted during the day and night.</td><td>10</td><td>CO2</td></tr>
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Q 2	Use the relation of dominance to solve the rectangular game whose payoff matrix to A is given in table. A / B 		I	II	III	IV	V	VI
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I	0	0	0	0	0	0
II	4	2	0	2	1	1
III	4	3	1	3	2	2
IV	4	3	7	-5	1	2
V	4	3	4	-1	2	2
VI	4	3	3	-2	2	2		**10**	**CO4**
Q 3	Compute the sequence for the given problem when passing out is not allowed: 	Item	Machine (Processing time in hours)			
	A	B	C	D
I	15	5	4	15
II	12	2	10	12
III	16	3	5	16
IV	17	3	4	17		**10**	**CO4**
Q 4	People arrive at a web browsing center at the rate of 10/hour (Poisson arrival). There are two computers used for browsing and the expected time taken by a person is 10 minutes (exponentially distributed). Determine: a) The probability that both the computer are free when a person arrives. b) The probability that the person can use a computer immediately on arrival. c) The probability the there is no queue on arrival. d) The expected number in the system. e) Waiting time in the queue. f) How many computers should be made available if the expected waiting time in the queue is to be less than 10 minutes?	**10**	**CO4**

Q 5	A company has 5 job to be done. The following matrix shows the return in rupees on assigning ith (i = 1, 2, 3, 4, 5) machine to the jth job (j = A, B, C, D, E). Assign the five jobs to the five machines so as to maximize the total expected profit. Machines 		A	B	C	D	E
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1	5	11	10	12	4
2	2	4	6	3	5
3	3	12	5	14	6
4	6	14	4	11	7
5	7	9	8	12	5		**10**	**CO3**
Q6	A project has the following time schedule: 	Activity	Time in months	Activity	Time in months
(1-2)	2	4-6	3
(1-3)	2	5-8	1
(1-4)	1	6-9	5
(2-5)	4	7-8	4
(3-6)	8	8-9	3
(3-7)	5			 Construct PERT network and compute: (i) Total float for each activity (ii) Critical path and its duration. (iii) And determine the minimum number of cranes the project must have for its activities 2-5, 3-7 and 8-9 without delaying the project.	**10**	**CO4**
	SECTION-C **(Do either 1st or 2nd question)**		
Q 1	A glass factory specializing in crystal is developing a substantial backlog and the firm's management is considering three courses of action: (S_1) arrange for sub-contracting, (S_2) construct new facilities. The correct choice depends largely upon future demand which may be low, medium, or high. By consensus, management ranks the respective probabilities as 0.10, 0.50 and 0.40. A cost analysis reveals the effect upon the profits that is shown in the table. 	Profit (Rs. '000) If demand is	Courses of action		
	S_1	S_2	S_3		**20**	**CO3**

		(Subcontracting)	(Overtime)	(Construct facilities)		
	Low (p = 0.10) Medium (p = 0.50) High (p = 0.40)	10 50 50	-20 60 100	-150 20 200		
	Show this decision situation is in the form of a decision tree and indicates the most preferred decision and corresponding expected value.					
	OR					
Q3	Dr. STRONG is dentist who schedules all per patients for 30 minutes appointments. Some of the patient take more or less than 30 minutes depending on the type of dental work to be done. The following summary shows the various categories of work, their probabilities and the time actually needed to complete the work.				**20**	**CO3**
	Categories Time required (min): Prob. of category:	Filling 45 0.40	Crown 60 0.15	Cleaning 15 0.15	Extraction 45 0.10	Checkup 15 0.20		
	Simulate the dentist's clinic for four hours and determine the average waiting time for the patients as well as the illness of the doctor. Assume that all the patients show up at the clinic at exactly their scheduled arrival time starting at 8:00 am. Use the following random numbers for handling the above problem: 40 82 11 34 25 66 17 79					