OBE: OPEN BOOK EXAMINATION_ **SET B**

Examination Roll no……..

Unique Paper Code	:	12481501
Name of the Paper	:	Quantitative Techniques for Management
Name of the Course	:	BA(H) Business Economics
Semester	:	V
Duration	:	3 hours
Maximum Marks	:	75 Marks

Instruction to candidates

Attempt any **four** questions. All questions carry equal Marks.

(Use of Non Scientific Calculator, Annuity Tables is allowed .If any assumptions are made while attempting a problem, the same must be stated clearly)

Q1. Solve the LP Problem:

$$\text{Max: } Z = 2x_1 + 4x_2$$
$$\text{s.t. } 2x_1 + x_2 \leq 18$$
$$3x_1 + 2x_2 \geq 30$$
$$x_1 + 2x_2 = 26$$
$$x_1, x_2 \geq 0$$

Show all workings to identify the entering and leaving variables.Are there any additional variables which must be added to solve the above problem

Q2. A company wants to determine the highest likely return of a new product for which annual demand in units, the investment required and per unit profit (revenue-cost) is given as under with the respective probabilities. You are required to simulate each of these three variables eight times using two digit random nos**. 08,66,99,33,31,2,88,49 (same random nos. for all variables)** and determine what shall be the highest simulated return , corresponding demand and investment required. The simulated return in % is given by **:- [(Demand x Profit Per Unit) / (Investment Required)] x 100**

Demand in Units	Prob.	Inv.Req. (Rs)	Prob.	Profit p.u(Rs.)	Prob.
15,000	0.05	15,00,000	0.25	2.00	0.10
20,000	0.10	20,00,000	0.50	4.00	0.20
25,000	0.20	25,00,000	0.25	6.00	0.40
35,000	0.30			8.00	0.20
45,000	0.20			10.0	0.10
60,000	0.10				
70,000	0.05				

Q3The following table gives the details of activities for a project:

Activity	Normal Time	Normal cost	Crash time	Crash cost
1-2	4	600	3	800
1-3	2	400	2	400
1-4	5	750	4	900
2-3	7	400	5	600
2-5	7	800	6	1000
3-5	2	500	1	650
4-5	5	600	4	850

(Duration is in days and the indirect cost per day for the project is Rs. 200/-)

(a)Draw a network & find normal projectcompletion time and cost.
(b)Find optimal project completion time and the minimum cost.
(c)Draw a graph (Project Cost Vs. Project Duration)

Q4.(a) Solve the following assignment problem when the time taken for each task by each operator is given row-wise & is shown in days

Operator	Task A	Task B	Task C	Task D
I	2	3	4	5
II	4	5	6	7
III	7	8	9	8
IV	3	5	8	4

Q4.(b)Apply Principle of Dominance and then solve the game using mixed strategy when two players A & B use I,II & III as their strategies:

	Player B		
Player A	**I**	**II**	**III**
I	1	7	2
II	6	2	7
III	6	1	6

Q5.(a)XYZ Co Ltdis having sufficient retained earnings and wishes to invest 50 lakhs in any one or more of its three companies. The investment must be at least 10 lakhs and in multiples of 10 lakh in these companies. The Net Present Value of the three Companies stands as under :-

NPV (Co. 1) : $4x_1 + 1$
NPV (Co. 2) : $7x_2 + 2$
NPV (Co 3) : $x_3 + 9$

In case no funds are employed then NPV shall be zero . The company intends to maximize its NPV . Using Dynamic Programming show how to achieve this objective by putting available funds in three companies.

Q5(b) A project has the following activities & other characteristics

Activity	**Preceding Activity**	**Most Optimistic**	**Most likely**	**Most pessimistic**
A	-	4	7	16
B	-	1	5	15
C	A	6	12	30
D	A	2	5	8
E	C	5	11	17
F	D	3	6	15
G	B	3	9	27
H	E,F	1	4	7
I	G	4	19	28

(a) Draw the PERT network diagram & identify the critical path.
(b) Determine the mean project completion time.
(c) Find the probability that the project will take more than 36 weeks but not more than 40 weeks

Q6(a) For a Bond having face value as Rs 100 and carrying 9 % coupon, the following transition Matrix is provided

Current State 'Period 0'	**Next Period**			
	A	**B**	**C**	**D**
A	**0.77**	**0.23**	**0**	**0**
B	**0.05**	**0.81**	**0.10**	**0.04**
C	**0.02**	**0.22**	**0.55**	**0.21**
D	**0.0**	**0.0**	**0.0**	**1.0**

(A,B,C &D are four ratings from Highest to Lowest for this bond and the Bond can move amongst ratings depending upon the Company's ability to pay. D being the Default Status and once a bond reaches that state no further improvement is possible . Also '0' probability denotes that this state is not possible.)

Determine

(i) Probability of Bondwhich is in State B Defaulting in next period

(ii) Bond's actual payoff Matrix when time 't' is less than last period and also when time 't' is the last period. The Bond pays 100 %, 100 %, 50 % & 0 % in the four states of A,B,C & D respectively.***(Note : The last period payment shall be principal + coupon interest and all preceding payments only coupon interest)***

(iii) State, how would you model the **expected payoff** of Bond presently in State B in period 2 . Period 2 is assumed to be not the last period (Note : actual computation not required).

Q6(b)A Co is thinking in terms of five alternative investment decisions

Project	**NPV**	**Cash Outflow (Investment)**
I	Rs. 20,000	Rs 12,000
II	Rs 28,000	Rs 14,000
III	Rs 18,500	Rs. 7,000
IV	Rs. 27,500	Rs. 13,000
V	Rs. 31,000	Rs. 16,000

In the above connection the following information is available :-

(i) The Company has a Capital of Rs 48,000 to be put in these five projects, however no more than three projects can be undertaken.
(ii) The Company can invest in Project II only if it decides to invest in Project III
(iii) If the Co. invests in Project IV, then Project V is ruled out.

Using above information, formulate an Integer Programming Problem(0-1) if the objective is to maximize the NPV

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