T.Y. BMS - SEM VI - Reg. Exam - April'2018

O.R.
19.4.18

Q.P. Code :31261

[Time: $2\frac{1}{2}$ Hours] **[Marks:75]**

Please check whether you have got the right question paper.

N.B:
1. All questions are compulsory.
2. Figures to the right indicate full marks.
3. Use of non-programmable calculator is allowed.
4. Normal distribution table is printed on last page.
5. Support answers by diagrams where applicable.
6. Graph paper will be supplied on Request.

Q.1 Attempt **any two** questions :

a) Use Simplex method to solve the following Linear programming problem **7.5**

Maximize $Z = 3x_1 + 7x_2$

Subject to the constraints,

$$2x_1 + 5x_2 \leq 20$$
$$x_1 + 2x_2 \leq 4$$
$$x_1 \geq 0, x_2 \geq 0$$

b) Use Graphical method to solve the following Linear programming problem **7.5**

Maximize $Z = 8x_1 + 5x_2$

Subject to the constraints,

$$5x_1 + 3x_2 \geq 30$$
$$2x_1 + 5x_2 \geq 20$$
$$x_1 + x_2 \leq 8$$
$$x_1 \geq 0, x_2 \geq 0$$

c) Answer each question in brief:

i) Discuss characteristics of Operations Research. **2.5**

ii) Explain "Redundant Constraint" in Graphical Method of LPP. **2.5**

iii) Write the Dual for the following Problem. **2.5**

Minimize $Z = 8x_1 + 2x_2 + 3x_3$

Subject to the constraints,

$$x_1 + 3x_2 + 5x_3 \geq 18$$
$$4x_1 + 2x_2 + x_3 \geq 7$$
$$x_1 \geq 0, x_2 \geq 0, , x_3 \geq 0$$

Q.2 Attempt **any two** questions:

a) Four jobs are to be assigned to four workers on one to one basis. Cost of each assignment is given in Rs. Thousands. Find optimal assignment of job and worker to minimize total cost. **7.5**

Workers	Jobs			
	A	B	C	D
Sunil	4	6	4	2
Jainil	12	5	6	5
Anil	3	9	4	3
Swapnil	6	5	3	2

b) The quantity of different products (in units) produced by the workers per day are given in the following matrix along with the profit in Rs. Per unit. Formulate a Profit Matrix and find the optimal assignment of workers to product which will maximize the profit. **7.5**

Workers	Quantity of Products in Units			
	Pencil	Rubber	Pen	Ink
Amit	30	40	100	50
Sumit	25	70	140	30
Vinit	40	90	130	60
Punit	35	45	120	40
Profit in Rs. Per Unit	4	2	1	3

c) There are 3 Factories A, B, C and three Markets X, Y and Z. Supply at the Factories is 60, 80 and 85 units. Demand at the market places is 75, 110 and 40 units. The supply and Demand of units with unit cost of Transportation (in Rs.) and the schedule followed from Factories to Markets are given below: (The numbers which are shown in circle indicates number of units transported from Factories to Markets.)

(Cost in Rs.)

Markets / Factories	X	Y	Z	Supply
A	6 (35)	3 (25)	5	60
B	5 (40)	2	2 (40)	80
C	12	7 (85)	8	85
Demand	75	110	40	225

i) Test the given solution for optimality and find optimal Transportation Solution. **03**

ii) Find one more optimal alternate Transportation solution. **3.5**

iii) Comment upon the managerial significance of alternate/ multiple optimal Transportation solution. **01**

Q.3 Attempt **any two** questions:

a) A small project consists of following activities:

Activity	Preceding Activity	Time (days)
A	-	6
B	A	7
C	A	9
D	B	12
E	C	7
F	D,E	8

i) Construct the network diagram and find out critical path and project completion time. **2.5**

ii) Calculate Earliest Start Time, Earliest Finish Time, Latest start time and Latest Finish Time for each activity. **04**

iii) Calculate Tail Slack and Head Slack for non critical activities. **01**

b) The data for a PERT network is given in the following table. The project manager has made following calculations of Average Expected Times from Optimistic time, most likely time and pessimistic time for various activities of a project as well respected standard Deviation and the variance values.

Events i-j	Expected Time (te) in weeks	Standard Deviation	Variance
1-2	5	1/3	1/9
1-3	6	1/3	1/9
2-3	4	1	1
2-4	6	4/3	16/9
3-5	3	4/3	16/9
4-6	2	1/3	1/9
5-6	4	1/3	1/9
6-7	2	1	1

i) Construct the network diagram of PERT network. **2.5**

ii) Identify Critical Path and find the expected completion time of the project. **01**

iii) Find project completion time for 95% confidence level. **02**

iv) If the fixed cost of the project is Rs.30, 00,000/- and the variable cost is Rs.20, 000/- per week. Find the amount the firm should bid under the policy of 95% confidence of completion of the project. (for the purpose of bidding, consider only cost that is break even situation – no loss and no profit) **02**

c) Answer each question in brief:

i) What are the objectives of project crashing? **2.5**

ii) Discuss the concept of Dummy Activity. **2.5**

iii) Discuss the difference between an Activity and an Event. **2.5**

Q.4 Attempt **any two** questions.

a) A department store with a bakery section is faced with the problem of how many cakes to buy order to meet the day's demand. The departmental store prefers not to sell day-old-cakes. Left over cakes are therefore, a complete loss. On the other hand, if a customer desires cake but all of them have been sold, he will buy elsewhere and the sales will be lost. The store has therefore, collected information on the past sales based on 100 day period as shown in the table below:

Sales (units)	25	26	27	28
Probability	0.2	0.4	0.3	0.1

i) Construct the conditional Pay-off (profit) table. **2.5**

ii) Calculate Expected Pay-off (profit) using EMV method and suggest best course of action. **03**

What is the optimal number of cakes that should be bought each day? A cake costs Rs.10/- and sells for Rs.15/-

iii) Calculate the Expected Value with Perfect Information. (EVPI) **02**

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b) There are 7 different products in a machine shop. Their manufacturing time in Hrs on machines 1 and 2 are given below. Each of the products must go through two machines 1 and 2 in the order 1 -2

Products	Time in Hrs on Machine 1	Time in Hrs on Machine 2
A	25	15
B	40	25
C	15	45
D	20	30
E	75	35
F	100	40
G	60	45

i) Find the optimal sequence of products manufacturing that minimizes the total elapsed time. **02**

ii) Find the total Elapsed time for the optimum sequence. **3.5**

iii) Calculate the idle time for machine 1. **01**

iv) Calculate the idle time for machine 2. **01**

c) You are given the Pay-off (profit in Rs.) matrix in respect of a Two – Person Zero – Sum Game as follows:

		Player B			
		B1	B2	B3	B4
Player A	A1	13	14	-4	-12
	A2	8	9	0	5
	A3	7	-5	-2	-8
	A4	-9	-5	0	-2

i) Find the Maximin strategy **2.5**

ii) Find the Minimax strategy **2.5**

iii) What is the Value of the game? **2.5**

Q.5 There are 3 warehouses A,B, C and four market places P, Q, R, S Supply at the warehouses is 8,9 and 13 units. Demand at the market places is 8, 9, 6 and 7 units
The following table shows the unit cost data of transportation and a feasible solution to the problem

Markets / WH	P	Q	R	S	Supply
A	19	17 (8)	18	17	8
B	11	12	5 (6)	9 (3)	9
C	7 (8)	9 (1)	11	12 (4)	13
Demand	8	9	6	7	

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i) Test the given solution for optimality. **03**

ii) If the given solution is not optimal, find optimal solution using MODI method and calculate optimal cost of transportation. **03**

From the obtained Optimal Table, answer the following Questions.

iii) If 3 units are transported from B to P, how will the cost be affected? **01**

iv) If the transporter from A to R is prepared to reduce the cost by 20% even if one unit transportation business is given to him. Should the offer be accepted? **02**

v) If the management wants to embark on an advertisement campaign in one of the market place, which one should be selected? **02**

vi) If the transport cost from C to R decreases from Rs. 11 to Rs.4, what will happen to transportations solution? **02**

vii) What should be the decrease in the cost of cell A-R so that it can be used alternatively so that multiple solutions are possible? **02**

NORMAL DISTRIBUTION TABLE

Area Under Standard Normal Distribution

z		0.01	0.02	0.03	0.04	0.05	0.06	0.07	0.08	0.09
0.0	0.0000	0.0040	0.0080	0.0120	0.0160	0.0199	0.0239	0.0279	0.0319	0.0359
0.1	0.0398	0.0438	0.0478	0.0517	0.0557	0.0596	0.0636	0.0675	0.0714	0.0753
0.2	0.0793	0.0832	0.0871	0.0910	0.0948	0.0987	0.1026	0.1064	0.1103	0.1141
0.3	0.1179	0.1217	0.1255	0.1293	0.1331	0.1368	0.1406	0.1443	0.1480	0.1517
0.4	0.1554	0.1591	0.I628	0.1664	0.1700	0.1736	0.!772	0.1808	0.1844	0.1879
0.5	0.1915	0.1950	0.1985	0.2019	0.2054	0.2088	0.2123	0.2157	0.2190	0.2224
0.6	0.2257	0.2291	0.2324	0.2357	0.2389	0.2422	0.2454	0.2486	0.2517	0.2549
0.7	0.2580	0.2611	0.2642	0.2673	0.2704	0.2734	0.2764	0.2794	0.2823	0.2852
0.8	0.2881	0.2910	0.2939	0.2967	0.2995	0.3023	0.3051	0.3078	0.3106	0.3133
0.9	0.3159	0.3186	0.3212	0.3238	0.3264	0.3289	0.3315	0.3340	0.3365	0.3389
1.0	0.3413	0.3438	0.3461	0.3485	0.3508	0.3531	0.3554	0.3577	0.3599	0.3621
1.1	0.3643	0.3665	0.3686	0.3708	0.3729	0.3749	0.3770	0.3790	0.3810	0.3830
1.2	0.3849	0.3869	0.3888	0.3907	0.3925	0.3944	0.3962	0.3980	0.3997	0.4015
1.3	0.4032	0.4049	0.4066	0.4082	0.4099	0.4115	0.4131	0.4147	0.4162	0.4177
1.4	0.4192	0.4207	0.4222	0.4236	0.4251	0.4265	0.4279	0.4292	0.4306	0.4319
1.5	0.4332	0.4345	0.4357	0.4370	0.4382	0.4394	0.4406	0.4418	0.4429	0.4441
1.6	0.4452	0.4463	0.4474	0.4484	0.4495	0.4505	0.4515	0.4525	0.4535	0.4545
1.7	0.4554	0.4f 64	0.4573	0.4582	0.4591	0.4599	0.4608	0.4616	0.4625	0.4633
1.8	0.4641	0.4649	0.4656	0.4664	0.4671	0.4678	0.4686	0.4693	0.4699	0.4706
1.9	0.4713	0.4719	0.4726	0.4732	0.4738	0.4744	0.4750	0.4756	0.4761	0.4767
2.0	0.4772	0.4778	0.4783	0.4788	0.4793	0.4798	0.4803	0.4808	0.4812	0.4817
2.1	0.4821	0.4826	0.4830	0.4834	0.4838	0.4842	0.4846	0.4850	0.4854	0.4857
2.2	0.4861	0.4864	;.4368	0.487	0.1875	0.4878	0.488!	0.4884	0.4887	0.4890
2.3	0.4893	0.4896	0.4898	0.4901	0.4904	0.4906	0.4909	0.4911	0.4913	0.4916
2.4	0.4918	0.4920	0.4922	0.4925	0.4927	0.4929	0.4931	0.4932	0.4934	0.4936
2.5	0.4938	0.4940	0.4941	0.4943	0.4945	0.4946	0.4948	0.4949	0.4951	0.4952
2.6	0.4953	0.4955	0.4956	0.4957	0.4959	0.4960	0.4961	0.4962	0.4963	0.4964
2.7	0.4965	0.4966	0.4967	0.4968	0.4969	0.4970	0.4971	0.4972	0.4973	0.4974
2.8	0.4974	0.4975	0.4976	0.4977	0.4977	0.4978	0.4979	0.4979	0.4980	0.4981
2.9	0.498 I	0.4982	0.4982	0.4983	0.4984	0.4984	0.4985	0.4985	0.4986	0.4986
3.0	0.4987	0.4987	0.4987	0.4988	0.4988	0.4989	0.4i89	0.4989	0.4990	0.4990

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