D-12/2110 5575/NJ

OPTIMIZATION TECHNIQUES-I

Paper: OR-305/SC-304

(SEMESTER-III)

Time Allowed: 2 Hours Maximum Marks: 70

Note: The Candidates are required to attempt any four questions from the given nine questions. Each question carries equal marks.

1. The demand for an item in a company is 18,000 units per year, and the company can produce the item at a rate of 3,000 per month. The cost of one set up is Rs.500 and the holding cost of one unit per month is 15 paise. The shortage cost of one unit is Rs.20 per year. Determine the optimum manufacturing quantity and the number of shortages. Also, determine the manufacturing time and the time between set ups.

2. A transportation equipment manufacturer uses rivets at an approximately constant rate of 2500 Kgs. per year. The cost of rivets is Rs.40 per Kg. The company's purchase manager estimates that it costs Rs.200 to place an order, and that the carrying cost of inventory is 10% per year.

   (a) How frequently should orders for rivets be placed, and what quantities should be ordered?

   (b) If the ordering cost is Rs.470 per order and 15% for carrying cost, how would the optimal policy change? How much is the company losing per year because of imperfect cost information?

3. (a) Derive the EOQ formula $q_0 = \sqrt{\frac{2C_3R}{C_1}}$, where the symbols have usual meanings. State the assumptions and limitations of this formula.

   (b) A supplier supplied at the constant rate of 200 units per day. Supplies of any amount can be had at any required time but each ordering costs Rs.50. Cost of holding the commodity in inventory is Rs.2 per unit per day while the delay in the supply of the item induces a penalty of Rs.10 per unit per delay of one day. Find the optimal policy, q and t, where t is the reorder cycle period and q is the inventory level after reorder. What would be the best policy if the penalty cost becomes infinity?

4. A company has a product for which the assumption of the inventory model with planned shortage are valid. The following data is given for the company:

Annual demand = 2000 units per year, Cost of unit = Rs.50 per unit, Ordering cost = Rs.25 per order, Carrying cost = Rs.10 per unit per year, Back order cost = Rs.30 per unit per year.Calculate

(a) Minimum cost order quantity

(b) Maximum number of back orders units

(c) Maximum Inventory level

(d) Time between orders

(e) Total annual costs.

5. Seven jobs, each of which has to go through the machines M_1 and M_2 in the order M_2M_1. Processing time (in hours) are given in the table below:

	Jobs	**A**	**B**	**C**	**D**	**E**	**F**	**G**
Machine	**M_1**	3	12	15	6	10	11	9
	M_2	8	10	10	6	12	1	3

(a) Determine the optimum sequence that will minimize the total elapsed time, with idle time of each machine.

(b) If the order is reversed to M_1M_2, what difference will it make to the calculated results?

6. (a) Explain briefly: Total elapsed time, Processing order, Processing time and No passing rule.

(b) Use graphical method to find the minimum elapsed total time sequences of 2 jobs and 5 machines, when we are given the following information:

P_1	**Sequence**	**A**	**B**	**C**	**D**	**E**
	Time (in hrs.)	2	3	4	6	2
P_2	**Sequence**	**C**	**A**	**D**	**E**	**B**
	Time (in hrs.)	4	5	3	2	6

7. Consider the data:

Activity	**Optimistic**	**Pessimistic**	**Most likely**
1 – 2	2	8	5
1 – 3	1	7	4
2 – 3	0	0	0
2 – 4	2	6	4
2 – 6	5	12	7
3 – 4	3	10	7
3 – 5	3	3	6
4 – 5	2	8	5
4 – 6	4	10	6
5 – 6	2	6	4

(a) Draw a Network.
(b) Determine the Critical Path and find the variances of each activity.
(c) Find the earliest and latest expected times to reach each node.
(d) Find the probability that the project is completed in 23 days?

8. (a) A Bakery keeps stock of a popular brand of cake. Their earlier experience indicates the daily demand as given below.

Daily demand	0	10	20	30	40	50
Probability	.01	.20	.15	.50	.12	.02

Using the following sequence of random numbers:

48, 78, 19, 51, 56, 77, 15, 14, 68, 09.

Simulate the demand for the next 10 days. Find out the stock situation if the owner of the bakery decides to make 30 cakes every day. Also estimate the daily average demand for the cakes on the basis of simulated data.

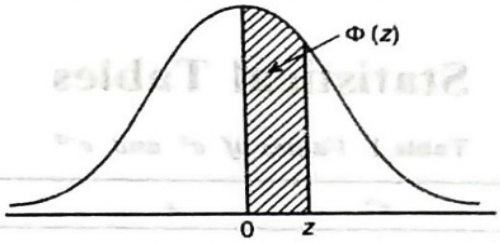
(b) An assembly line has three work stations. The time required for each station to complete its operation is as follows:

Time (minutes)	**Probabilities**		
	Station 1	**Station 2**	**Station 3**
4	0.25	0.10	0.05
5	0.25	0.30	0.25
6	0.25	0.40	0.25
7	0.25	0.20	0.45

The times given are the only values the operation times take on. Simulate the flow of 20 items through the assembly line. What is the average time that an item takes to go through all the operations?

9.
(a) What is Economic Ordering Quantity? Explain EOQ graphically.
(b) What is the minimum average cost of economic lot size with different rates of demand in different cycles?
(c) What is the formula derived for EOQ in multi-item inventory having limitation on investment?
(d) What is PERT? Explain 'Optimistic Time', 'Pessimistic Time' and Most Likely Time', in relation to PERT.
(e) What are the areas where simulations can be used?

Table 2. *Area Under Standard Normal Curve*



z	.00	.01	.02	.03	.04	.05	.06	.07	.08	.09
0.0	.0000	.0040	.0080	.0120	.0160	.0199	.0239	.0279	.0319	.0359
0.1	.0398	.0438	.0478	.0517	.0557	.0596	.0636	.0675	.0714	.0753
0.2	.0793	.0832	.0871	.0910	.0948	.0987	.1026	.1064	.1103	.1141
0.3	.1179	.1218	.1255	.1293	.1331	.1368	.1406	.1443	.1480	.1517
0.4	.1554	.1591	.1628	.1664	.1700	.1736	.1772	.1808	.1844	.1879
0.5	.1915	.1950	.1985	.2019	.2054	.2088	.2123	.2157	.2190	.2224
0.6	.2257	.2291	.2324	.2357	.2389	.2422	.2454	.2486	.2517	.2549
0.7	.2580	.2611	.2642	.2673	.2703	.2734	.2764	.2794	.2823	.2852
0.8	.2881	.2910	.2939	.2967	.2995	.3023	.3051	.3078	.3106	.3133
0.9	.3159	.3181	.3212	.3238	.3264	.3289	.3315	.3340	.3365	.3389
1.0	.3413	.3438	.3461	.3485	.3508	.3531	.3554	.3577	.3599	.3621
1.1	.3643	.3665	.3686	.3708	.3729	.3749	.3770	.3790	.3810	.3830
1.2	.3849	.3869	.3888	.3907	.3925	.3944	.3962	.3980	.3997	.4015
1.3	.4032	.4049	.4066	.4082	.4099	.4115	.4131	.4147	.4162	.4177
1.4	.4192	.4207	.4222	.4236	.4251	.4265	.4279	.4292	.4306	.4319
1.5	.4332	.4345	.4357	.4370	.4302	.4394	.4406	.4418	.4429	.4441
1.6	.4452	.4463	.4474	.4484	.4405	.4505	.4515	.4525	.4535	.4545
1.7	.4554	.4564	.4573	.4582	.4591	.4599	.4608	.4616	.4625	.4633
1.8	.4641	.4649	.4656	.4664	.4671	.4678	.4686	.4693	.4699	.4706
1.9	.4713	.4719	.4726	.4732	.4738	.4744	.4750	.4756	.4761	.4767
2.0	.4772	.4778	.4783	.4788	.4793	.4798	.4803	.4808	.4812	.4817
2.1	.4821	.4826	.4830	.4834	.4838	.4842	.4846	.4850	.4852	.4857
2.2	.4861	.4864	.4868	.4871	.4875	.4878	.4881	.4884	.4887	.4890
2.3	.4893	.4896	.4898	.4901	.4904	.4906	.4909	.4911	.4913	.4916
2.4	.4918	.4920	.4922	.4925	.4927	.4926	.4931	.4932	.4934	.4936
2.5	.4938	.4940	.4941	.4943	.4945	.4946	.4948	.4949	.4951	.4952
2.6	.4953	.4955	.4956	.4957	.4959	.4960	.4961	.4962	.4963	.4964
2.7	.4965	.4966	.4967	.4968	.4969	.4970	.4971	.4972	.4973	.4974
2.8	.4974	.4975	.4976	.4977	.4977	.4978	.4979	.4979	.4980	.4981
2.9	.4981	.4982	.4982	.4983	.4984	.4985	.4985	.4985	.4986	.4986
3.0	.4987	.4987	.4987	.4988	.4988	.4989	.4989	.4989	.4990	.4990

An entry in the table is the proportion under the entire curve which is between $z = 0$ and a positive value of z. Areas for negative values of z are obtained by symmetry :

$$P(Z \leq 1.35) = 0.5 + \Phi(1.35) = 0.5 + 0.4115 = 0.9115$$
$$P(Z \leq -1.35) = 0.5 - \Phi(1.35) = 0.5 - 0.4115 = 0.0885.$$