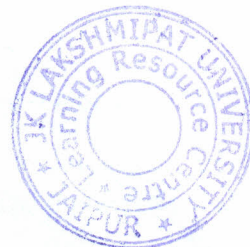




**Institute of Management
JK Lakshmipat University
Jaipur**



END TERM EXAMINATION 2015

MBA (FT) Sem-I

MM: 50 Marks

Course: Operations Research

Time: 3 Hours

Subject code: MBA 108

Instructions: Attempt any three questions from Section A. Section B is compulsory

Section A

(Attempt any 3)

Q1. A. Describe in detail the different phases involved in OR . (6 Marks)

B. What are the advantages of Duality ? (4 Marks)

Q2. A company is producing a single product and is selling it through five agencies situated in different cities. All of a sudden, there is a demand for the product in another five cities not having any agency of the company. The company is struggling to decide how to assign the existing agencies for dispatching the product to nearby cities in such a way that the total travelling distance is minimized. The distance between the surplus and deficit cities in km. is given in the following table

	A	B	C	D	E
A	10	5	9	18	11
B	13	19	6	12	14
C	3	2	4	4	5
D	18	9	12	17	15
E	11	6	14	19	10

Determine the optimal assignment schedule

(10 Marks)

Note: each step should be clearly explained with the help of the tables on the answer sheet

Q3. A. Following data is available for a firm which manufactures three products A,B and C

Products	A	B	C
Net sale price(Rs. Per unit)	10	12	15
Cost (per unit)	6	9	10

The wholesaler who is responsible for selling to the customer is to be paid Rs.150 per day irrespective of the quantities sold in each of the products.

The products are processed in three different operations. The time (hrs.) required to produce one product in each of the operations and the daily capacity (hrs.) available for each center are given as

Operations	Products			Daily capacity (hrs)
	A	B	C	
1	2	3	2	400
2	3	2	2	350
3	1	4	2	300

What product mix would yield maximum profit and how much? Solve by simplex method. (6 Marks)

B. ABC is an investment firm. To aid its investment decision, ABC has developed the investment alternatives, given in the following table. The returns on investment are expressed as annual return on invested capital. The risk is subjective estimate on a scale from 0 to 10 made by portfolio manager of the safety of investment. The term of the investment is the average length of time required to release the return on investment indicated in the given table.

Investment alternatives	Yearly return on Investment (in Percentage)	Risk	Term of Investment (in years)
A	15	3	6
B	13	2	8
C	20	4	4
D	24	5	10
Cash	0	0	0

The objective of the company is to maximize the return on investments. The guide for selecting the portfolios is:

- The average risk should not exceed 3
- The average term of investment should not exceed 5 years
- Atleast 15% of the fund should be retained in the form of cash

Formulate an LP problem from the above given information .

(4 Marks)

Q4. A. XYZ firm plans going on with 3 subsidiary projects with minimum investments; Project A with an investment of Rs. 4,000 and Project B and C with Rs. 6,000 and Rs. 5,000 respectively. The projects are trial projects and have a chance to be successful.

Project	A	B	C
Probability of success	.8	.4	.5
Profit if successful	20000	25000	24000
Loss if fails	2000	2000	1000

Draw decision tree and take decision •

(5 Marks)

B. A farmer wants to grow, any one of the three crops- A, B or C.

Cost of seeds, and fertilizers plus labor charges for growing crop A in his farm are estimated to be Rs.3000. In the same way for crop B and C estimated amount are Rs. 4000 and Rs. 2500 respectively.

The yield depends on weather conditions and percentage of precipitation. As studied, we have three of such states.

- Heavy rain and damp weather
- Moderate rain and mixed (often dry and damp)
- Scanty rain and dry weather

The yield in kg. Of each type of crop under different weather conditions is estimated as follows

Crop type \ Weather condition	A	B	C
Damp	1000	900	850
Moderate	600	700	1100
Dry	500	900	700

In addition, market condition are estimated as follows

Crop type	A	B	C
Sale prize (in Rs/ kg)	20	18	24

Analysis the situation by drawing a decision tree •

(5 Marks)



Q5. A. What is the importance of ABC analysis for Inventory Control? (4 Marks)

B. Grey Wolf Lodge is a popular 500 –room hotel in the North Woods. Manager need to keep close tabs on all room service items, including a special pine –scented bar soap. The daily demand for the soap is 275 bars, with a standard deviation of 30 bars. Ordering cost is \$10 and the inventory holding cost is \$ 0.30 per bar per year. The lead time from the supplier is 5 days, with a standard deviation of 1 day. The lodge is open 365 days a year.

- What is the EOQ for the bar of soap?
- What should be the reorder point to be for the bar of soap if management wants to have a 95% cycle service level
- What is the total annual cost for the soap bar, assuming a Q system will be used (6 Marks)

Section B

(All questions are compulsory)

Q6. A. A project consist of 7 activities and the estimated time of the activates is given below

Activities	Optimistic	Most likely	Pessimistic
1-2	4	10	16
1-3	3	6	9
1-4	4	7	16
2-5	5	5	5
3-5	8	11	32
4-6	4	10	16
5-6	2	5	8

- Draw a network diagram
- Identify the critical path and its duration
- What is the probability that the project will be completed in 5 days earlier than critical path duration
- What project duration will provide 95% confidence level of completion ($Z_{0.95} = 1.65$)

(2*4 = 8 Marks)

B. The following list of activities must be accomplished in order to complete a construction project

Activities	A	B	C	D	E	F	G	H	I	J
Predecessor	-	-	A,B	B	A	C	E,F	D,F	G,H	I
Time in Weeks	3	8	4	2	1	7	5	6	8	9

- a. Construct a network diagram for this project find the critical path and the duration of the project
- b. Assume that you are the project manager and the project has progressed to the end of week 10 and the status is as follows

Activities completed : A B & E

Activities not completed: C, D, F, G, H, I & J

- If no managerial action is taken at all, when will the project get completed?

(2*3 = 6 marks)

- C. Different customers arrive at a gas station requiring different types of services. They arrive following Poisson distribution with a mean time equal to 4 minutes between 2 consecutive arrivals. They are served at a single service point following an exponential distribution with mean equal to 20 customers.

- a. Find the average waiting time that a customer has to spend in a queue.
- b. A survey shows that the customers will not change over if the waiting time is reduced to atmost 5 minutes. You are required to find incremental service resource that satisfies customer's demand.

(1.5*2 = 3 marks)

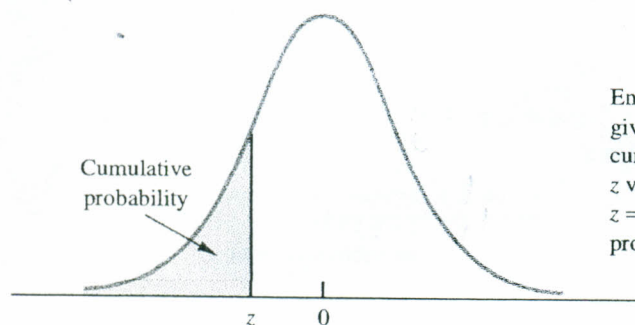
- D. For the standard Q system we have $\lambda = 12$ and $\mu = 15$.

- a. Find the percentage non-utilization factor
- b. Find the probability that there are more than 8 customers in the system

(1.5*2 = 3 marks)



CUMULATIVE PROBABILITIES FOR THE STANDARD NORMAL DISTRIBUTION

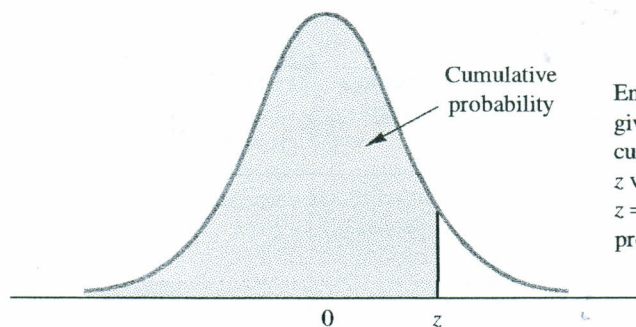


Entries in this table give the area under the curve to the left of the z value. For example, for $z = -0.85$, the cumulative probability is .1977.



z	.00	.01	.02	.03	.04	.05	.06	.07	.08	.09
+3.0	.0013	.0013	.0013	.0012	.0012	.0011	.0011	.0011	.0010	.0010
-2.9	.0019	.0018	.0018	.0017	.0016	.0016	.0015	.0015	.0014	.0014
-2.8	.0026	.0025	.0024	.0023	.0023	.0022	.0021	.0021	.0020	.0019
-2.7	.0035	.0034	.0033	.0032	.0031	.0030	.0029	.0028	.0027	.0026
-2.6	.0047	.0045	.0044	.0043	.0041	.0040	.0039	.0038	.0037	.0036
+2.5	.0062	.0060	.0059	.0057	.0055	.0054	.0052	.0051	.0049	.0048
-2.4	.0082	.0080	.0078	.0075	.0073	.0071	.0069	.0068	.0066	.0064
-2.3	.0107	.0104	.0102	.0099	.0096	.0094	.0091	.0089	.0087	.0084
-2.2	.0139	.0136	.0132	.0129	.0125	.0122	.0119	.0116	.0113	.0110
-2.1	.0179	.0174	.0170	.0166	.0162	.0158	.0154	.0150	.0146	.0143
-2.0	.0228	.0222	.0217	.0212	.0207	.0202	.0197	.0192	.0188	.0183
-1.9	.0287	.0281	.0274	.0268	.0262	.0256	.0250	.0244	.0239	.0233
-1.8	.0359	.0351	.0344	.0336	.0329	.0322	.0314	.0307	.0301	.0294
-1.7	.0446	.0436	.0427	.0418	.0409	.0401	.0392	.0384	.0375	.0367
-1.6	.0548	.0537	.0526	.0516	.0505	.0495	.0485	.0475	.0465	.0455
-1.5	.0668	.0655	.0643	.0630	.0618	.0606	.0594	.0582	.0571	.0559
-1.4	.0808	.0793	.0778	.0764	.0749	.0735	.0721	.0708	.0694	.0681
-1.3	.0968	.0951	.0934	.0918	.0901	.0885	.0869	.0853	.0838	.0823
-1.2	.1151	.1131	.1112	.1093	.1075	.1056	.1038	.1020	.1003	.0985
-1.1	.1357	.1335	.1314	.1292	.1271	.1251	.1230	.1210	.1190	.1170
-1.0	.1587	.1562	.1539	.1515	.1492	.1469	.1446	.1423	.1401	.1379
-9	.1841	.1814	.1788	.1762	.1736	.1711	.1685	.1660	.1635	.1611
-8	.2119	.2090	.2061	.2033	.2005	.1977	.1949	.1922	.1894	.1867
-7	.2420	.2389	.2358	.2327	.2296	.2266	.2236	.2206	.2177	.2148
-6	.2743	.2709	.2676	.2643	.2611	.2578	.2546	.2514	.2483	.2451
-5	.3085	.3050	.3015	.2981	.2946	.2912	.2877	.2843	.2810	.2776
-4	.3446	.3409	.3372	.3336	.3300	.3264	.3228	.3192	.3156	.3121
-3	.3821	.3783	.3745	.3707	.3669	.3632	.3594	.3557	.3520	.3483
-2	.4207	.4168	.4129	.4090	.4052	.4013	.3974	.3936	.3897	.3859
-1	.4602	.4562	.4522	.4483	.4443	.4404	.4364	.4325	.4286	.4247
-0	.5000	.4960	.4920	.4880	.4840	.4801	.4761	.4721	.4681	.4641

CUMULATIVE PROBABILITIES FOR THE STANDARD NORMAL DISTRIBUTION



Entries in the table give the area under the curve to the left of the z value. For example, for $z = 1.25$, the cumulative probability is .8944.

z	.00	.01	.02	.03	.04	.05	.06	.07	.08	.09
.0	.5000	.5040	.5080	.5120	.5160	.5199	.5239	.5279	.5319	.5359
.1	.5398	.5438	.5478	.5517	.5557	.5596	.5636	.5675	.5714	.5753
.2	.5793	.5832	.5871	.5910	.5948	.5987	.6026	.6064	.6103	.6141
.3	.6179	.6217	.6255	.6293	.6331	.6368	.6406	.6443	.6480	.6517
.4	.6554	.6591	.6628	.6664	.6700	.6736	.6772	.6808	.6844	.6879
.5	.6915	.6950	.6985	.7019	.7054	.7088	.7123	.7157	.7190	.7224
.6	.7257	.7291	.7324	.7357	.7389	.7422	.7454	.7486	.7517	.7549
.7	.7580	.7611	.7642	.7673	.7704	.7734	.7764	.7794	.7823	.7852
.8	.7881	.7910	.7939	.7967	.7995	.8023	.8051	.8078	.8106	.8133
.9	.8159	.8186	.8212	.8238	.8264	.8289	.8315	.8340	.8365	.8389
1.0	.8413	.8438	.8461	.8485	.8508	.8531	.8554	.8577	.8599	.8621
1.1	.8643	.8665	.8686	.8708	.8729	.8749	.8770	.8790	.8810	.8830
1.2	.8849	.8869	.8888	.8907	.8925	.8944	.8962	.8980	.8997	.9015
1.3	.9032	.9049	.9066	.9082	.9099	.9115	.9131	.9147	.9162	.9177
1.4	.9192	.9207	.9222	.9236	.9251	.9265	.9279	.9292	.9306	.9319
1.5	.9332	.9345	.9357	.9370	.9382	.9394	.9406	.9418	.9429	.9441
1.6	.9452	.9463	.9474	.9484	.9495	.9505	.9515	.9525	.9535	.9545
1.7	.9554	.9564	.9573	.9582	.9591	.9599	.9608	.9616	.9625	.9633
1.8	.9641	.9649	.9656	.9664	.9671	.9678	.9686	.9693	.9699	.9706
1.9	.9713	.9719	.9726	.9732	.9738	.9744	.9750	.9756	.9761	.9767
2.0	.9772	.9778	.9783	.9788	.9793	.9798	.9803	.9808	.9812	.9817
2.1	.9821	.9826	.9830	.9834	.9838	.9842	.9846	.9850	.9854	.9857
2.2	.9861	.9864	.9868	.9871	.9875	.9878	.9881	.9884	.9887	.9890
2.3	.9893	.9896	.9898	.9901	.9904	.9906	.9909	.9911	.9913	.9916
2.4	.9918	.9920	.9922	.9925	.9927	.9929	.9931	.9932	.9934	.9936
2.5	.9938	.9940	.9941	.9943	.9945	.9946	.9948	.9949	.9951	.9952
2.6	.9953	.9955	.9956	.9957	.9959	.9960	.9961	.9962	.9963	.9964
2.7	.9965	.9966	.9967	.9968	.9969	.9970	.9971	.9972	.9973	.9974
2.8	.9974	.9975	.9976	.9977	.9977	.9978	.9979	.9979	.9980	.9981
2.9	.9981	.9982	.9982	.9983	.9984	.9984	.9985	.9985	.9986	.9986
3.0	.9987	.9987	.9987	.9988	.9988	.9989	.9989	.9989	.9990	.9990