UNIVERSITY OF SWAZILAND

FACULTY OF COMMERCE

DEPARTMENT OF BUSINESS ADMINISTRATION

MAIN EXAMINATION PAPER

MAY, 2012

(FULL TIME / IDE STUDENTS)

TITLE OF PAPER	:	**MANAGEMENT SCIENCE**
COURSE CODE	:	**BA 412**
TIME ALLOWED	:	**THREE (3) HOURS**
TOTAL MARKS	:	**100 MARKS**
INSTRUCTIONS	:	**(1) TOTAL NUMBER OF QUESTIONS IN THIS PAPER IS SIX (6)**

(2) THE PAPER CONSISTS OF SECTION A AND SECTION B.

(3) ANSWER ALL THE QUESTIONS IN SECTION A WHICH ARE COMPULSORY AND ANY TWO (2) QUESTIONS IN SECTION B.

(4) THE MARKS ALLOCATED FOR A QUESTION / PART OF A QUESTION ARE INDICATED AT THE END OF EACH QUESTION/PART OF A QUESTION

(5) WHERE APPLICABLE, ALL WORKINGS / CALCULATIONS MUST BE CLEARLY SHOWN

NOTE: MAXIMUM MARKS WILL BE AWARDED FOR GOOD QUALITY LAYOUT, ACCURACY, AND PRESENTATION OF WORK.

THIS PAPER MUST NOT BE OPENED UNTIL PERMISSION HAS BEEN GRANTED BY THE INVIGILATOR.

SECTION A (COMPULSORY) – 50 MARKS

Q1. Foster Generators has production facilities in Cleveland, Bedford and York. Production capabilities for these plants over the next 3 month planning period for one particular type of generator are as follows:

Plant Location	**3 Month Production Capacity**
Cleveland	5000
Bedford	6000
York	2500

The firm distributes its generators through four regional distribution centers located in Boston, Chicago, St. Louis, and Lexington; the 3 month forecast of demand for the distribution centers are as follows:

Distribution Center	**3 Month Demand Forecast**
Boston	6000
Chicago	4000
St. Louis	2000
Lexington	1500

Management would like to know how much of its production should be shipped from each plant to each distribution center. The cost (in $) for each unit shipped via each route is given in the following table:

Destination / Origin	**Boston**	**Chicago**	**St. Louis**	**Lexington**
Cleveland	3	2	7	6
Bedford	7	5	2	3
York	2	5	4	5

(i) Draw the transportation tableau (5 Marks).

(ii) Use both the Minimum cost method and the Stepping-Stone Method to obtain the optimal solution. (15 Marks).

Q2. (a) Prentice-Hall wants to assign recently hired college graduates: Jones, Smith, Andy and Wilson to regional sales districts in Omaha, Dallas and Miami. But the firm also has an opening in New York and would send one of the three there if it were more economical than a move to Omaha, Miami, or Dallas. It will cost $10 to relocate Jones to New York, $8 to relocate Smith there and $15 to move Wilson.

Based on the following cost table, find the optimal assignment of personnel to offices? (15 Marks)

Office / Hiree	Omaha	Miami	Dallas
Jones	8	11	12
Smith	5	16	13
Wilson	5	10	23

(b) The Electrocomp Corporation manufactures two electrical products: air conditioners and large fans. The assembly process for each is similar in that both require a certain amount of wiring and drilling. Each air conditioner takes 3 hours of wiring and 2 hours of drilling. Each fan must go through 2 hours of wiring and 1 hour of drilling. During the next production period, 240 hours of wiring time are available and up to 140 hours of drilling time may be used. Each air conditioner sold yields a profit of $25. Each fan assembled may be sold for a $15 profit. Formulate and solve this LP production mix situation to find the best combination of air conditioners and fans that yields the highest profit. Use the corner point graphical approach.
(15 Marks)

SECTION B (ANSWER ANY TWO QUESTIONS) – 50 MARKS

Q3. Consider a project having the following seven activities:

Activity	Immediate Predecessor	Optimistic Time (weeks)	Most likely Time (weeks)	Pessimistic Time (weeks)
A	none	2	3	4
B	A	4	4	8
C	A	3	5	7
D	B	5	5	5
E	B, C	3	6	7
F	D	4	5	9
G	E, F	3	3	7

a) Draw the network and find the expected project completion time. (15 Marks)
b) What is the critical path? (5 Marks)
c) What is the probability that the project will be completed in less than 24 weeks? (5 Marks)

Q4. Info-tech is a large firm of consultants for business computer systems. The firm requires a supply of floppy disks for the system programmes. The disks are purchased from an outside supplier and it is estimated that the annual usage will be 20,000 over the foreseeable future. The cost of placing each order for the disks is E32. For any disk in stock it is estimated that the annual holding cost is equal to 1% of its cost. The disks cost E0.80. No stock-out is permitted and the rest of usage may be assumed constant.

(a) What is the optimal order size and how many orders should be placed in a year? (6 Marks)

(b) What is the total relevant inventory cost per annum? (6 Marks)

(c) If the demand has been underestimated and the true demand is 24,200 disks per annum, what would the effect of keeping to the order quantity calculated in (a) and still meeting demand, rather than using the new optimal order level?
(7 Marks)

(d) What does your answer in (c) tell us about the sensitivity of your model to change demand? (6 Marks)

Q5. Floyd, Vusi and Okocha, who work for a firm of investment consultants, have been approached by one of their clients with regard to the investment of a sum of E100, 000 over a period of two years. After a thorough survey of the available opportunities, two alternatives (A and B) are proposed, one involving a small amount of risk, the other being risk free. Investment A will lead to a return of either 8%, 10% or 12% in each year, but due to the nature of the investment, there will be some correlation between year 1 and year 2 returns. This is shown by the following table which gives the probability of various returns in year 2 given returns in year 1.

	YEAR 2		
YEAR 1	**8%**	**10%**	**12%**
8%	0.6	0.3	0.1
10%	0.2	0.5	0.3
12%	0.1	0.2	0.7

At this stage, the three different returns in year 1 are considered to be equally likely. Investment B will produce a certain return of 9.5% per year. You may ignore the effects of taxation, and you may assume that the interest earned in year 1 is re-invested for the second year.

Assuming that the whichever alternative is chosen, the investment will be made for the full two year period:

a) Draw a decision tree to represent the alternative courses of action and outcomes.
(10 marks)

b) On the basis of the expected value of returns, which investment would you recommend (7 marks)

c) What is the probability that investment B produces a greater return that investment A? (8 marks)

Q6. A company has 3 products, A, B and C of which it can introduce only 1. The level of demand for each course of action might be low, medium, or high. If the company decides to introduce product A, the net income that would result from the levels of demand possible are estimated as E20, E40, and E50 respectively. Similarly, if product B is chosen, net income is estimated at E80, E70, and –E10 and product C, E10, E100, and E40 respectively. The likelihood of low, medium and high performance are, 0.1, 0.6, and 0.3 respectively.

Calculate

a) Maximum payoff (10Marks)

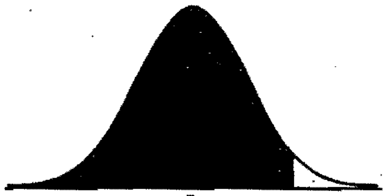
b) Minimax opportunity loss (10Marks)

c) Expected payoff with perfect information (5Marks)

TABLE 7S.1
Learning curve coefficients

	70%		75%		80%		85%		90%	
Unit Number	Unit Time	Total Time	Unit Time	Total Time	Unit Time	Total Time	Unit Time	Total Time	Unit Time	Total Time
1	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000
2	.700	1.700	.750	1.750	.800	1.800	.850	1.850	.900	1.900
3	.568	2.268	.634	2.384	.702	2.502	.773	2.623	.846	2.746
4	.490	2.758	.562	2.946	.640	3.142	.723	3.345	.810	3.556
5	.437	3.195	.513	3.459	.596	3.738	.686	4.031	.783	4.339
6	.398	3.593	.475	3.934	.562	4.299	.657	4.688	.762	5.101
7	.367	3.960	.446	4.380	.534	4.834	.634	5.322	.744	5.845
8	.343	4.303	.422	4.802	.512	5.346	.614	5.936	.729	6.574
9	.323	4.626	.402	5.204	.493	5.839	.597	6.533	.716	7.290
10	.306	4.932	.385	5.589	.477	6.315	.583	7.116	.705	7.994
11	.291	5.223	.370	5.958	.462	6.777	.570	7.686	.695	8.689
12	.278	5.501	.357	6.315	.449	7.227	.558	8.244	.685	9.374
13	.267	5.769	.345	6.660	.438	7.665	.548	8.792	.677	10.052
14	.257	6.026	.334	6.994	.428	8.092	.539	9.331	.670	10.721
15	.248	6.274	.325	7.319	.418	8.511	.530	9.861	.663	11.384
16	.240	6.514	.316	7.635	.410	8.920	.522	10.383	.656	12.040
17	.233	6.747	.309	7.944	.402	9.322	.515	10.898	.650	12.690
18	.226	6.973	.301	8.245	.394	9.716	.508	11.405	.644	13.334
19	.220	7.192	.295	8.540	.388	10.104	.501	11.907	.639	13.974
20	.214	7.407	.288	8.828	.381	10.485	.495	12.402	.634	14.608
21	.209	7.615	.283	9.111	.375	10.860	.490	12.892	.630	15.237
22	.204	7.819	.277	9.388	.370	11.230	.484	13.376	.625	15.862
23	.199	8.018	.272	9.660	.364	11.594	.479	13.856	.621	16.483
24	.195	8.213	.267	9.928	.359	11.954	.475	14.331	.617	17.100
25	.191	8.404	.263	10.191	.355	12.309	.470	14.801	.613	17.713
26	.187	8.591	.259	10.449	.350	12.659	.466	15.267	.609	18.323
27	.183	8.774	.255	10.704	.346	13.005	.462	15.728	.606	18.929
28	.180	8.954	.251	10.955	.342	13.347	.458	16.186	.603	19.531
29	.177	9.131	.247	11.202	.338	13.685	.454	16.640	.599	20.131
30	.174	9.305	.244	11.446	.335	14.020	.450	17.091	.596	20.727

Areas under the standardized normal curve, from – ∞ to + z



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	.7703	.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
3.1	.9990	.9991	.9991	.9991	.9991	.9992	.9992	.9992	.9993	.9993
3.2	.9993	.9993	.9994	.9994	.9994	.9994	.9994	.9995	.9995	.9995
3.3	.9995	.9995	.9995	.9996	.9996	.9996	.9996	.9996	.9996	.9997
3.4	.9997	.9997	.9997	.9997	.9997	.9997	.9997	.9997	.9997	.9998