UNIVERSITY OF SWAZILAND

FACULTY OF COMMERCE

DEPARTMENT OF BUSINESS ADMINISTRATION

SUPPLEMENTARY EXAMINATION PAPER

JULY, 2011

(FULL TIME / IDE STUDENTS).

TITLE OF PAPER	:	OPERATIONS MANAGEMENT
COURSE CODE	:	BA 513
TIME ALLOWED	:	THREE (3) HOURS
TOTAL MARKS	:	100 MARKS
INSTRUCTIONS	:	(1) TOTAL NUMBER OF QUESTIONS IN THIS PAPER IS FIVE (5)

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

(3) ANSWER THE QUESTION IN SECTION A WHICH IS COMPULSORY AND ANY THREE (3) 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 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)

Q1. XYZ are becoming worried about the number of employees who are leaving the organisation. Employee statistics are as follows:

	2009	2010
Number of employees at the start of the year	300	340
Number of employees employed throughout the year	290	300

Other data are:

(i). Leavers and the month in which they left:

	Jan	Feb	Mar	Apr	May	June	July	Aug	Sept	Oct	Nov	Dec
Yr 2009	02	03	02	04	05	03	03	05	06	06	01	00
Yr 2010	01	02	01	02	02	11	10	08	03	05	02	03

(ii). Recruits and the months they joined the organisation:

	Jan	Feb	Mar	Apr	May	June	July	Aug	Sept	Oct	Nov	Dec
Yr 2009	05	06	08	06	05	09	11	05	06	09	05	05
Yr 2010	01	02	03	01	04	05	11	14	14	11	03	01

Required: Use four (4) different techniques to calculate labour stability.   (25marks).

SECTION B (ANSWER ANY THREE QUESTIONS).

Q2 (a). The manager of the repair shop, after consulting with the managers of the departments chat use the shop's services, has revised the list of tools chat are given the highest priorities. This is reflected by revised arrival rates. Suppose that the revised rates are: $\lambda_1 = 1.5$, $\lambda_2 = 2.5$, and λ_3 remains unchanged at 1.0.
Determine the following information:

(i). The system utilization.   (2½marks).
(ii). The average waiting time for units in each priority class.   (2½marks).

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(b).The "Dine 'Corporation is both a producer and a user of brass couplings. The firm operates 220 days a year and uses the couplings at a steady rate of 50 per day. Couplings can be produced at a rate of 200 per day. Annual storage cost is E1 per coupling, and machine setup cost is E35 per run.

   (i). Determine the economic run size. (2½marks).
   (ii). Approximately how many runs per year will there be? (2½marks).
(iii).Compute the maximum inventory level. (2½marks).
(iv). Determine the length of the pure consumption portion of the circle. (2½marks).

(c). One line of radial tires produced by a large company has a wear-out life that can be modeled using a normal distribution with a mean of 25,000 km and a standard deviation of 2000km. Determine each of the following:

(i).The percentage of tires that can be expected to wear out within ±2000km of the average (i.e. between 23,000 km and 27,000km). (5marks).

(ii).The percentage of tires that can be expected to fail between 26,000km and 29,000km. (5marks).

Q3 (a). Twenty samples of $n = 200$ were taken by an operator at a workshop in a production process. The numbers of defective items in each sample were recorded as follows:

Sample	No. of defective	p	Sample	No. of defective	p
1	12	0.060	11	16	0.080
2	18	0.090	12	14	0.070
3	10	0.050	13	12	0.060
4	14	0.070	14	16	0.080
5	16	0.080	15	18	0.090
6	19	0.095	16	20	0.100
7	17	0.085	17	18	0.090
8	12	0.060	18	20	0.100
9	11	0.055	19	21	0.105
10	14	0.070	20	22	0.110

Management wants to develop a *p – chart* using 3-sigma limits. Set up the *p - chart* and plot the observations to determine if the process was out of control at any point.
(10marks).

(b). In the preceding problem, even though the control chart indicates that the process is in control or not, management wants to use *pattern tests* to further determine if the process is in control. Develop the *pattern test* for the management. (15marks).

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Q4. The ABC Office Supplies Company Ltd is a well established firm of paper merchants and stationers, which is open for 50 weeks each year and specialises in the retailing of general office supplies. Its many customers include financial institutions, legal establishments and insurance companies. However, steadily increasing operating costs have diminished their financial reserves which have prompted the chief accountant to recommend a reduction in overall stock levels. Whereas in previous times it was common for the company to hold over 12 months' stock for many stock items in order to guarantee availability, pressures on liquidity seemed to demand a reduction in inventory levels.

The company's main selling item was a high quality typing paper which tended to have erratic demand but can be assumed to have a normal distribution with a mean of 800 boxes each week and a standard deviation of 250 boxes per week. This paper is supplied by the Tiara Paper Company at a cost of E2.50 per box. It was found that the lead time of supply of this paper recently had been very consistent at 3 weeks. The annual cost of stockholding was estimated at 15% of the stock item value and is based on the cost of storage and the company's cost of capital. In order to estimate the cost of a delivery of paper from Tiara, it is assumed that the cost of making and receiving the order together with the associated accounting and stock control tasks requires a total effort of approximately 12 man hours, where the average wage rate is E160 per week for a 40-hour week.
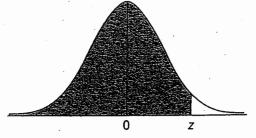
Required:
(i)   Calculate the economic order quantity for this stock item, together with the average length of time between replenishment.   (7marks)

(ii) Determine the recommended re-order level if there is to be no more than a 1% chance that a stock out will occur in any one replenishment period.   (9marks)

(iii) Determine the total stockholding cost (storage and delivery costs) per annum using the calculated values of the economic order quantity and re-order level.   (9marks)

[Hint: from the Standard Normal table, $Z = 2.33$]

Q5 (a). Respond to this statement: *"The importance of the location decision is often vastly overrated; the fact that virtually every type of business is located in every section of the country means there should be no problem in finding a suitable location."*   (15marks).

(b). What is factor rating, and how does it work? *Give explicit example.*   (10marks).

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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

TABLE 18S.1
Random numbers

	1	2	3	4	5	6	7	8	9	10	11	12
1	18	20	84	29	91	73	64	33	15	67	54	07
2	25	19	05	64	26	41	20	09	88	40	73	34
3	73	57	80	35	04	52	81	48	57	61	29	35
4	12	48	37	09	17	63	94	08	28	78	51	23
5	54	92	27	61	58	39	25	16	10	46	87	17
6	96	40	65	75	16	49	03	82	38	33	51	20
7	23	55	93	83	02	19	67	89	80	44	99	72
8	31	96	81	65	60	93	75	64	26	90	18	59
9	45	49	70	10	13	79	32	17	98	63	30	05
10	01	78	32	17	24	54	52	44	28	50	27	68
11	41	62	57	31	90	18	24	15	43	85	31	97
12	22	07	38	72	69	66	14	85	36	71	41	58

TABLE 18S.2
Normally distributed random numbers

	1	2	3	4	5	6	7	8	9	10
1	1.46	−0.09	−0.59	0.19	−0.52	−1.82	0.53	−1.12	1.36	−0.44
2	−1.05	0.56	−0.67	−0.16	1.39	−1.21	0.45	−0.62	−0.95	0.27
3	0.15	−0.02	0.41	−0.09	−0.61	−0.18	−0.63	−1.20	0.27	−0.50
4	0.81	1.87	0.51	0.33	−0.32	1.19	2.18	−2.17	1.10	0.70
5	0.74	−0.44	1.53	−1.76	0.01	0.47	0.07	0.22	−0.59	−1.03
6	−0.39	0.35	−0.37	−0.52	−1.14	0.27	−1.78	0.43	1.15	−0.31
7	0.45	0.23	0.26	−0.31	−0.19	−0.03	−0.92	0.38	−0.04	0.16
8	2.40	0.38	−0.15	−1.04	−0.76	1.12	−0.37	−0.71	−1.11	0.25
9	0.59	−0.70	−0.04	0.12	1.60	0.34	−0.05	−0.26	0.41	0.80
10	−0.06	0.83	−1.60	−0.28	0.28	−0.15	0.73	−0.13	−0.75	−1.49

$$\text{Simulated value} = \text{Mean} + \text{Random number} \times \text{Standard deviation} \qquad (18S-1)$$

In effect, the random number equates to a normal z value, which indicates how far a particular value is above or below the distribution mean.

TABLE 7S.1
Learning curve coefficients

Unit Number	70%		75%		80%		85%		90%	
	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	.501	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