UNIVERSITY OF SWAZILAND

FACULTY OF COMMERCE

DEPARTMENT OF BUSINESS ADMINISTRATION

SUPPLEMENTARY EXAMINATION PAPER

JULY 2007

(FULL TIME / IDE STUDENTS).

TITLE PAPER : **PRODUCTION/OPERATIONS MANAGEMENT**

COURSE TITLE : **BA 513**

TIME ALLOWED : **THREE (3) HOURS**

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 QUESTIONS IN SECTION A AND ANY TWO (2) QUESTIONS IN SECTION B.**

(4) **THE MARKS AWARDED 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.

GOOD LUCK!!!

SECTION A (ANSWER ALL QUESTIONS)

QUESTION 1.

Mandla, an inventory manager, wants to develop a short-range forecasting system to estimate the amount of inventory flowing out of his warehouse each week. He thinks that the demand for inventory has been gradually steady with some slight week-to-week random fluctuations. A forecasting expert from the Company headquarters suggested that he use a 3-, 5-, or 7- week moving average. Before selecting one of these, Mandla decides to compare the accuracy of each using the actual data for the most recent 10- week period. The data are shows below:

Week	***Actual Inventory Demand (E'000)***
1	100
2	125
3	90
4	110
5	105
6	130
7	85
8	102
9	110
10	90
11	105
12	95
13	115
14	120
15	80
16	95
17	100

Required:

(a) (i) Compute the 3-, 5- and 7- week moving average forecast. (10marks)

(ii) Compute the Mean Absolute Deviation (MAD) for the three forecasts. (l0marks)

(iii) On the basis of your answer in (ii), what is the cash demand for inventory for the next week. (5marks)

(b). Forecasting is an essential part of planning in that it is about estimating the future demand for products and services and the resources necessary to produce these outputs. Give some reasons for ineffective forecasting that may hinder management to achieve the best results from any forecasting method used. (5marks).

QUESTION 2

Swazi Airline is planning to open satellite ticket desk in a new shopping plaza, staffed by one ticket agent. It is estimated that requests for tickets and information will average 15 per hour; and request will have a Poisson distribution. Service time is assumed to be exponentially distributed. Previous experience suggests that mean service average 3 minutes per request.

Required:

(i) Calculate the System utilization. (4marks)

(ii) Percentage of time the server will be idle (2marks)

(iii) The expected number of customers waiting to be served (4marks)

(iv) The average time customers will spend in the system (4marks)

(v) The probability-of zero customer in the system and the probability of 4 customers in the system. (6marks)

SECTION B (ANSWER ANY TWO QUESTIONS)

QUESTION 3.

XYZ Company has two factories at Manzini and Mbabane; and three warehouses at Sitegi, Big Bend, and Simunye. A new factory at Sicunusa is proposed to increase factory capacity and satisfy the market demand. The XYZ management wants to determine the monthly shipping costs if a new factory is located at Sicunusa.
The monthly capacities of the old and new factories, the monthly warehouse requirements and the transportation costs per unit from each factory to each warehouse are:

Factory	*Monthly Capacity (Units)*	*Warehouse*	*Monthly W/H Rqts (Units)*	*Transportation Costs*			
				Warehouse			
				Factory	*Sitegi*	*B/Bend*	*Simunye*
Manzini	400	Sitegi	300	Manzini	E31	E21	E42
Mbabane	1000	Big Bend	900	Mbabane	E20	E21	E30
Sicunusa	600	Simunye	800	Sicunusa	E23	E20	E15

Required:

(a). Use the MODI transportation method to determine the total monthly transportation costs if the new factory is located at Sicunusa. (20marks).

(b). How many units per month should be shipped from each factory to each warehouse after the new factory is built? (5marks).

QUESTION 4.

University of Swaziland is embarking on a certain project comprising 10 activities which have the following durations and precedence:

Activity	*Durations (days)*	*Immediate Preceding Activities*
A	6	-
B	1	A
C	2	A
D	1	B
E	1	D
F		B
G	1	C
H		F, G
I	4	E, H
J	5	I

Activities ***F*** and ***H*** have uncertain durations which at this stage are difficult to estimate.

Required:

(a) Draw a suitable network to represent the inter-relationship between the 10 activities. (7marks).

(b) What is the minimum time that the project could take, ignoring the effects of activities F and H? (4marks).

(c) If the project must be completed in 19 days, what restrictions does this place on the durations of activities F and H?. (6marks).

(d) After further investigation, it is estimated that the expected times for activities F and H are 2 days and 1 day respectively. Furthermore, it may be assumed that the uncertainty in these two activity durations may be represented by a Poisson distribution. On the basis of this, what is the probability that the project will be completed in no more than 19 days? (8marks).

A selection of Poisson probabilities is given in the following table:

	Probability of				
Mean (μ)	**0**	**1**	**2**	**3**	**4 or more**
1	0.368	0.368	0.184	0.061	0.019
2	0.135	0.271	0.271	0.180	0.143

QUESTION 5.

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, 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 El 60 per week for a 40 hours 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]

QUESTION 6.

Rolls of coiled wire are monitored using a C-chart. 18 rolls have been examined, and the number of defects per roll has been recorded in the following table:

Sample	*No. of Defects*	*Sample*	*No. of Defects*
1	3	10	1
2	2	11	3
3	4	12	4
4	5	13	2
5	1	14	4
6	2	15	2
7	4	16	1
8	1	17	3
9	2	18	1

Required:

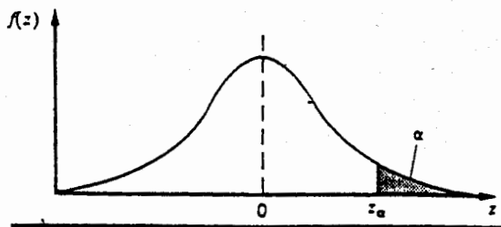
(a). Plot the values on a control chart using three (3) standard deviation control limits. (13marks).

(b) Using the appropriate control chart, determine two-sigma control limits for each case.

(i) An inspector found an average of 3.9 scratches in the exterior paint of each of the automobiles being prepared for shipment to dealers. (6marks).

(ii) Before shipping lawnmowers to dealers, an inspector attempts to start each mower and notes any that do not start on the first try. The lot size is 100 mowers, and an average of 4 did not start. (6marks).

Normal distribution (areas)



Area (α) in the tail of the standardised Normal curve, $N(0, 1)$, for different values of z. Example: Area beyond $z = 1.96$ (or below $z = -1.96$) is $\alpha = 0.02500$. For Normal curve with $\mu = 10$ and $\sigma = 2$, area beyond $x = 12$, say, is the same as area beyond $z = \dfrac{x - \mu}{\sigma} = \dfrac{12 - 10}{2} = 1$, i.e. $\alpha = 0.15866$.

$z \rightarrow$ $\downarrow$	0.00	0.01	0.02	0.03	0.04	0.05	0.06	0.07	0.08	0.09
0.0	.50000	.49601	.49202	.48803	.48405	.48006	.47608	.47210	.46812	.46414
0.1	.46017	.45620	.45224	.44828	.44433	.44038	.43644	.43251	.42858	.42465
0.2	.42074	.41683	.41294	.40905	.40517	.40129	.39743	.39358	.38974	.38591
0.3	.38209	.37828	.37448	.37070	.36693	.36317	.35942	.35569	.35197	.34827
0.4	.34458	.34090	.33724	.33360	.32997	.32636	.32276	.31918	.31561	.31207
0.5	.30854	.30503	.30153	.29806	.29460	.29116	.28774	.28434	.28096	.27760
0.6	.27475	.27093	.26763	.26435	.26109	.25785	.25463	.25143	.24825	.24510
0.7	.24196	.23885	.23576	.23270	.22965	.22663	.22363	.22065	.21770	.21476
0.8	.21186	.20897	.20611	.20327	.20045	.19766	.19489	.19215	.18943	.18673
0.9	.18406	.18141	.17879	.17619	.17361	.17106	.16853	.16602	.16354	.16109
1.0	.15866	.15625	.15386	.15150	.14917	.14686	.14457	.14231	.14007	.13786
1.1	.13567	.13350	.13136	.12924	.12714	.12507	.12302	.12100	.11900	.11702
1.2	.11507	.11314	.11123	.10935	.10749	.10565	.10383	.10204	.10027	.09853
1.3	.09680	.09510	.09342	.09176	.09012	.08851	.08692	.08534	.08379	.08226
1.4	.08076	.07927	.07780	.07636	.07493	.07353	.07214	.07078	.06944	.06811
1.5	.06681	.06552	.06426	.06301	.06178	.06057	.05938	.05821	.05705	.05592
1.6	.05480	.05370	.05262	.05155	.05050	.04947	.04846	.04746	.04648	.04551
1.7	.04457	.04363	.04272	.04182	.04093	.04006	.03920	.03836	.03754	.03673
1.8	.03593	.03515	.03438	.03362	.03288	.03216	.03144	.03074	.03005	.02938
1.9	.02872	.02807	.02743	.02680	.02619	.02559	.02500	.02442	.02385	.02330
2.0	.02275	.02222	.02169	.02118	.02068	.02018	.01970	.01923	.01876	.01831
2.1	.01786	.01743	.01700	.01659	.01618	.01578	.01539	.01500	.01463	.01426
2.2	.01390	.01355	.01321	.01287	.01254	.01222	.01191	.01160	.01130	.01101
2.3	.01072	.01044	.01017	.00990	.00964	.00939	.00914	.00889	.00866	.00842
2.4	.00820	.00798	.00776	.00755	.00734	.00714	.00695	.00676	.00657	.00639
2.5	.00621	.00604	.00587	.00570	.00554	.00539	.00523	.00509	.00494	.00480
2.6	.00466	.00453	.00440	.00427	.00415	.00403	.00391	.00379	.00368	.00357
2.7	.00347	.00336	.00326	.00317	.00307	.00298	.00289	.00280	.00272	.00263
2.8	.00256	.00248	.00240	.00233	.00226	.00219	.00212	.00205	.00199	.00193
2.9	.00187	.00181	.00175	.00169	.00164	.00159	.00154	.00149	.00144	.00139
3.0	.00135	.00131	.00126	.00122	.00118	.00114	.00111	.00107	.00104	.00100
3.1	.00097	.00094	.00090	.00087	.00085	.00082	.00079	.00076	.00074	.00071
3.2	.00069	.00066	.00064	.00062	.00060	.00058	.00056	.00054	.00052	.00050
3.3	.00048	.00047	.00045	.00043	.00042	.00040	.00039	.00038	.00036	.00035
3.4	.00034	.00032	.00031	.00030	.00029	.00028	.00027	.00026	.00025	.00024
3.5	.00023	.00022	.00022	.00021	.00020	.00019	.00019	.00018	.00017	.00017
3.6	.00016	.00015	.00015	.00014	.00014	.00013	.00013	.00012	.00012	.00011
3.7	.00011	.00010	.00010	.00010	.00009	.00009	.00009	.00008	.00008	.00008
3.8	.00007	.00007	.00007	.00006	.00006	.00006	.00006	.00005	.00005	.00005
3.9	.00005	.00005	.00004	.00004	.00004	.00004	.00004	.00004	.00004	.00003
4.0	.00003	.00003	.00003	.00003	.00003	.00002	.00002	.00002	.00002	.00002

α	0.4	0.25	0.2	0.15	0.1	0.05	0.025	0.01	0.005	0.001
z_α	.2533	.6745	.8416	1.0364	1.2816	1.6449	1.9600	2.3265	2.5758	3.0902

TABLE 19-4

Infinite-source values for L_q and P_0 given λ/μ and M

λ/μ	M	L_q	P_0	λ/μ	M	L_q	P_0	λ/μ	M	L_q	P_0
0.15	1	0.026	.850	1.3	3	0.130	.264	2.7	3	7.354	.025
	2	0.001	.860		4	0.023	.271		4	0.811	.057
0.20	1	0.050	.800		5	0.004	.272		5	0.198	.065
	2	0.002	.818	1.4	2	1.345	.176		6	0.053	.067
0.25	1	0.083	.750		3	0.177	.236		7	0.014	.067
	2	0.004	.778		4	0.032	.245	2.8	3	12.273	.016
0.30	1	0.129	.700		5	0.006	.246		4	1.000	.050
	2	0.007	.739	1.5	2	1.929	.143		5	0.241	.058
0.35	1	0.188	.650		3	0.237	.211		6	0.066	.060
	2	0.011	.702		4	0.045	.221		7	0.018	.061
0.40	1	0.267	.600		5	0.009	.223	2.9	3	27.193	.008
	2	0.017	.667	1.6	2	2.844	.111		4	1.234	.044
0.45	1	0.368	.550		3	0.313	.187		5	0.293	.052
	2	0.024	.633		4	0.060	.199		6	0.081	.054
	3	0.002	.637		5	0.012	.201		7	0.023	.055
0.50	1	0.500	.500	1.7	2	4.426	.081	3.0	4	1.528	.038
	2	0.033	.600		3	0.409	.166		5	0.354	.047
	3	0.003	.606		4	0.080	.180		6	0.099	.049
0.55	1	0.672	.450		5	0.017	.182		7	0.028	.050
	2	0.045	.569	1.8	2	7.674	.053		8	0.008	.050
	3	0.004	.576		3	0.532	.146	3.1	4	1.902	.032
0.60	1	0.900	.400		4	0.105	.162		5	0.427	.042
	2	0.059	.538		5	0.023	.165		6	0.120	.044
	3	0.006	.548	1.9	2	17.587	.026		7	0.035	.045
0.65	1	1.207	.350		3	0.688	.128		8	0.010	.045
	2	0.077	.509		4	0.136	.145	3.2	4	2.386	.027
	3	0.008	.521		5	0.030	.149		5	0.513	.037
0.70	1	1.633	.300		6	0.007	.149		6	0.145	.040
	2	0.098	.481	2.0	3	0.889	.111		7	0.043	.040
	3	0.011	.495		4	0.174	.130		8	0.012	.041
0.75	1	2.250	.250		5	0.040	.134	3.3	4	3.027	.023
	2	0.123	.455		6	0.009	.135		5	0.615	.033
	3	0.015	.471	2.1	3	1.149	.096		6	0.174	.036
0.80	1	3.200	.200		4	0.220	.117		7	0.052	.037
	2	0.152	.429		5	0.052	.121		8	0.015	.037
	3	0.019	.447		6	0.012	.122	3.4	4	3.906	.019
0.85	1	4.817	.150	2.2	3	1.491	.081		5	0.737	.029
	2	0.187	.404		4	0.277	.105		6	0.209	.032
	3	0.024	.425		5	0.066	.109		7	0.063	.033
	4	0.003	.427		6	0.016	.111		8	0.019	.033
0.90	1	8.100	.100	2.3	3	1.951	.068	3.5	4	5.165	.015
	2	0.229	.379		4	0.346	.093		5	0.882	.026
	3	0.030	.403		5	0.084	.099		6	0.248	.029
	4	0.004	.406		6	0.021	.100		7	0.076	.030
0.95	1	18.050	.050	2.4	3	2.589	.056		8	0.023	.030
	2	0.277	.356		4	0.431	.083		9	0.007	.030
	3	0.037	.383		5	0.105	.089	3.6	4	7.090	.011
	4	0.005	.386		6	0.027	.090		5	1.055	.023
1.0	2	0.333	.333		7	0.007	.091		6	0.295	.026
	3	0.045	.364	2.5	3	3.511	.045		7	0.019	.027
	4	0.007	.367		4	0.533	.074		8	0.028	.027
1.1	2	0.477	.290		5	0.130	.080		9	0.008	.027
	3	0.066	.327		6	0.034	.082	3.7	4	10.347	.008
	4	0.011	.367		7	0.009	.082		5	1.265	.020
1.2	2	0.675	.250	2.6	3	4.933	.035		6	0.349	.023
	3	0.094	.294		4	0.658	.065		7	0.109	.024
	4	0.016	.300		5	0.161	.072		8	0.034	.025
	5	0.003	.301		6	0.043	.074		9	0.010	.025
1.3	2	0.951	.212		7	0.011	.074	3.8	4	16.937	.005

λ/μ	M	L_q	P_0	λ/μ	M	L_q	P_0	λ/μ	M	L_q	P_0
3.8	5	1.519	.017	4.6	5	9.289	.004	5.3	8	0.422	.005
	6	0.412	.021		6	1.487	.008		9	0.155	.005
	7	0.129	.022		7	0.453	.009		10	0.057	.005
	8	0.041	.022		8	0.156	.010		11	0.021	.005
	9	0.013	.022		9	0.054	.010		12	0.007	.005
3.9	4	36.859	.002		10	0.018	.010	5.4	6	6.661	.002
	5	1.830	.015	4.7	5	13.382	.003		7	1.444	.004
	6	0.485	.019		6	1.752	.007		8	0.483	.004
	7	0.153	.020		7	0.525	.008		9	0.178	.004
	8	0.050	.020		8	0.181	.008		10	0.066	.004
	9	0.016	.020		9	0.064	.009		11	0.024	.005
4.0	5	2.216	.013		10	0.022	.009		12	0.009	.005
	6	0.570	.017	4.8	5	21.641	.002	5.5	6	8.590	.002
	7	0.180	.018		6	2.071	.006		7	1.674	.003
	8	0.059	.018		7	0.607	.008		8	0.553	.004
	9	0.019	.018		8	0.209	.008		9	0.204	.004
4.1	5	2.703	.011		9	0.074	.008		10	0.077	.004
	6	0.668	.015		10	0.026	.008		11	0.028	.004
	7	0.212	.016	4.9	5	46.566	.001		12	0.010	.004
	8	0.070	.016		6	2.459	.005	5.6	6	11.519	.001
	9	0.023	.017		7	0.702	.007		7	1.944	.003
4.2	5	3.327	.009		8	0.242	.007		8	0.631	.003
	6	0.784	.013		9	0.087	.007		9	0.233	.004
	7	0.248	.014		10	0.031	.007		10	0.088	.004
	8	0.083	.015		11	0.011	.007		11	0.033	.004
	9	0.027	.015	5.0	6	2.938	.005		12	0.012	.004
	10	0.009	.015		7	0.810	.006	5.7	6	16.446	.001
4.3	5	4.149	.008		8	0.279	.006		7	2.264	.002
	6	0.919	.012		9	0.101	.007		8	0.721	.003
	7	0.289	.130		10	0.036	.007		9	0.266	.003
	8	0.097	.013		11	0.013	.007		10	0.102	.003
	9	0.033	014	5.1	6	3.536	.004		11	0.038	.003
	10	0.011	.014		7	0.936	.005		12	0.014	.003
4.4	5	5.268	.006		8	0.321	.006	5.8	6	26.373	.001
	6	1.078	.010		9	0.117	.006		7	2.648	.002
	7	0.337	.012		10	0.042	.006		8	0.823	.003
	8	0.114	.012		11	0.015	.006		9	0.303	.003
	9	0.039	.012	5.2	6	4.301	.003		10	0.116	.003
	10	0.013	.012		7	1.081	.005		11	0.044	.003
4.5	5	6.862	.005		8	0.368	.005		12	0.017	.003
	6	1.265	.009		9	0.135	.005	5.9	6	56.300	.000
	7	0.391	.010		10	0.049	.005		7	3.113	.002
	8	0.133	.011		11	0.017	.006		8	0.939	.002
	9	0.046	.011	5.3	6	5.303	.003		9	0.345	.003
	10	0.015	.011		7	1.249	.004		10	0.133	.003