

UNIVERSITY OF SWAZILAND

FACULTY OF COMMERCE

DEPARTMENT OF BUSINESS ADMINISTRATION

MAIN EXAMINATION PAPER

MAY, 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 SIX (6)**
 - (2) THE PAPER CONSISTS OF SECTION A AND SECTION B.**
 - (3) ANSWER ALL 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 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. Among many products, a firm manufactures three different electronic components (A, B, and C) on any of the three different machines (1, 2, and 3). The quarterly forecasted demand for the three components is given in below:

<i>Quarterly Forecasted Demand by Product Type</i>				
Component	Winter	Spring	Summer	Fall
A	8,000	20,000	12,000	6,400
B	4,000	12,000	8,000	5,600
C	9,600	19,200	14,400	7,200

The unit production time for each product on each machine is as follows:

<i>Unit Production Time in hours</i>			
Machine	A	B	C
1	0.25	0.50	0.40
2	0.10	0.30	0.15
3	0.45	0.20	0.35

- (a). Determine the maximum number of machine hours demanded for each quarter machine combination. (10marks).
- (b). The Operation Manager has determined that the amount of productive time available for each machine per quarter is 600 hours. Determine the maximum number of each machine type needed to be dedicated to produce all components in each quarter. (10marks).
- (c). Does there appear to be seasonal variation in demand? Explain (5marks).

Q2. Customers arrive at a catalog department of a large store. The time between arrivals varies uniformly between 10 and 20 minutes. Service time is normal with a mean of 15 minutes and a standard deviation of 2 minutes.

- (a). Simulate processing and waiting times for nine customers. Read three-digit numbers going down columns 9 and 10 of Table 18S.1 for arrivals (e.g., 156, 884). Use the column 8, Table 18S.2, for processing time. (13marks).
- (b). If management can reduce the range of arrival times to between 13 and 17 minutes, what would the impact be on customers waiting times? (Use the same service times and the same random numbers for arrival times from part 'a'). Round arrival times to two decimal places. (12marks).

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SECTION B (ANSWER ANY TWO QUESTIONS) - 50 MARKS

Q3. The time needed for checking in at a hotel is to be investigated. Historically, the process has had a variance of 0.0213. The means of 39 samples of $n=14$ are:

<i>Sample</i>	<i>Mean</i>	<i>Sample</i>	<i>Mean</i>	<i>Sample</i>	<i>Mean</i>
1	3.86	14	3.81	27	3.81
2	3.90	15	3.83	28	3.86
3	3.83	16	3.86	29	3.98
4	3.81	17	3.82	30	3.96
5	3.84	18	3.86	31	3.88
6	3.83	19	3.84	32	3.76
7	3.87	20	3.87	33	3.83
8	3.88	21	3.84	34	3.77
9	3.84	22	3.82	35	3.86
10	3.80	23	3.89	36	3.80
11	3.88	24	3.86	37	3.84
12	3.86	25	3.88	38	3.79
13	3.88	26	3.90	39	3.85

(a). Construct an appropriate chart for this process with three-sigma limits. Is the process in control? (10marks).

(b). Analyze the data using a median run test and up/down run test. What can you conclude? (15marks).

Q4. (a). How many observations should a time study analyst plan for in an operation that has a variance of 2.25 minutes per piece if the goal is to estimate the mean time per piece to within 0.4 minute with a confidence of 95.5percent? (5marks).

(b). The 5th unit of a 25-unit job took 14.5 hours to complete. If a 90 percent learning curve is appropriate; how long should it take to complete the last unit? (6marks).

(c). The labour cost to produce a certain item is E8.50 per hour. Job setup costs E50 and materials costs are E20 per unit. The item can be purchased for E88.50 per unit. The learning rate is 90 percent. Overhead is charged at a rate of 50 percent of labour, materials, and setup costs.

(i). Determine the unit cost for 20units, given that the first unit took 5 hours to complete. (8marks).

(ii). What is the minimum production quantity necessary to make production cost less than purchase cost? (6marks).

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Q5 (a). Determine the optimum preventive maintenance frequency for each of the pieces of equipment if breakdown time is normally distributed:

<u>Equipment</u>	<u>Average Time (days) between Breakdowns</u>	<u>Standard Deviation</u>
A201	20	2
B400	30	3
C850	40	4

<u>Equipment</u>	<u>Preventive Maintenance Cost (£)</u>	<u>Breakdown Cost (£)</u>	
A201	300	2,300	
B400	200	3,500	
C850	530	4,800.	(15marks).

(b). Enumerate three key different ways that technology has improved the ability to manage supply chains. (10marks).

Q6. Use the dimensions of quality to describe typical characteristics of these products and services:

- (a). A television set. (8marks).
- (b). A restaurant meal (product). (8marks).
- (c). A restaurant meal (service). (9marks).
- (d). Painting a house. (8marks).

Simulation

	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.1
Random numbers

Simulation

	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

TABLE 18S.2
Normally distributed random numbers

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

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% _a		75% _a		80% _a		85% _a		90% _a	
	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

