UNIVERSITY OF SWAZILAND

FACULTY OF COMMERCE

DEPARTMENT OF BUSINESS ADMINISTRATION

FINAL EXAMINATION PAPER

MAY 2006

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 ANY TWO QUESTIONS FROM EACH SECTION.
		(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 CLERLY 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 ANY TWO QUESTIONS)

QUESTION 1.

Hi-tech, a large electronics manufacturer assembles model BT99 hand-held calculators at Sandton, South Africa. The assembly tasks that must be performed on each calculator are shown below. The parts used in this assembly line are supplied by materials-handling personnel to parts bins used in each task. The assemblies are moved along by belt conveyors between work stations. If 540 calculators must be produced by this assembly line per hour; then,

(a). Compute the cycle time per calculator in minutes. (3marks).

(b). Compute the minimum number of work stations. (3marks).

(c). How would you combine the tasks into work stations to minimize idle time? Evaluate your proposal. (19marks).

Task	*Preceding Task*	*Task time (Minutes)*	*Task*	*Preceding Task*	*Task time (Minutes).*
A	-	0.18	I	H	0.30
B	A	0.12	J	I	0.18
C	A	0.32	K	J	0.36
D	A	0.45	L	J	0.42
E	B,C,D	0.51	M	K, L	0.48
F	E	0.55	N	M	0.30
G	F	0.38	O	N	0.39
H	G	0.42			

Assuming that the break time is 360 seconds.

QUESTION 2.

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

	2001	**2002**
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 2001:	02	03	02	04	05	03	03	05	06	06	01	00
Yr 2002:	01	02	01	02	02	11	10	08	03	05	02	03

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

	Jan	**Feb**	**Mar**	**Apr**	**May**	**June**	**July**	**Aug**	**Sept**	**Oct**	**Nov**	**Dec**
Yr 2001:	05	06	08	06	05	09	11	05	06	09	05	05
Yr 2002:	01	02	03	01	04	05	11	14	14	11	03	01

Required: Use four different techniques to calculate the labour stability for this company. (25marks).

QUESTION 3.

(a). A company produces various types of fans. In May, the company produced 1,728 window fans at a standard price of E40. The company has 12 direct labour employees whose compensation (including wages and fringe benefits) amounts to E21 per hour. During May, window fans were produced on 9 working days (of 8 hours each), and other products were produced on other days.
Determine the labour productivity of the window fans. (4marks).

(b). The company also produces desk fans at a standard price of E25. During May, 1,872 desk fans were produced on 11 working days (of 8 hours each). On one day, two employees called in sick.
Determine the labour productivity of the desk fans. Was productivity higher for the window fans or for the desk fans in May? (4marks).

(c). As additional information to the above, assuming there were 20 working days in May. And that the direct material cost of window fans is E7; the direct material cost of desk fans is E5. And the annual overhead expense incurred in operating the factory is E144,000.
Determine the multi-factor productivity of the company in May. What is the interpretation of your calculated multi-factor productivity? (7marks).

(d). From your knowledge in Operations Management, *of what relevance* are ***models*** to *operations manager and why?* (10marks).

SECTION B (ANSWER ANY TWO QUESTIONS)

QUESTION 4.

(a). A process for manufacturing shock absorbers for light trucks produces 5% defectives. Inspection cost per shock absorber is E0.40, and 100% inspection generally catches all defects, due to the nature of the inspection and the small volume produced. Any defects installed on trucks must eventually be replaced at a cost of E12 per shock absorber. Is 100% inspection justified and why? (5marks).

(b). Shipments of 300 boxes of glassware are received at a warehouse of a large department store. Random samples of five are checked, and the lot is rejected if more than one box reveals breakage. Generate cumulative binomial probabilities and construct the OC curve for this plan. (20marks).

QUESTION 5.

(a). A toy manufacturer uses 48,000 rubber wheels per year for its popular dump truck series. The firm makes its own wheels, which it can produce at a rate of 800 per day. The toy trucks are assembled uniformly over the entire year. Carrying cost is E1 per wheel a year. Set-up cost for a production run of wheels is E45. The firm operates 240 days per year. Determine the:

(i). Optimum run size (4marks).

(ii). Minimum total annual cost for carrying and set-up. (6marks).

(iii). Cycle time for the optimal run size. (3marks).

(iv). Run time. (3marks).

(b). Suppose a manager of a construction supply house determined from historical records that demand for sand during lead time averages 50 tons. In addition, suppose the manager determined that demand during lead time could be described by a normal distribution that has a mean of 50 tons and a standard deviation of 5 tons. Calculate the followings, assuming that the manager is willing to accept a stock-out risk of no more than 3%:

(i). What value of z is appropriate? (3marks).

(ii). How much safety stock should be held? (3marks).

(iii). What reorder point should be used? (3marks).

QUESTION 6.

(a). Planners for a company that makes several models of skateboards are about to prepare the aggregate plan that will cover six periods. They have obtained the following information:

Period	***1***	***2***	***3***	***4***	***5***	***6***	***Total***
Forecast	***200***	***200***	***300***	***400***	***500***	***200***	***1800***

Costs:

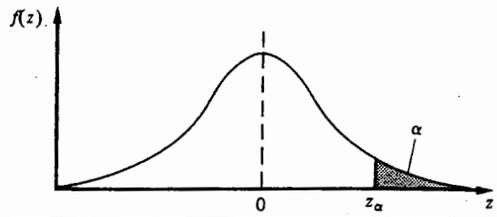
Regular time = E2 per skateboard
Overtime = E3 per skateboard
Subcontract = E6 per skateboard
Inventory = E1 per skateboard per period on average inventory
Back orders = E5 per skateboard per period.

Overtime and subcontracting are not used because they want steady output.

Prepare an aggregate plan and determine its cost using the preceding information. Assume a level output rate of 300 units (skateboard) per period with regular time (i.e. 1800/6 = 300). The planned ending inventory is zero and there are 15 workers, and each can produce 20 skateboards per period. (15marks).

(b). After reviewing the plan in *"part a"*, the planners decided to develop an alternative plan. They learnt that one person is about to retire from the company. Rather than replace the person, they would like to stay with the smaller workforce and use overtime to make up for the lost output. The reduced regular time output is 280 units per period. The maximum amount of overtime output per period is 40 units. Develop this alternative plan. (10marks).

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 $z = \frac{x - \mu}{\sigma} = \frac{12 - 10}{2} = 1$, i.e. $\alpha = 0.15866$.

z→ ↓	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	.27425	.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	2.3263	2.5758	3.0902