THE OPEN UNIVERSITY OF SRI LANKA

POSTGRADUATE DIPLOMA / MASTER OF TECHNOLOGY IN APPAREL PRODUCTION AND MANAGEMENT

FINAL EXAMINATION - 2012/2013

TTX7151 OPERATIONS RESEARCH

OPEN BOOK TEST

DURATION -THREE HOURS

DATE: 03 August 2013 **TIME: 0930 - 1230 Hours**

Answer any five (05) questions. All questions carry twenty (20) marks each.

01. The following table represents a set of activity times for a PERT network

$i-j$	A	B	C	D	E	F	G	H	I	J	K	L
t_o	10	12	8	4	0	12	6	9	4	0	5	9
t_m	13	15	11	7	0	18	12	12	6	0	8	12
t_p	22	18	20	16	0	36	18	27	8	0	11	33

a. Determine the expected completion time of each activity

b. Determine the earliest expected completion time, the latest expected completion time and float on each activity

c. What is the total project completion time and what are the activities on the critical path?

d. Determine the Standard Deviation of expected completion time of only those activities which are on the critical path

e. Determine the probability that the project will be completed within 41 weeks.

02. An apparel manufacturing company manufactures four different product categories A, B, C and D. These products are processed through four departments in the factory: pre-production, cutting, garment assembly and finishing. The time requirements to process a batch (one dozen) of each product category in the various departments, in hours are as given below.

Product	Department			
	Pre-production	Cutting	Garment Assembly	Finishing
A	0.5	2.0	3.0	0.5
B	1.0	1.0	1.0	0.5
C	1.0	1.0	2.0	1.0
D	1.0	1.0	3.0	1.0

Capacities (man-hours) of the four different departments are as follows:

Department	Available man-hours
Pre-production	1,800
Cutting	2,800
Garment assembly	6,000
Finishing	3,000

Minimum sales requirements and the profit contribution of one dozen garments from each of the product categories A, B, C and D are as below.

Product	Minimum sales requirement, no. of dozens	Profit contribution per dozen of garment, in LKR
A	100	96.00
B	600	108.00
C	500	84.00
D	400	72.00

a. Determine the number of garments the company needs to produce from each product category A, B, C, and D to maximize profit

b. Determine the total maximum profit contribution by each of the garment categories A, B, C and D

c. Determine the slack time available in each department.

03. a. A particular item has a demand of 9,000 units per year. The cost of one procurement is LKR 100/= and the holding cost per unit is LKR 2.40 per year. The replacement is instantaneous and no shortages are allowed. Determine:

i. The economic lot size

ii. The number of orders per year

iii. The time between orders

iv. The total cost per year if the cost of one unit is LKR 1/=

b. A baker manufactures bread and sells at a profit of LKR 15/=. If a bread does not get sold on a particular day he would lose LKR 55/=. Daily demand of bread has the following distribution.

Number of bread sold	400	410	420	430	440	450	460	470
Probability	0.05	0.07	0.08	0.20	0.30	0.15	0.10	0.05

If each day's demand is independent of the previous day, how many loaves of bread should the baker manufacture each day?

04. a. A well known intimate fashion company knows that for the coming festive season its sales will not definitely be less than 25,000 garments. The plant capacity of the fashion company limits its production to 80,000 garments. According to the market survey, there are 2 chances in 5 for a sales volume of exactly 50,000 garments. The probability that it will be more than 50,000 garments is 4 times the probability that it will be less than 50,000 garments. If the sales exceed 50,000 garments, volumes of 60,000 garments and 80,000 garments are equally likely. A volume of 70,000 garments is four times likely as 60,000 garments.

It costs LKR 300/= to produce the intimate garment and the selling price is estimated at LKR 500/=. The initial investment is estimated at LKR 8,000,000/=.

Determine should the fashion company undertake this venture or not?

b. Two apparel retailers LankaApparels and LankaFashions have been involved in fashion business for number of years with similar products and in the same customer market. In one of the strategic meetings, the Marketing Manager of LankaApparels, wanted to know the decision of the management of the LankaApparels on the issue of advertising strategy based on the following data that has been made available by the market research team of the LankaApparels.

i. No advertising, medium advertising and large advertising by both LankaApparels and LankaFashions will result in equal market share for both companies

ii. If LankaApparels does not advertise, but LankaFashions does;

- medium advertising, LankaApparels will get 40% of market share
- large advertising, LankaApparels will get only 28% of market share

iii. If LankaApparels does medium advertising, and LankaFashions does;

- no advertising, then LankaApparels will get 70% of market share
- large advertising, then LankaApparels will get 45% of market share

iv. If LankaApparels does large advertising and LankaFashions does;

- no advertising, LankaApparels will get 70% of the market share
- medium advertising, LankaApparels can get a market share of 47.5%

Based on the above available information, with reference to advertising strategy, what should the Strategic Committee of LankaApparels recommend to its Marketing Manager?

05. a. A maker of golf shirts has been tracking the relationship between sales and advertising budget. Using linear regression find out what the sales might be if the company invested LKR 53,000/= in advertising in the year 2013. The sales and advertising budget statistics for the past four years are as given below:

Year	2009	2010	2011	2012
Sales Revenue in '000 LKR	130	151	150	158
Advertising cost in '000 LKR	32	52	50	55

b. A clothing retailer uses exponential smoothing with trend to forecast his sales of a particular product line. At the end of July the company wishes to forecast sales for August. The demand for the month of July was 62 pieces of garments. The trend through June has been 15 additional garments sold per month and the average sales have been 57 garments per month. If the clothing retailer uses alpha +0.2 and beta +0.10, what would be the sales forecast for the month of August?

06. In an inspection department of a garment factory garment quality checkers do the final inspection. The arrival of garments for checking at one of the counters is random and it varies between 1 to 5 minutes. The frequency distribution of arrival time of a garment at that counter is as given below.

Time between arrival of garments (minutes)	1	2	3	4	5
Frequency (%)	5	25	35	20	15

The time taken by the quality checker at the counter to check a single garment varies from 1 to 3 minutes, whose frequency distribution is as follows.

Checking time for a single garment (minutes)	0	0.5	1.0	1.5	2.0	2.5	3.0
Frequency (%)	5	35	25	15	10	7	3

The quality checker complains that her workload is high, and requests the management to recruit additional quality checkers to her counter. Determine whether the management should accept the request of the quality checker and appoint additional persons in her counter.

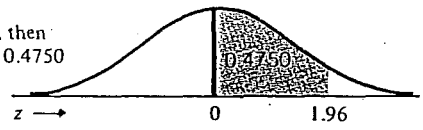
Random Numbers Table

11164	21215	10438	36792	73944	49563	64208	51486	99756	71325
36318	91791	44482	26236	04773	12872	48237	72875	26360	55217
75061	76831	66558	33266	12032	14063	41701	38605	64516	13015
37674	58678	37649	66583	51414	93104	73117	29341	17971	72907
26320	87054	08882	60881	82384	78483	33242	80749	48478	00431
75100	31687	90870	97395	38370	72717	42314	80151	09610	45117
10431	93205	12462	20461	00249	68714	83049	33835	04638	33827
20418	43685	41810	36742	80709	18048	21933	52602	17141	92873
19228	19732	01806	02852	72605	25005	92813	79147	09227	02953
91792	08468	02977	50564	67497	04151	04763	08868	10606	85474
65285	17264	95639	61555	78137	62490	24216	16975	59138	29478
97198	57327	99754	76404	98768	99215	63444	95428	39542	59652
12138	38224	31199	86210	04689	84987	21283	33226	71168	50414
53010	29301	92558	11808	87130	28759	07044	55903	57609	31966
94601	31381	68368	12841	79225	19177	92729	31605	91510	87912
15838	38109	04985	45147	08153	14733	37284	43817	77904	87154
16805	34976	51092	97438	84967	24550	13211	22250	74244	12944
61004	65692	37780	60022	64539	28067	37485	03918	50940	49862
43516	98566	40261	12645	79493	68894	10415	46999	31553	96566
17020	29550	14479	62000	74917	38490	36457	98501	62562	48825
96155	29621	12639	14544	83403	67642	64041	17048	93039	82244
95009	66583	75291	37134	88827	05204	99011	94523	89416	34392
27429	62966	71020	54714	09834	30697	14610	97444	52795	96607
72918	12468	17265	02401	11333	44806	40273	59904	10631	17220
08457	20245	41598	63228	68431	96989	09482	16936	09728	51984
78134	14015	64074	26831	31706	68403	62864	39384	68202	10753
48407	04014	64629	19386	26652	85621	01573	97551	20963	76272
26061	35713	63293	15457	04711	45556	82274	09620	02477	50985
58754	03980	53307	17999	34593	35434	81446	63932	55494	97593
05326	03024	48766	18306	22561	09532	32477	03091	39563	34320
96990	09119	57666	46492	08433	10011	92420	35542	86595	72115
55244	74803	41204	61594	19172	75004	65431	55865	26247	34985
70693	97303	47589	26729	08320	86054	16530	07304	18552	58036
25255	88701	78364	58272	20839	41190	05547	47010	29491	99137
40029	51380	38266	81754	13715	10061	10683	43233	33712	47482
23289	73143	94393	14648	10597	19660	88102	57022	32285	06204
48819	98251	70713	77210	17234	03500	30176	52161	64844	24138
07159	78635	53388	12923	39355	68412	84750	82976	69395	24272
60172	27556	79865	53712	74816	57812	10115	47981	41387	16196
81697	20712	92069	87771	03363	57929	69220	46588	87195	04393
07428	35379	10982	90127	63002	40779	43216	96167	70975	85812
58863	27922	22807	33341	12990	86382	12608	64375	62693	61875
96023	28906	10920	77806	23510	48454	18167	74108	35684	23570
88936	55013	26299	12446	68774	65269	84631	93643	72607	75754
51343	26937	23593	15444	48983	91239	94058	09204	23026	29090
70958	48174	64629	49244	20481	45989	82458	98855	37004	40264
96768	04197	57801	47277	59815	45389	15139	59051	32989	80399
74317	36074	10437	11346	67248	54847	76856	56492	24843	47254
27176	65315	43965	15884	17076	77919	86019	11933	01128	40135
29600	12537	15344	28131	78910	41105	47928	64958	74658	69911

AREAS UNDER THE NORMAL CURVE

00035

Example:
If $z = 1.96$, then
$P(0 \text{ to } z) = 0.4750$



z	0.00	0.01	0.02	0.03	0.04	0.05	0.06	0.07	0.08	0.09
0.0	0.0000	0.0040	0.0080	0.0120	0.0160	0.0199	0.0239	0.0279	0.0319	0.0359
0.1	0.0398	0.0438	0.0478	0.0517	0.0557	0.0596	0.0636	0.0675	0.0714	0.0753
0.2	0.0793	0.0832	0.0871	0.0910	0.0948	0.0987	0.1026	0.1064	0.1103	0.1141
0.3	0.1179	0.1217	0.1255	0.1293	0.1331	0.1368	0.1406	0.1443	0.1480	0.1517
0.4	0.1554	0.1591	0.1628	0.1664	0.1700	0.1736	0.1772	0.1808	0.1844	0.1879
0.5	0.1915	0.1950	0.1985	0.2019	0.2054	0.2088	0.2123	0.2157	0.2190	0.2224
0.6	0.2257	0.2291	0.2324	0.2357	0.2389	0.2422	0.2454	0.2486	0.2517	0.2549
0.7	0.2580	0.2611	0.2642	0.2673	0.2704	0.2734	0.2764	0.2794	0.2823	0.2852
0.8	0.2881	0.2910	0.2939	0.2967	0.2995	0.3023	0.3051	0.3078	0.3106	0.3133
0.9	0.3159	0.3186	0.3212	0.3238	0.3264	0.3289	0.3315	0.3340	0.3365	0.3389
1.0	0.3413	0.3438	0.3461	0.3485	0.3508	0.3531	0.3554	0.3577	0.3599	0.3621
1.1	0.3643	0.3665	0.3686	0.3708	0.3729	0.3749	0.3770	0.3790	0.3810	0.3830
1.2	0.3849	0.3869	0.3888	0.3907	0.3925	0.3944	0.3962	0.3980	0.3997	0.4015
1.3	0.4032	0.4049	0.4066	0.4082	0.4099	0.4115	0.4131	0.4147	0.4162	0.4177
1.4	0.4192	0.4207	0.4222	0.4236	0.4251	0.4265	0.4279	0.4292	0.4306	0.4319
1.5	0.4332	0.4345	0.4357	0.4370	0.4382	0.4394	0.4406	0.4418	0.4429	0.4441
1.6	0.4452	0.4463	0.4474	0.4484	0.4495	0.4505	0.4515	0.4525	0.4535	0.4545
1.7	0.4554	0.4564	0.4573	0.4582	0.4591	0.4599	0.4608	0.4616	0.4625	0.4633
1.8	0.4641	0.4649	0.4656	0.4664	0.4671	0.4678	0.4686	0.4693	0.4699	0.4706
1.9	0.4713	0.4719	0.4726	0.4732	0.4738	0.4744	0.4750	0.4756	0.4761	0.4767
2.0	0.4772	0.4778	0.4783	0.4788	0.4793	0.4798	0.4803	0.4808	0.4812	0.4817
2.1	0.4821	0.4826	0.4830	0.4834	0.4838	0.4842	0.4846	0.4850	0.4854	0.4857
2.2	0.4861	0.4864	0.4868	0.4871	0.4875	0.4878	0.4881	0.4884	0.4887	0.4890
2.3	0.4893	0.4896	0.4898	0.4901	0.4904	0.4906	0.4909	0.4911	0.4913	0.4916
2.4	0.4918	0.4920	0.4922	0.4925	0.4927	0.4929	0.4931	0.4932	0.4934	0.4936
2.5	0.4938	0.4940	0.4941	0.4943	0.4945	0.4946	0.4948	0.4949	0.4951	0.4952
2.6	0.4953	0.4955	0.4956	0.4957	0.4959	0.4960	0.4961	0.4962	0.4963	0.4964
2.7	0.4965	0.4966	0.4967	0.4968	0.4969	0.4970	0.4971	0.4972	0.4973	0.4974
2.8	0.4974	0.4975	0.4976	0.4977	0.4977	0.4978	0.4979	0.4979	0.4980	0.4981
2.9	0.4981	0.4982	0.4982	0.4983	0.4984	0.4984	0.4985	0.4985	0.4986	0.4986
3.0	0.4987	0.4987	0.4987	0.4988	0.4988	0.4989	0.4989	0.4989	0.4990	0.4990