THE OPEN UNIVERSITY OF SRI LANKA
FACULTY OF ENGINEERING TECHNOLOGY
BACHELOR OF INDUSTRIAL STUDIES
FINAL EXAMINATION 2009/2010

MEX4241– OPERATIONAL DECISION MAKING
DATE : 07th March 2010
TIME : 1330hours – 1630hours
DURATION : 03 Hours

INSTRUCTIONS:

- **Answer any five (05) questions.**
- **All questions carry equal marks.**

1. The data in the table below refers to types of degree obtained by 280 engineers working in large automobile company.

Age in Yrs	Bachelor degree	Master Degree	Total
Less than 25 yrs	140	20	160
25- 40 Yrs	20	30	50
More than 40 Yrs	60	10	70
Total	220	60	

If an engineer is selected at random find the followings;

A. Probability that he has a bachelor degree
B. Probability that he has a bachelor degree given that he is less than 25 yrs
C. Probability that he is over 40 yrs given that he has only a bachelor degree
D. Probability that he has a master degree given that he is between 25-40 Yrs.

2. A manufacturer of fruit drinks sells his product in bottles. The volume per bottle is normally distributed with a mean of 300 ml and a standard deviation of 10 ml. A bottle is chosen at random and the volume of its content is measured. Find the probability that the volume is ;

A. Between 295 and 310 ml
B. Less than 315 ml
C. More than 312 ml

3. The probability that a machine A in good working order after another five years time is 5/6 while the probability that the machine B will be in good working order after the same period is 5/8. Find the probability by drawing the Venn diagram or by any other method assuming that A & B are independent events.

A. Both machines will be in good working order
B. Only B will be in good working order
C. That at least one machine is in good order
D. Non of the machines is in good order

4. Minimize the following LP model using the graphical method.

$C = 80X_1 + 120X_2$

Subject to; $X1 + X_2 \geq 500$
$7X_1 \geq 3X_2$
$3X_1 + 8X_2 \geq 2400$
$X_1, X2 \geq 0$

5. Using the simplex method solve the following LP problem.

Maximize $Z = 3X_1 + 5X_2 + 4X_3$

Subject to; $2X_1 + 3X_2 \leq 8$
$2X_1 + 5X_3 \leq 10$
$3X_1 + 2X_2 + 4X_3 \leq 15$
$X_1, X_2, X_3 \geq 0$

6. A company produces 60,000 items in a year and the estimated annual demand is 20,000 units with a constant demand rate throughout the year. In the production process, the fixed costs associated with a production run are Rs 1000. Annual inventory holding cost is estimated to be Rs 80 per unit. Assume uniform replenishment method and find the followings;

A. Economic order quantity
B. Total inventory costs
C. Number of production runs per year
D. Length of inventory cycle
E. Length of production run

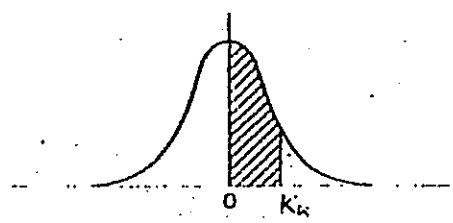
7. An automatic teller machine at a bank can provide services to customers at an average rate of 20 customers per hour. Assuming that the arrival pattern of customers follows a Poisson distribution with an average arrival rate of 15 customers per hour and that service times are exponentially distributed. Compute the operating characteristics for this single channel queuing system.

$P_0 = [1 - \lambda/\mu]$ Probability that the system is idle
$L = \lambda/(\mu - \lambda)$ Average number of units in the system
$W = 1/(\mu - \lambda)$ Average time a unit spends in the system
$L_q = \lambda^2/\mu(\mu - \lambda)$ Average number of units in the queue
$W_q = \lambda/\mu(\mu - \lambda)$ Average time a unit spends in the queue
$P_q = \lambda/\mu$ Probability that an arriving unit has to wait for services
where λ is arrival rate per unit time and μ is service rate per unit time

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Table A Normal Distribution Areas*

Fractional parts of the total area (1.000) under the normal curve between the mean and a perpendicular erected at various numbers of standard deviations (K) from the mean. To illustrate the use of the table, 39.065 percent of the total area under the curve will lie between the mean and a perpendicular erected at a distance of 1.23σ from the mean.



Each figure in the body of the table is preceded by a decimal point.

K	0.00	0.01	0.02	0.03	0.04	0.05	0.06	0.07	0.08	0.09
0.0	00000	00399	00798	01197	01595	01994	02392	02790	03188	03586
0.1	03983	04380	04776	05172	05567	05962	06356	06749	07142	07535
0.2	07926	08317	08706	09095	09483	09871	10257	10642	11026	11409
0.3	11791	12172	12552	12930	13307	13683	14058	14431	14803	15173
0.4	15554	15910	16276	16640	17003	17364	17724	18082	18439	18793
0.5	19146	19497	19847	20194	20540	20884	21226	21566	21904	22240
0.6	22575	22907	23237	23565	23891	24215	24537	24857	25175	25490
0.7	25804	26115	26424	26730	27035	27337	27637	27935	28230	28524
0.8	28814	29103	29389	29673	29955	30234	30511	30785	31057	31327
0.9	31594	31859	32121	32381	32639	32894	33147	33398	33646	33891
1.0	34134	34375	34614	34850	35083	35313	35543	35769	35993	36214
1.1	36433	36650	36864	37076	37286	37493	37698	37900	38100	38298
1.2	38493	38686	38877	39065	39251	39435	39617	39796	39973	40147
1.3	40320	40490	40658	40824	40988	41149	41308	41466	41621	41774
1.4	41924	42073	42220	42364	42507	42647	42786	42922	43056	43189
1.5	43319	43448	43574	43699	43822	43943	44062	44179	44295	44408
1.6	44520	44630	44738	44845	44950	45053	45154	45254	45352	45449
1.7	45543	45637	45728	45818	45907	45994	46080	46164	46246	46327
1.8	46407	46485	46562	46638	46712	46784	46856	46926	46995	47062
1.9	47128	47193	47257	47320	47381	47441	47500	47558	47615	47670
2.0	47725	47778	47831	47882	47932	47982	48030	48077	48124	48169
2.1	48214	48257	48300	48341	48382	48422	48461	48500	48537	48574
2.2	48610	48645	48679	48713	48745	48778	48809	48840	48870	48899
2.3	48928	48956	48983	49010	49036	49061	49086	49111	49134	49158
2.4	49180	49202	49224	49245	49266	49286	49305	49324	49343	49361
2.5	49379	49396	49413	49430	49446	49461	49477	49492	49506	49520
2.6	49534	49547	49560	49573	49585	49598	49609	49621	49632	49643
2.7	49653	49664	49674	49683	49693	49702	49711	49720	49728	49736
2.8	49744	49752	49760	49767	49774	49781	49786	49795	49801	49807
2.9	49813	49819	49825	49831	49836	49841	49846	49851	49856	49861
3.0	49865	49869	49874	49878	49882	49886	49889	49893	49896	49900
3.1	49903	49906	49910	49913	49915	49918	49921	49924	49926	49929
3.2	49931	49934	49936	49938	49940	49942	49944	49946	49948	49950
3.3	49952	49953	49955	49957	49958	49960	49961	49962	49964	49965

* This table has been adapted, by permission, from F. C. Kent, *Elements of Statistics*, McGraw-Hill Book Company, New York, 1924.