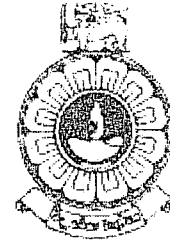THE OPEN UNIVERSITY OF SRI LANKA

DIPLOMA IN INDUSTRIAL STUDIES

FINAL EXAMINATION – 2006/2007

088

TTZ4241 – STATISTICS FOR INDUSTRIAL STUDIES

DURATION – THREE HOURS

DATE: 27th March 2007   TIME: 0930 – 1230 HOURS

Answer Question 01, which is **compulsory** and additional five (05) questions.
Question 1 carries twenty-five marks and Questions 2 to 9 carry fifteen (15) marks each.

01 Compulsory Question

For Questions (i) – (iv) refer the following.

An admission test was conducted for 16 applicants who applied for the post of Programmer in the IT division of OUSL. The results are as follows.

27	27	27	28	27	25	25	28
26	28	26	28	31	30	26	26

These scores are to be organised in to a frequency distribution.

(i)   How many classes would you recommend.

(ii) Organise the scores in to frequency distribution.

(iii) Determine the mean and median of the scores.

(iv) Determine the Quartiles of the data.

For question (v) to (vii) refer to the following:

A selected group of employees of ABC Company is to be surveyed with respect to a new pension scheme. In-depth interviews are to be conducted. The employees are classified as follows.

Category	Event	Number of employees
Supervisors	A	120
Maintenance	B	50
Production	C	1460
Management	D	302
Secretarial	E	68

(v) What is the probability that the first person selected is a maintenance employee?

(vi) What is the probability that the first person selected is either a maintenance or a secretarial employee?

(vii) What is the rule you used to determine the answer to question (vi).

(viii) List two characteristics of Binomial probability Distribution

(ix) What are the characteristics of Poisons probability Distribution

(x) Write 5 steps involved in testing a Hypothesis.

(25 Marks)

(02) (a) Name the statistical measures of numerical data under each of the following group, with illustration. **(04 Marks)**

    (i) Measure of central of tendency.

    (ii) Measure of dispersion.

(b) 36 bobbins of yarn are selected as a sample of large production of a spinning factory. The tensile strength of the yarn in each cone is measured. Following are the reading in gram.

135	125	128	128	140	116	123	121	124
128	133	127	128	131	140	134	124	128
145	145	132	136	131	129	130	131	128
124	139	131	135	139	138	124	130	129

Calculate,

    (i) Mean and median tensile strength of the yarn. **(06 Marks)**

    (ii) Calculate the standard deviation and coefficient of variation of the above data. **(05 Marks)**

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(03) (a) Write the general rule of multiplication and general rule of addition in probability. **(02 Marks)**

(b) There are 20 fabric rolls in a store, 6 of which are defective. Two fabric rolls are to be selected, one after the other. What would be the probability of selecting a defective roll, followed by another defective roll. **(05 Marks)**

(c) A survey was conducted among the executives of ABC clothing company to find out the loyality to the company. One of the questions asked was "If you were given an offer by another company with slightly better than your present position, would you remain in the company or take the new position?

The responses of the 200 executives in the survey were cross-classified with their period of service with the company. Results are given in the table.

	Less than 1 year	1 – 5 years	6 – 10 years	More than 10 years	Total
Would remain	10	30	5	75	120
Would not remain	25	15	10	30	80

(i) What is the probability of randomly selecting an executive who would remain and who has more than 10 years of service? **(04 Marks)**

(ii) What is the probability of randomly selecting an executive who would take the new job and having more than or equal 6 years of service in the company? **(04 Marks)**

(04) (a) Write the mathematical formula of the binomial probability distribution. **(03 Marks)**

(b) According to the records of H.R.M division of ABC Company, on average 5% of the workforce is absent everyday.

Twenty employees are to be selected at random for a special study on absenteeism.

(i) What is the random variable in this problem. **(02 Marks)**

(ii) Is this variable discrete or continuous? **(02 Marks)**

Explain Why?

(iii) What is the probability of selecting 20 employees at random and finding that none of them is absent? **(04 Marks)**

(iv) Develop a binomial probability distribution for this experiment. **(04 Marks)**

(05) (a) Write the mathematical formula of the ' Poisson probability distribution'.

(03 Marks)

(b) An inspection of a production line revealed that, during a shift, the average number of defective garment is four.

What is the probability that during a shift,

(i)   No defective items were found?

(ii)   Four defective items were found?

(iii)   Four or fewer items were found?

(iv)   Four or more defective items were found?   **(12 Marks)**

(06) (a) What do you understand by the term 'point estimation' and 'interval estimation'.   **(03 Marks)**

(b) 20 bobbins of yarn are selected as a sample of the production of a spinning mill to determine the strength. The strength of the yarn is measured and its mean is 20.24 kgf with a standard deviation of 1.2 kgf.

Calculate (i) 99% confidence limits

(ii) 95% confidence limits

(iii) 92% confidence limits for the mean strength of the yarn.

(You should show very clearly each step involved in the calculation).

(12 Marks)

(07) (a) Describe the term " statistical Inference"   **(03 Marks)**

(b) Explain the importance of "statistical Inference"   **(04 Marks)**

(c) Briefly describe any three of the following.

(i) Systematic Random sampling.

(ii) Stratified Random Sampling

(iii) Sample distribution of mean.

(iv) 'Mean Control Charts' and 'Range Control Charts'   **(08 Marks)**

(08) (a) Briefly explain " Test of Hypothesis" ?   **(05 Marks)**

(b) The efficiency rating marks of ABC Apparel Company have been normally distributed over a period of time. The mean of the distribution is 200 and the standard deviation is 16. Company has introduced modern production techniques and training programs for their employees in order to improve their efficiency rating.

After introducing the new changes, company want to know whether the ratings of the employees have been changed or not. The efficiency of ratings of the 100 production employees were analyzed and the mean of the sample been 205.3. Using the 0.01 level significance, check whether the efficiency ratings of the employees have been changed or not.   **(10 Marks)**

(09) (a) List the major characteristics of a normal probability distribution.

(03 Marks)

(b) Final exam marks of the students are distributed with mean 53 and variance 225.

5% of students got "A" pass while 10% of students fail the exam.

(i)   What is the percentage of students who obtained marks between 40 and 60.   **(04 Marks)**

(ii)   Determine the minimum marks required to obtain "A" pass.

(04 Marks)

(iii)   Determine the minimum marks required to pass the examination.

(04 Marks)

Poisson Distribution: Probability of Exactly X Occurrences

X					μ				
	0.1	0.2	0.3	0.4	0.5	0.6	0.7	0.8	0.9
0	0.9048	0.8187	0.7408	0.6703	0.6065	0.5488	0.4966	0.4493	0.4066
1	0.0905	0.1637	0.2222	0.2681	0.3033	0.3293	0.3476	0.3595	0.3659
2	0.0045	0.0164	0.0333	0.0536	0.0758	0.0988	0.1217	0.1438	0.1647
3	0.0002	0.0011	0.0033	0.0072	0.0126	0.0198	0.0284	0.0383	0.0494
4	0.0000	0.0001	0.0003	0.0007	0.0016	0.0030	0.0050	0.0077	0.0111
5	0.0000	0.0000	0.0000	0.0001	0.0002	0.0004	0.0007	0.0012	0.0020
6	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0001	0.0002	0.0003
7	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000

X					μ				
	1.0	2.0	3.0	4.0	5.0	6.0	7.0	8.0	9.0
0	0.3679	0.1353	0.0498	0.0183	0.0067	0.0025	0.0009	0.0003	0.0001
1	0.3679	0.2707	0.1494	0.0733	0.0337	0.0149	0.0064	0.0027	0.0011
2	0.1839	0.2707	0.2240	0.1465	0.0842	0.0446	0.0223	0.0107	0.0050
3	0.0613	0.1804	0.2240	0.1954	0.1404	0.0892	0.0521	0.0286	0.0150
4	0.0153	0.0902	0.1680	0.1954	0.1755	0.1339	0.0912	0.0573	0.0337
5	0.0031	0.0361	0.1008	0.1563	0.1755	0.1606	0.1277	0.0916	0.0607
6	0.0005	0.0120	0.0504	0.1042	0.1462	0.1606	0.1490	0.1221	0.0911
7	0.0001	0.0034	0.0216	0.0595	0.1044	0.1377	0.1490	0.1396	0.1171
8	0.0000	0.0009	0.0081	0.0298	0.0653	0.1033	0.1304	0.1396	0.1318
9	0.0000	0.0002	0.0027	0.0132	0.0363	0.0688	0.1014	0.1241	0.1318
10	0.0000	0.0000	0.0008	0.0053	0.0181	0.0413	0.0710	0.0993	0.1186
11	0.0000	0.0000	0.0002	0.0019	0.0082	0.0225	0.0452	0.0722	0.0970
12	0.0000	0.0000	0.0001	0.0006	0.0034	0.0113	0.0263	0.0481	0.0728
13	0.0000	0.0000	0.0000	0.0002	0.0013	0.0052	0.0142	0.0296	0.0504
14	0.0000	0.0000	0.0000	0.0001	0.0005	0.0022	0.0071	0.0169	0.0324
15	0.0000	0.0000	0.0000	0.0000	0.0002	0.0009	0.0033	0.0090	0.0194
16	0.0000	0.0000	0.0000	0.0000	0.0000	0.0003	0.0014	0.0045	0.0109
17	0.0000	0.0000	0.0000	0.0000	0.0000	0.0001	0.0006	0.0021	0.0058
18	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0002	0.0009	0.0029
19	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0001	0.0004	0.0014
20	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0002	0.0006
21	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0001	0.0003
22	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0001

Standard normal distribution

z	.00	.01	.02	.03	.04	.05	.06	.07	.08	.09
0.0	.500000	.503989	.507978	.511966	.515953	.519939	.523922	.527903	.531881	.535856
0.1	.539828	.543795	.547758	.551717	.555670	.559618	.563559	.567495	.571424	.575345
0.2	.579260	.583166	.587064	.590954	.594835	.598706	.602568	.606420	.610261	.614092
0.3	.617911	.621720	.625516	.629300	.633072	.636831	.640576	.644309	.648027	.651732
0.4	.655422	.659097	.662757	.666402	.670031	.673645	.677242	.680822	.684386	.687933
0.5	.691462	.694974	.698468	.701944	.705401	.708840	.712260	.715661	.719043	.722405
0.6	.725747	.729069	.732371	.735653	.738914	.742154	.745373	.748571	.751748	.754903
0.7	.758036	.761148	.764238	.767305	.770350	.773373	.776373	.779350	.782305	.785236
0.8	.788145	.791030	.793892	.796731	.799546	.802337	.805105	.807850	.810570	.813267
0.9	.815940	.818589	.821214	.823814	.826391	.828944	.831472	.833977	.836457	.838913
1.0	.841345	.843752	.846136	.848495	.850830	.853141	.855428	.857690	.859929	.862143
1.1	.864334	.866500	.868643	.870762	.872857	.874928	.876976	.879000	.881000	.882977
1.2	.884930	.886861	.888768	.890651	.892512	.894350	.896165	.897958	.899727	.901475
1.3	.903200	.904902	.906582	.908241	.909877	.911492	.913085	.914657	.916207	.917736
1.4	.919243	.920730	.922196	.923641	.925066	.926471	.927855	.929219	.930563	.931888
1.5	.933193	.934478	.935745	.936992	.938220	.939429	.940620	.941792	.942947	.944083
1.6	.945201	.946301	.947384	.948449	.949497	.950529	.951543	.952540	.953521	.954486
1.7	.955435	.956367	.957284	.958185	.959070	.959941	.960796	.961636	.962462	.963273
1.8	.964070	.964852	.965620	.966375	.967116	.967843	.968557	.969258	.969946	.970621
1.9	.971283	.971933	.972571	.973197	.973810	.974412	.975002	.975581	.976148	.976705
2.0	.977250	.977784	.978308	.978822	.979325	.979818	.980301	.980774	.981237	.981691
2.1	.982136	.982571	.982997	.983414	.983823	.984222	.984614	.984997	.985371	.985738
2.2	.986097	.986447	.986791	.987126	.987455	.987776	.988089	.988396	.988696	.988989
2.3	.989276	.989556	.989830	.990097	.990358	.990613	.990863	.991106	.991344	.991576
2.4	.991802	.992024	.992240	.992451	.992656	.992857	.993053	.993244	.993431	.993613
2.5	.993790	.993963	.994132	.994297	.994457	.994614	.994766	.994915	.995060	.995201
2.6	.995339	.995473	.995604	.995731	.995855	.995975	.996093	.996207	.996319	.996427
2.7	.996533	.996636	.996736	.996833	.996928	.997020	.997110	.997197	.997282	.997365
2.8	.997445	.997523	.997599	.997673	.997744	.997814	.997882	.997948	.998012	.998074
2.9	.998134	.998193	.998250	.998305	.998359	.998411	.998462	.998511	.998559	.998605