THE OPEN UNIVERSITY OF SRI LANKA

DIPLOMA IN INDUSTRIAL STUDIES

FINAL EXAMINATION – 2005/2006

TTZ4241 – STATISTICS FOR INDUSTRIAL STUDIES

DURATION – THREE HOURS

DATE: 1st April 2006 **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 10 carry fifteen (15) marks each.

01 Compulsory Question

For Questions (i) – (v) refer the following frequency table.

The ages of newly recruited employees were grouped into the following distribution.

Ages	Frequencies
30 - 20	4
30 - 23	8
30 - 26	11
30 - 29	20
30 - 32	7

(i) Obtain the cumulative distribution **(02 marks)**

(ii) Estimate the mean of the data. **(02 marks)**

(iii) Estimate the median of the data **(02 marks)**

(iv) Estimate the first quartile and the third quartile of the data **(02 marks)**

(v) Compute the inter quartile range **(02 marks)**

For question (vi) to (viii) refer to the following:

The following data presents the marks obtained by students in an assignment test.

48, 17,13,64, 67, 85.61, 59, 29, 37, 35, 43,45,47,49,52,57,87, 55

(vi) Compute the sample mean and sample median. **(03 Marks)**

(vii) Compute the quartiles. **(03 Marks)**

(viii) Compute the inter-quartile range. **(02 Marks)**

(ix) (i) Name two applications of Poission Probability Distribution. **(02 marks)**

(ii) In a Poisson distribution $\mu = 0.3$ **(02 marks)**

(please refer the table to answer this question)

- What is the probability that x = 0?
- What is the probability that $x \geq 0$?

(x) What is the area under the **standard normal curve** for the following values? **(03 marks)**

- Area to the left of Z = 1.24
- rea to the right of Z = 0.34
- Area between Z = -2.14 and 1.26

(02) (a) Compare the strengths and weaknesses of mean, mode and median as measure of centre of location in a set of data. **(04 Marks)**

(b) Following are the results of a yarn strength test obtained in a spinning mill.

All readings are in gramme force.

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

(i) Arrange the above data in a frequency table. **(05 Marks)**

(ii) Determine the mean, median and quantities. **(06 Marks)**

(3) (a) Describe the importance of the dispersion of a set of data. **(03 Marks)**

(b) Each person who applies for employment in ABC Apparel Company is given an aptitude test. One part of it involves sewing a part of a garment. A sample of the lengths of time it took 42 persons to sew the garment was organized into the following frequency distribution.

Time (minute)	Number of persons
1 - 3	4
4 - 6	8
7 - 9	14
10 - 12	9
13 - 15	5
16 - 18	2

(i) What is the range of the time **(02 Marks)**

(ii) Determine the standard deviation and the variance of the time **(10 Marks)**

(4) (a) Write three characteristics of Binomial Distribution. **(03 Marks)**

(b) According to past records, it is revealed that 5% of Sri Lankan Apparel factories are not following the environmental rules. Six factories are selected at random for a depth study on environmental issues.

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

(ii) What is the probability that out of six factories selected, all of them follow the environment rules? **(05 Marks)**

(iii) Develop a Binomial Distribution for this experiment. **(05 Marks)**

(5) (a) Write the mathematical formula of the Poisson Distribution. **(03 Marks)**

(b) A study of a production line in a manufacturing company revealed that, products are produced at the rate of three per hour.
If the distribution of the production approximates the Poisson Distribution,

(i) What is the probability that no product is produced in a particular hour. **(04 Marks)**

(ii) What is the probability that three products are produced in a particular hour? **(04 Marks)**

(iii) What is the probability that at least one product is produced in an hour? **(04 Marks)**

(6) (a) Discuss the importance of Standard Normal Distribution. **(03 Marks)**

(b) ABC Marketing Company estimates that the average sale of a product is 4700 per month and standard deviation is 500. If sales follow the normal distribution,

(i) What is the probability that sales will be greater than 4700 **(04 Marks)**

(ii) What is the probability that sales will be greater than 5500? **(04 Marks)**

(iii) What is the probability that sales will be between 4900 and 4300? **(04 Marks)**

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

(b) 4% of the graments produced by a certain factory are known to be defective.

(i) Find the probability that two shirts selected from this collection are both defective. **(04 Marks)**

(ii) Calculate the probability that out of two garments selected only one is defective. **(04 Marks)**

(c) The employees of a certain company have elected five of their employees to represent quality circle. Profile of the five are as follows

1. Male aged 30
2. Male aged 32
3. Female aged 45
4. Female aged 20
5. Male aged 40

The group decided to elect the spokes person randomly, What is the probability the spokes person will be either female or over 35? **(05 Marks)**

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

(b) A large company uses thousands of light bulbs every year. The brand that had been used in the past had an average life of 1000 hrs with standard deviation of 100 hours. The manufacturer has come out with a new brand with a same standard but for a cheaper price. The company would not buy the new brand unless it is proved to have the same average life at 5% level of significance. A sample of 100 of these new brand bulb is tested yielding an average life of 985 hours.

Should the company switch over to the new brand or continue to buy the old one? **(10 Marks)**

(9) (a) Describe "statistical Inference" **(02 Marks)**

(b) Explain four major reasons as to why sampling is necessary? **(04 Marks)**

(c) Describe the follwong **(09 Marks)**

(i) Stratified Random sampling

(ii) Cluster sampling

(iii) Sampling distribution of a mean

(iv) "Point Estimation" and "Interval Estimation"

(10) (a) Distinguish "chance variable" and a "Assignable variables" **(02 Marks)**

(b) Discuss the importance of quality control charts in Apparel Factories. **(04 Marks)**

(c) Every hour the quality control inspector records the weight of five products

The results are shown in the following table.

Time	Sample				
	A	B	C	D	E
08.00 hrs	41	43	42	41	43
09.00 hrs	39	40	40	39	42
10.00 hrs	41	44	43	46	41
11.00 hrs	38	39	40	39	39

(i) Compute the overall mean **(02 Marks)**

(ii) Determine the control limits **(02 Marks)**

(iii) Construct the mean control chart **(05 Marks)**

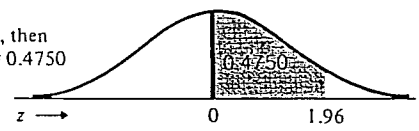
Poisson Distribution: Probability of Exactly X Occurrences

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

Areas under the Normal Curve

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