EASTERN UNIVERSITY SRI LANKA

FACULTY OF COMMERCE AND MANAGEMENT

SECOND YEAR SECOND SEMESTER EXAMINATION IN

BUSINESS ADMINISTRATION/ COMMERCE 2009/2010

(SEPT 2010) - REPEAT

DAF 3134 BUSINESS STATISTICS

Time: 03 Hours

Answer All Questions

01. (I) Define the terms given below clearly:

    (a) Random variable;
                  (b) Probability distribution;

    (c) Sampling distribution.

(II) After watching a number of children playing games at a video arcade, a statistics practitioner estimated the following probability distribution of X, the number of games per visit:

X	1	2	3	4	5	6	7
P(x)	0.05	0.15	0.15	0.25	0.20	0.10	0.10

    (a) What is the probability that a child play at most 3 games?

    (b) Compute the mean and variance of the number of games played.

    (c) Suppose that each game costs the player 25 cents. Construct the probability distribution of the amount of money the arcade takes in per child.

(III) Suppose that the random variables X_A and X_B which denote the respective cash flows of the two firms A and B, are statistically independent. The firms A and B each faced with the same probability distribution of annual cash flows are as shown below:

X_A	100	250	500
Probability	0.1	0.2	0.7

| X_B	100	250	500
Probability	0.1	0.2	0.7

(a) Construct the bivariate probability distribution of the cash flows of the two firms.

(b) If the two firms are merged, find the probability distribution of $X_A + X_B$, th combined cash flows of the firms.

(c) Find the probability that the combined cash flow of the firms is less than 480.

(20 Mark

02. (I) (a) When the Poisson approximation to the binomial is used?

(b) On average 2% of all persons who are given a breathalyzer test by the stat police pass the test. Suppose that 500 breathalyzer tests are given. What is th approximated probability that at least 6 will pass the exam? Justify your answer.

(II) (a) Two firms A and B manufacture similar components with a mean breakin strength of 3000 and 2500 and standard deviation of 200 and 100 respectively. I a random samples of 100 components of firm A and 50 components of firm B ar tested, what is the probability that the components from firm A will have a mea breaking strength which is at least 450 more than the components of firm B?

(b) A normal population of 700 wage earners has a mean income of Rs 200 pe month and the variance is 332. Find the number of persons who earn between R 150 and Rs 200.

(c) A factory turns out an article by mass production methods. From the pas experience it appears that 20 articles, on average, are rejected out of every batc of 100. Find the variance of number of rejects in a batch.

(III) Digital Technology Incorporated uses statistical quality control to monitor th production process during the manufacture of memory chips. Historically, digita manufacturing process has produced 5.5% defective chips. Digital takes randon samples of n chips from the production line at regular intervals and if the fraction o chips that are defective in a sample is found to be not more than 0.0866, the productio process is considered to be "in- control". Otherwise the production process will b halted for further investigation. Find the probability that a random sample of 200 chip will result in the process being declared "in- control" if it is presently producin defective chips at the rate of 5.5%.

(20 Marks

03. (I) A department store gives in service training to its salesmen followed by a test to consider whether it should terminate the services of any of the salesmen who do not qualify the test. The following data give the test scores and sales made by nine salesmen during a certain period:
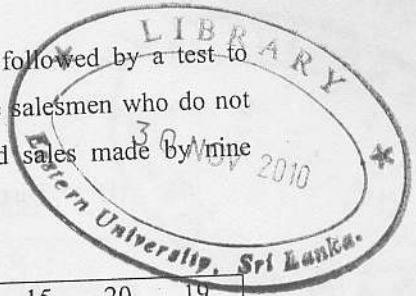
Test score	14	19	24	21	28	22	15	20	19
Sales (1000 Rs)	31	36	48	37	50	45	33	41	39

(a) Calculate the coefficient of correlation between the scores and the sales.

(b) Does it indicate that the termination of services of the low test score is justified? Explain.

(c) Find the least squares line of sales on test score.

(d) If the firm wants a minimum sales volume of Rs 3000, what is the test score that will ensure continuation of the services?

(II) (a) What is a time series? Distinguish between the seasonal variations and the cyclical fluctuations?

(b) The following data give, by quarter, the total number (in thousands) of crimes and offenses recorded by the police in England and Wales:

Quarter	1	2	3	4
1982	186.5	191.8	190.1	197.7
1983	190.0	198.0	203.8	207.6
1984	188.9	207.0	202.9	212.6
1985	196.4	207.8	203.1	206.4
1986	196.4	206.1		

Calculate quarterly indices for the data using a four- quarter centered moving average.

(20 Marks)

04. (I) Distinguish between the pair of terms given below:

(a) Level of significance and level of confidence ;

(b) Type I error and Type II error ·

(c) Confidence interval estimate and point estimate ;

(d) Parameter and statistic ,

(II) (a) A courier services advertises that its average delivery time is less than 6 hour for local deliveries. A random sample times for 12 deliveries to an address acros town was recorded. These data are shown here. Is there sufficient evidence t support the courier's claim at the 5% level of significance?

| 3.03 | 6.33 | 6.50 | 5.22 | 3.56 | 6.76 |
| 7.98 | 4.82 | 7.96 | 4.54 | 5.09 | 6.46 |

(b) Surveys have been widely used by politicians around the world as a way o monitoring the opinions of the electorate. Six months ago a survey wa undertaken to determine the degree of support for a national party leader. Of sample 1100, 56% indicated that they would vote for this politician. This montl another survey of 800 voters revealed that 46% now support the leader. At th 5% significance level, can we infer that the national leader's popularity ha decreased?

(20 Marks

05. **A**
The Fisher Company manufactures vacuum cleaners and uses electric motors from 3 different suppliers. Six motors are randomly selected from each supplier and all of the motors are run until failure occurs. The results are given in hundreds of hours.
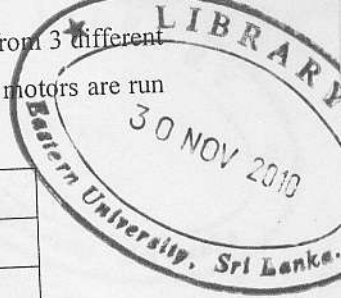
Supplier 1	Supplier 2	Supplier 3
7.3	7.1	5.6
6.4	6.2	6.3
7.0	7.0	6.0
6.5	6.4	5.7
7.0	6.8	6.2
7.2	6.7	5.0

A one – way analysis of variance is conducted at the 5% level of significance to test whether or not motors from the three suppliers have the same mean life (before failure).

(a) State the null and alternative hypotheses being tested.

The partially completed SPSS output for this test is given below.

ANOVA

		Sum of squares	Df	Mean Squares	F
LIFE	Between groups	4.120	……..	……….	……..
	Within groups	……….	……..		
	Total	6.540			

(b) Produce the completed ANOVA table.

(c) What is the critical value for the test?

(d) State the decision of the hypothesis test (show your reasoning).

(e) Interpret your result in the context of the problem.

(f) What assumptions are necessary for the test?

(g) If appropriate, which supplier's electric motors appear to differ significantly in average life?

(h) What should the management conclude?

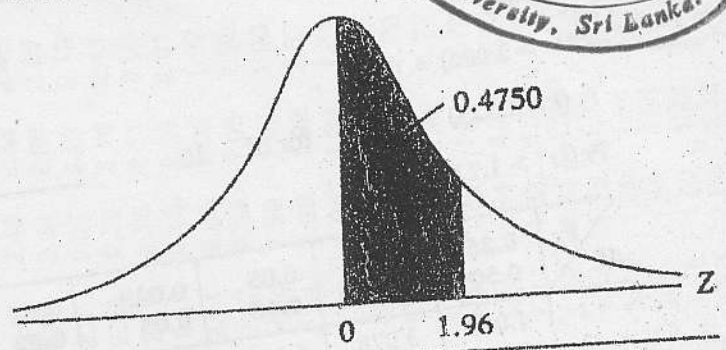(20 Marks)

0.4750

ple

$Z \le 1.96) = 0.4750$

$1.96) = 0.5 - 0.4750 = 0.025$

.00	.01	.02	.03	.04	.05	.06	.07	.08	.09
.0000	.0040	.0080	.0120	.0160	.0199	.0239	.0279	.0319	.0359
.0398	.0438	.0478	.0517	.0557	.0596	.0636	.0675	.0714	.0753
.0793	.0832	.0871	.0910	.0948	.0987	.1026	.1064	.1103	.1141
.1179	.1217	.1255	.1293	.1331	.1368	.1406	.1443	.1480	.1517
.1554	.1591	.1628	.1664	.1700	.1736	.1772	.1808	.1844	.1879
.1915	.1950	.1985	.2019	.2054	.2088	.2123	.2157	.2190	.2224
.2257	.2291	.2324	.2357	.2389	.2422	.2454	.2486	.2517	.2549
.2580	.2611	.2642	.2673	.2704	.2734	.2764	.2794	.2823	.2852
.2881	.2910	.2939	.2967	.2995	.3023	.3051	.3078	.3106	.3133
.3159	.3186	.3212	.3238	.3264	.3289	.3315	.3340	.3365	.3389
.3413	.3438	.3461	.3485	.3508	.3531	.3554	.3577	.3599	.3621
.3643	.3665	.3686	.3708	.3729	.3749	.3770	.3790	.3810	.3830
.3849	.3869	.3888	.3907	.3925	.3944	.3962	.3980	.3997	.4015
.4032	.4049	.4066	.4082	.4099	.4115	.4131	.4147	.4162	.4177
.4192	.4207	.4222	.4236	.4251	.4265	.4279	.4292	.4306	.4319
.4332	.4345	.4357	.4370	.4382	.4394	.4406	.4418	.4429	.4441
.4452	.4463	.4474	.4484	.4495	.4505	.4515	.4525	.4535	.4545
.4454	.4564	.4573	.4582	.4591	.4599	.4608	.4616	.4625	.4633
.4641	.4649	.4656	.4664	.4671	.4678	.4686	.4693	.4699	.4706
.4713	.4719	.4726	.4732	.4738	.4744	.4750	.4756	.4761	.4767
.4772	.4778	.4783	.4788	.4793	.4798	.4803	.4808	.4812	.4817
.4821	.4826	.4830	.4834	.4838	.4842	.4846	.4850	.4854	.4857
.4861	.4864	.4868	.4871	.4875	.4878	.4881	.4884	.4887	.4890
.4893	.4896	.4898	.4901	.4904	.4906	.4909	.4911	.4913	.4916
.4918	.4920	.4922	.4925	.4927	.4929	.4931	.4932	.4934	.4936
.4938	.4940	.4941	.4943	.4945	.4946	.4948	.4949	.4951	.4952
.4953	.4955	.4956	.4957	.4959	.4960	.4961	.4962	.4963	.4964
.4965	.4966	.4967	.4968	.4969	.4970	.4971	.4972	.4973	.4974
.4974	.4975	.4976	.4977	.4977	.4978	.4979	.4979	.4980	.4981
.4981	.4982	.4982	.4983	.4984	.4984	.4985	.4985	.4986	.4986
.4987	.4987	.4987	.4988	.4988	.4989	.4989	.4989	.4990	.4990

table gives the area in the right-hand tail of the distribution (i.e., $Z \ge 0$). But since the normal dis-
s symmetrical about $Z = 0$, the area in the left-hand tail is the same as the area in the corresponding
tail. For example. $P(-1.96 \le Z \le 0) = 0.4750$. Therefore, $P(-1.96 \le Z \le 1.96) = 2(0.4750) = 0.95$.

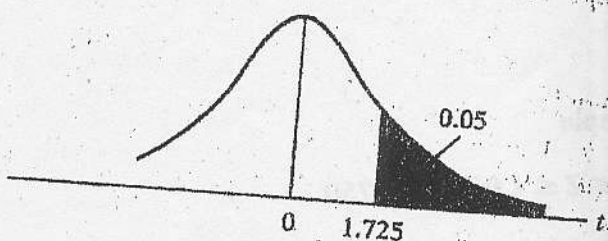# Percentage points of the *t* distribution

Example

$\Pr(t > 2.086) = 0.025$

$\Pr(t > 1.725) = 0.05$ for df = 20

$\Pr(|t| > 1.725) = 0.10$

Pr df	0.25 0.50	0.10 0.20	0.05 0.10	0.025 0.05	0.01 0.02	0.005 0.010	0.001 0.002
1	1.000	3.078	6.314	12.706	31.821	63.657	318.31
2	0.816	1.886	2.920	4.303	6.965	9.925	22.327
3	0.765	1.638	2.353	3.182	4.541	5.841	10.214
4	0.741	1.533	2.132	2.776	3.747	4.604	7.173
5	0.727	1.476	2.015	2.571	3.365	4.032	5.893
6	0.718	1.440	1.943	2.447	3.143	3.707	5.208
7	0.711	1.415	1.895	2.365	2.998	3.499	4.785
8	0.706	1.397	1.860	2.306	2.896	3.355	4.501
9	0.703	1.383	1.833	2.262	2.821	3.250	4.297
10	0.700	1.372	1.812	2.228	2.764	3.169	4.144
11	0.697	1.363	1.796	2.201	2.718	3.106	4.025
12	0.695	1.356	1.782	2.179	2.681	3.055	3.930
13	0.694	1.350	1.771	2.160	2.650	3.012	3.852
14	0.692	1.345	1.761	2.145	2.624	2.977	3.787
15	0.691	1.341	1.753	2.131	2.602	2.947	3.733
16	0.690	1.337	1.746	2.120	2.583	2.921	3.686
17	0.689	1.333	1.740	2.110	2.567	2.898	3.646
18	0.688	1.330	1.734	2.101	2.552	2.878	3.610
19	0.688	1.328	1.729	2.093	2.539	2.861	3.579
20	0.687	1.325	1.725	2.086	2.528	2.845	3.552
21	0.686	1.323	1.721	2.080	2.518	2.831	3.527
22	0.686	1.321	1.717	2.074	2.508	2.819	3.505
23	0.685	1.319	1.714	2.069	2.500	2.807	3.485
24	0.685	1.318	1.711	2.064	2.492	2.797	3.467
25	0.684	1.316	1.708	2.060	2.485	2.787	3.450
26	0.684	1.315	1.706	2.056	2.479	2.779	3.435
27	0.684	1.314	1.703	2.052	2.473	2.771	3.421
28	0.683	1.313	1.701	2.048	2.467	2.763	3.408
29	0.683	1.311	1.699	2.045	2.462	2.756	3.396
30	0.683	1.310	1.697	2.042	2.457	2.750	3.385
40	0.681	1.303	1.684	2.021	2.423	2.704	3.307
60	0.679	1.296	1.671	2.000	2.390	2.660	3.232
120	0.677	1.289	1.658	1.980	2.358	2.617	3.160
∞	0.674	1.282	1.645	1.960	2.326	2.576	3.090

Note: The smaller probability shown at the head of each column is the area in one tail; the larger probability is the area in both tails.

n_1 = degrees of freedom for numerator

n_2 \ n_1	1	2	3	4	5	6	7	8	9	10	12	15	20	24	30	40	60	120	∞
1	161.4	199.5	215.7	224.6	230.2	234.0	236.8	238.9	240.5	241.9	243.9	245.9	248.0	249.1	250.1	251.1	252.2	253.3	254.3
2	18.51	19.00	19.16	19.25	19.30	19.33	19.35	19.37	19.38	19.40	19.41	19.43	19.45	19.45	19.46	19.47	19.48	19.49	19.50
3	10.13	9.55	9.28	9.12	9.01	8.94	8.89	8.85	8.81	8.79	8.74	8.70	8.66	8.64	8.62	8.59	8.57	8.55	8.53
4	7.71	6.94	6.59	6.39	6.26	6.16	6.09	6.04	6.00	5.96	5.91	5.86	5.80	5.77	5.75	5.72	5.69	5.66	5.63
5	6.61	5.79	5.41	5.19	5.05	4.95	4.88	4.82	4.77	4.74	4.68	4.62	4.56	4.53	4.50	4.46	4.43	4.40	4.36
6	5.99	5.14	4.76	4.53	4.39	4.28	4.21	4.15	4.10	4.06	4.00	3.94	3.87	3.84	3.81	3.77	3.74	3.70	3.67
7	5.59	4.74	4.35	4.12	3.97	3.87	3.79	3.73	3.68	3.64	3.57	3.51	3.44	3.41	3.38	3.34	3.30	3.27	3.23
8	5.32	4.46	4.07	3.84	3.69	3.58	3.50	3.44	3.39	3.35	3.28	3.22	3.15	3.12	3.08	3.04	3.01	2.97	2.93
9	5.12	4.26	3.86	3.63	3.48	3.37	3.29	3.23	3.18	3.14	3.07	3.01	2.94	2.90	2.86	2.83	2.79	2.75	2.71
10	4.96	4.10	3.71	3.48	3.33	3.22	3.14	3.07	3.02	2.98	2.91	2.85	2.77	2.74	2.70	2.66	2.62	2.58	2.54
11	4.84	3.98	3.59	3.36	3.20	3.09	3.01	2.95	2.90	2.85	2.79	2.72	2.65	2.61	2.57	2.53	2.49	2.45	2.40
12	4.75	3.89	3.49	3.26	3.11	3.00	2.91	2.85	2.80	2.75	2.69	2.62	2.54	2.51	2.47	2.43	2.38	2.34	2.30
13	4.67	3.81	3.41	3.18	3.03	2.92	2.83	2.77	2.71	2.67	2.60	2.53	2.46	2.42	2.38	2.34	2.30	2.25	2.21
14	4.60	3.74	3.34	3.11	2.96	2.85	2.76	2.70	2.65	2.60	2.53	2.46	2.39	2.35	2.31	2.27	2.22	2.18	2.13
15	4.54	3.68	3.29	3.06	2.90	2.79	2.71	2.64	2.59	2.54	2.48	2.40	2.33	2.29	2.25	2.20	2.16	2.11	2.07
16	4.49	3.63	3.24	3.01	2.85	2.74	2.66	2.59	2.54	2.49	2.42	2.35	2.28	2.24	2.19	2.15	2.11	2.06	2.01
17	4.45	3.59	3.20	2.96	2.81	2.70	2.61	2.55	2.49	2.45	2.38	2.31	2.23	2.19	2.15	2.10	2.06	2.01	1.96
18	4.41	3.55	3.16	2.93	2.77	2.66	2.58	2.51	2.46	2.41	2.34	2.27	2.19	2.15	2.11	2.06	2.02	1.97	1.92
19	4.38	3.52	3.13	2.90	2.74	2.63	2.54	2.48	2.42	2.38	2.31	2.23	2.16	2.11	2.07	2.03	1.98	1.93	1.88
20	4.35	3.49	3.10	2.87	2.71	2.60	2.51	2.45	2.39	2.35	2.28	2.20	2.12	2.08	2.04	1.99	1.95	1.90	1.84
21	4.32	3.47	3.07	2.84	2.68	2.57	2.49	2.42	2.37	2.32	2.25	2.18	2.10	2.05	2.01	1.96	1.92	1.87	1.81
22	4.30	3.44	3.05	2.82	2.66	2.55	2.46	2.40	2.34	2.30	2.23	2.15	2.07	2.03	1.98	1.94	1.89	1.84	1.78
23	4.28	3.42	3.03	2.80	2.64	2.53	2.44	2.37	2.32	2.27	2.20	2.13	2.05	2.01	1.96	1.91	1.86	1.81	1.76
24	4.26	3.40	3.01	2.78	2.62	2.51	2.42	2.36	2.30	2.25	2.18	2.11	2.03	1.98	1.94	1.89	1.84	1.79	1.73
25	4.24	3.39	2.99	2.76	2.60	2.49	2.40	2.34	2.28	2.24	2.16	2.09	2.01	1.96	1.92	1.87	1.82	1.77	1.71
26	4.23	3.37	2.98	2.74	2.59	2.47	2.39	2.32	2.27	2.22	2.15	2.07	1.99	1.95	1.90	1.85	1.80	1.75	1.69
27	4.21	3.35	2.96	2.73	2.57	2.46	2.37	2.31	2.25	2.20	2.13	2.06	1.97	1.93	1.88	1.84	1.79	1.73	1.67
28	4.20	3.34	2.95	2.71	2.56	2.45	2.36	2.29	2.24	2.19	2.12	2.04	1.96	1.91	1.87	1.82	1.77	1.71	1.65
29	4.18	3.33	2.93	2.70	2.55	2.43	2.35	2.28	2.22	2.18	2.10	2.03	1.94	1.90	1.85	1.81	1.75	1.70	1.64
30	4.17	3.32	2.92	2.69	2.53	2.42	2.33	2.27	2.21	2.16	2.09	2.01	1.93	1.89	1.84	1.79	1.74	1.68	1.62
40	4.08	3.23	2.84	2.61	2.45	2.34	2.25	2.18	2.12	2.08	2.00	1.92	1.84	1.79	1.74	1.69	1.64	1.58	1.51
60	4.00	3.15	2.76	2.53	2.37	2.25	2.17	2.10	2.04	1.99	1.92	1.84	1.75	1.70	1.65	1.59	1.53	1.47	1.39
120	3.92	3.07	2.68	2.45	2.29	2.17	2.09	2.02	1.96	1.91	1.83	1.75	1.66	1.61	1.55	1.50	1.43	1.35	1.25
∞	3.84	3.00	2.60	2.37	2.21	2.10	2.01	1.94	1.88	1.83	1.75	1.67	1.57	1.52	1.46	1.39	1.32	1.22	1.00

n_2 = degrees of freedom for denominator

(Contd.)