EASTERN UNIVERSITY, SRI LANKA

FACULTY OF COMMERCE AND MANAGEMENT

THIRD YEAR – FIRST SEMESTER EXAMINATION IN BUSINESS ADMINISTRATION/ COMMERCE

2008 / 2009 (SEPT. 2009)

DAF 3134 BUSINESS STATISTICS

Answer all Questions **Time: 03 hours**

(i) Distinguish between probability distribution and sampling distribution.

(ii) A surprise quiz contains three multiple choice questions; question 1 has 3 suggested answers, question 2 has four, and question 3 has two. A completely unprepared student decides to choose the answers at random. If X is the number of questions the student answers correctly, find

(a) the probability distribution of X.

(b) the shape of the distribution.

(c) the probability of at least one correct answer.

(d) the expected number and variance of correct answers.

(iii) A population has mean of 200 and a standard deviation of 50. A simple random sample of size 100 will be taken and the sample mean $\bar{x}$ will be used to estimate the population mean.

(a) What is the expected value of $\bar{x}$?

(b) What is the standard deviation of $\bar{x}$?

(c) Show graphically, the sampling distribution of $\bar{x}$.

(d) What does the sampling distribution of $\bar{x}$ show?

(iv) 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. Two 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) Suppose that each firm has borrowed money to finance operations, and that each firm faces a contractual obligation to pay \$240 annually to service this debt. What is the probability that either A or B will default on their obligation?

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

(c) Now suppose that the two firms merge. Find the probability distribution of $X_A + X_B$ the combined cash flow of the firms

(d) If the merged firms have a contractual obligation to pay $480 annually what is the probability that the merged firms will default on this obligation?

(e) Does there appear to be a financial benefit to this merger? Explain.

(20 Marks)

2. (i) The speed of cars passing a certain point in a motorway can be taken to be normally distributed. Observations show that of cars passing the point, 95% are traveling at less than 85 km. p. h and 10% are traveling at less than 55km.p.h. Find the proportion of cars that travel more than 70 km. p. h.

(ii) A manufacturer finds that the average demand per day for the machines to repair new products is 2, over a period of one year and the demand per day is distributed as Poisson variate. He employs 3 mechanics. On how many days in one year:

(a) all the mechanics will be free,

(b) some demand will be refused?

(iii) Digital Technology Incorporated uses statistical quality control to monitor the production process during the manufacture of memory chips. Historically, digital manufacturing process has produced 5.5% defective chips. Digital takes random samples of n chips from the production line at regular intervals and if the fraction of chips that are defective in a sample is found to be not more than 0.0866, the production process is considered to be "in- control". Otherwise the production process will be halted for further investigation.

(a) Find the probability that a random sample of 200 chips will result in the process being declared "in-control" if it is presently producing defective chips at the rate of 5.5%.

(b) Determine the minimum sample size, n, such that the probability is at least 99% that such a random sample of n chips will result in the process being declared " in-control", if it is presently producing defective chips at the rate of 5.5%.

(iv) An investor is given the following information about the returns on two stocks.

Stock	1	2
Mean	0.09	0.13
Standard deviation	0.15	0.21

(a) If the investor is most interested in maximizing investor's returns which stock should the investor choose?

(b) If the investor is most interested in minimizing investor' risk, which stock should the investor choose?

(c) Compute the expected value and the variance of the portfolio composed of 60% stock 1 and 40% stock2. The coefficient correlation is 0.4

(20 Marks)

Over the last several years, the use of cell phones has increased dramatically. An article in USA today reported that according to a poll, the mean talking time per month for cell phones was 372 minutes for men and 275 minutes for women, while the mean talking time per month for traditional home phones was 334 minutes for men and 510 minutes for women. Suppose that the poll was based on a sample of 100 men and 100 women, and that the standard deviation of the talking time per month for cell phones was 120 minutes for men 100 minutes for women, while the standard deviation of the talking time per month for traditional home phones was 100 minutes for men and 150 minutes for women.

(a) Estimate mean of monthly talking time on cell phones for men with 95% confidence.

(b) Estimate mean of monthly talking time on traditional home phones for women with 95% confidence.

(c) Estimate the differences in the mean monthly talking time on cell phones for men and women with 95% confidence.

(d) Estimate the difference in the mean monthly talking time on traditional home phones for men and women with 95% confidence.

(e) Is there evidence of a difference in the mean monthly talking time on cell phones for men and women?.

(f) Is there evidence of a difference in the mean monthly talking time on traditional home phones for men and women?

(g) What assumptions must be made in (e) and (f)?

(h) Is there evidence of a difference in the variance of the monthly talking time on cell phones for men and women?

(i) Is there evidence of a difference in the variance of the monthly talking time on traditional home phones for men and women?

(j) What assumptions must be made in (h) and (i)?

(k) Based on the results of (a) – (j) what conclusions can you make concerning cell phone and traditional home phone usage between men and women?

(20 Marks)

(i) 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?

(ii) The following data relate to training and performance of salesmen employed in a company.

Salesman	1	2	3	4	5
Hours of training	20	05	10	13	12
Performance(Average weekly sales in '000Rs)	44	22	25	32	27

(a) Fit the least squares linear regression line to the above data.

(b) Interpret the slope of the regression line in the context of the data.

(c) Estimate the weekly sales that are likely to be attained by a salesman who is given 16 hours of training.

(d) Compute the value of R^2, the coefficient of determination.

(e) Interpret R^2 in the context of the data.

(f) Compute the value of r, the correlation coefficient.

(g) Interpret r in the context of the data.

(20 Marks)

5. (i) Which of the four components of a time series you would use in the following cases and why?

(a) The effect of new year sales of textiles on a large retail outlet of readymade garments

(b) The effect of war

(c) Increasing house construction activity during the past five years

(d) Recession.

(ii) The revenues (in Rs. millions) of a chain of Ice cream stores are listed for each quarter during the pervious 5 years.

Year

Quarter	2004	2005	2006	2007	2008
1	68	65	68	70	60
2	62	58	63	59	55
3	61	56	63	56	31
4	63	61	67	62	58

(a) Calculate the four – quarter centered moving averages.

(b) Graph the time series and the moving averages.

(c) What can you conclude from your time – series smoothing?

(d) Using the moving averages computed in part (a) calculate the seasonal indexes.

(e) Interpret the seasonal indexes.

(iii) The following trend line and seasonal indexes were computed from 10 years of quarterly observations. Forecast the next year's time series.

$$\hat{Y} = 150 + 3t \quad t = 1,2,\text{----------}40$$

Quarter	1	2	3	4
Seasonal Index	0.7	1.2	1.5	0.6

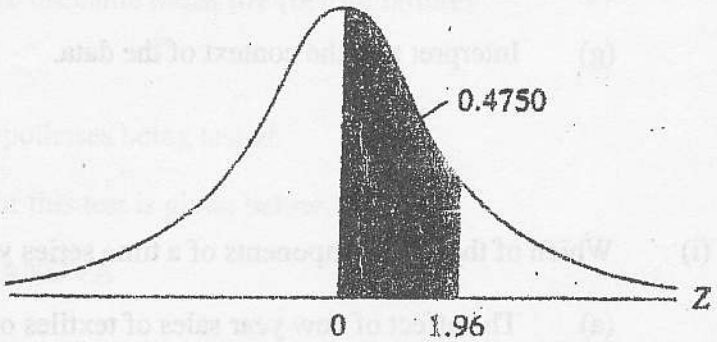
(20 Marks)

Areas under the standardized normal distribution

Example

$\Pr(0 \le Z \le 1.96) = 0.4750$

$\Pr(Z \ge 1.96) = 0.5 - 0.4750 = 0.025$



Z	.00	.01	.02	.03	.04	.05	.06	.07	.08	.09
0.0	.0000	.0040	.0080	.0120	.0160	.0199	.0239	.0279	.0319	.0359
0.1	.0398	.0438	.0478	.0517	.0557	.0596	.0636	.0675	.0714	.0753
0.2	.0793	.0832	.0871	.0910	.0948	.0987	.1026	.1064	.1103	.1141
0.3	.1179	.1217	.1255	.1293	.1331	.1368	.1406	.1443	.1480	.1517
0.4	.1554	.1591	.1628	.1664	.1700	.1736	.1772	.1808	.1844	.1879
0.5	.1915	.1950	.1985	.2019	.2054	.2088	.2123	.2157	.2190	.2224
0.6	.2257	.2291	.2324	.2357	.2389	.2422	.2454	.2486	.2517	.2549
0.7	.2580	.2611	.2642	.2673	.2704	.2734	.2764	.2794	.2823	.2852
0.8	.2881	.2910	.2939	.2967	.2995	.3023	.3051	.3078	.3106	.3133
0.9	.3159	.3186	.3212	.3238	.3264	.3289	.3315	.3340	.3365	.3389
1.0	.3413	.3438	.3461	.3485	.3508	.3531	.3554	.3577	.3599	.3621
1.1	.3643	.3665	.3686	.3708	.3729	.3749	.3770	.3790	.3810	.3830
1.2	.3849	.3869	.3888	.3907	.3925	.3944	.3962	.3980	.3997	.4015
1.3	.4032	.4049	.4066	.4082	.4099	.4115	.4131	.4147	.4162	.4177
1.4	.4192	.4207	.4222	.4236	.4251	.4265	.4279	.4292	.4306	.4319
1.5	.4332	.4345	.4357	.4370	.4382	.4394	.4406	.4418	.4429	.4441
1.6	.4452	.4463	.4474	.4484	.4495	.4505	.4515	.4525	.4535	.4545
1.7	.4454	.4564	.4573	.4582	.4591	.4599	.4608	.4616	.4625	.4633
1.8	.4641	.4649	.4656	.4664	.4671	.4678	.4686	.4693	.4699	.4706
1.9	.4713	.4719	.4726	.4732	.4738	.4744	.4750	.4756	.4761	.4767
2.0	.4772	.4778	.4783	.4788	.4793	.4798	.4803	.4808	.4812	.4817
2.1	.4821	.4826	.4830	.4834	.4838	.4842	.4846	.4850	.4854	.4857
2.2	.4861	.4864	.4868	.4871	.4875	.4878	.4881	.4884	.4887	.4890
2.3	.4893	.4896	.4898	.4901	.4904	.4906	.4909	.4911	.4913	.4916
2.4	.4918	.4920	.4922	.4925	.4927	.4929	.4931	.4932	.4934	.4936
2.5	.4938	.4940	.4941	.4943	.4945	.4946	.4948	.4949	.4951	.4952
2.6	.4953	.4955	.4956	.4957	.4959	.4960	.4961	.4962	.4963	.4964
2.7	.4965	.4966	.4967	.4968	.4969	.4970	.4971	.4972	.4973	.4974
2.8	.4974	.4975	.4976	.4977	.4977	.4978	.4979	.4979	.4980	.4981
2.9	.4981	.4982	.4982	.4983	.4984	.4984	.4985	.4985	.4986	.4986
3.0	.4987	.4987	.4987	.4988	.4988	.4989	.4989	.4989	.4990	.4990

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

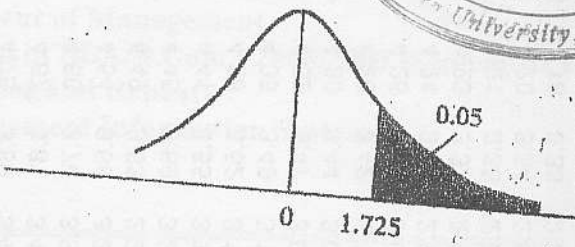
Percentage points of the t distribution

Example

$\Pr(t > 2.086) = 0.025$

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

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



df \ Pr	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.

Source: From E. S. Pearson and H. O. Hartley, eds., *Biometrika Tables for Statisticians*, vol. 1, 3d ed., table 12, Cambridge University Press, New York, 1966. Reproduced by permission of the editors and trustees of *Biometrika*.

Appendix Table 6 Percentiles of the *F*-Distribution

$F_{.95(n1, n2)}$ $a = 0.05$

n_1 = degrees of freedom for numerator

n_2 = degrees of freedom for denominator

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	2.24	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	21.5	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	3.84	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	2.43	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

(Contd.)