[This question paper contains 8 printed pages.]

Sr. No. of Question Paper : 6061 **Your Roll No................**

Unique Paper Code : 248102

Name of the Paper : Statistics for Business Economics

Name of the Course : **B.A. (Hons.) Business Economics, 2016**

Semester : I

Duration : 3 Hours

Maximum Marks : 75

Instructions for Candidates

1. Write your Roll No. on the top immediately on receipt of this question paper.
2. Attempt **all** questions.
3. Choice is available within each question.
4. Use of simple calculators is permitted.
5. Begin each question from a new page.

Enclosure :

(a) Table for Areas under the Standard Normal Curve.

(b) Table for critical values of the distribution.

1. Attempt any **two** parts : (5×2)

(a) The number of ice creams sold by vendors in Delhi University on a particular day has the following distribution

Number of ice creams sold	No. of vendors
80 – 120	12
120 – 150	15
150 – 170	18
170 – 220	25

(i) Sketch the histogram to depict the data.

(ii) What proportion of vendors sell less than 140 ice creams ?

(b) The following measures were computed from a problem in statistics :

Mode = 83, Arithmetic Mean = 74, and Median = 77.

Sketch a curve indicating the general shape of the distribution and comment. Is it possible for this distribution to have a positive third central moment ? Explain.

(c) For a distribution the first four moments about zero are 1, 7, 38 and 155 respectively. Compute the moment coefficient of skewness and kurtosis. Is the distribution mesokurtic ? Give reason.

2. Attempt any **three** parts : (5×3)

(a) For a given set of bivariate data, the following results were obtained :

Mean of X = 53, Mean of Y = 28, b (Y on X) = −1.5, b (X on Y) = − 0.2

Find :

(i) The two regression equations,

(ii) The most probable value of Y when X = 60, and

(iii) The most probable value of X when Y = 20.5

(b) In fitting of a regression of Y on X to a bivariate distribution consisting of 9 observations, the explained and the unexplained variations were computed as 24 and 36, respectively. Find :

(i) the coefficient of determination and

(ii) standard error of the estimate of Y on X.

(c) Summary details from bivariate data of 10 pairs of values of X and Y are as follows :

$$\sum X_i = 38, \sum Y_i = 54, \quad \sum X_i^2 = 166, \sum Y_i^2 = 358 \text{ and } \sum X_i Y_i = 235$$

(i) Compute the regression line of Y on X.

(ii) Explain the meaning of the coefficients of the regression line.

(iii) State any two properties satisfied by the residual term of the regression.

(d) The covariance between two variables P and Q is 190. Variables P and Q have variances 100 and 625 respectively. New variables S and T are created from the variables P and Q through changes in origin and scale as

$S_i = \dfrac{10+2P_i}{3}$ and $T_i = \dfrac{5-P_i}{8}$. Calculate:

(i) the covariance between S and T

(ii) the coefficient of correlation between S and T.

3. Attempt any **five** parts : (5×5)

(a) If it is given that $P(A \cup B) = 0.8$ and $P(A) = 0.3$, find P(B) for each of situations given in the parts below :

(i) A and B are independent events

(ii) A and B are mutually exclusive events

(iii) $P(A \mid B) = 0.5$

(b) The probabilities of X, Y and Z becoming managers are 4/9, 2/9, and 1/3 respectively. The probabilities that a mandatory meeting with the labour union will be introduced if X, Y or Z become managers are 3/10, 1/9 and 4/5 respectively.

(i) What is the probability that mandatory meeting will be introduced ?

(ii) If the mandatory meeting is introduced, what is the probability that X was appointed manager ?

(c) The probability density function of a continuous random variable X is given by :

$$f(x)=\begin{cases}-k(x-3)^2, & 0<x<6\\ 0, & elsewhere\end{cases}$$

(i) Find the value of k for f(x) to be a valid probability density function.

(ii) Use the value of k calculated above to find the cumulative distribution function for variable X.

(d) A joint probability mass function for discrete variable X and Y is as follows :

X ↓ \ Y →	5	10	15
2	0.05	0.1	0
4	0.15	0.25	0.05
6	0.05	0.2	0.15

Calculate

(i) The Marginal distributions of X and Y.

(ii) The Variance of X

(iii) Conditional distribution of Y given $X \geq 4$.

(e) (i) Under what conditions does a variable possess a binomial distribution ?

(ii) The probability that a train is late on any run is 0.2. What is the probability that it is late on more than 6 times in 10 runs ?

(f) The weight of bricks available at construction site are normally distributed. The lightest 20% of the bricks have a maximum weight 1500 grams and the heaviest 10% of the bricks have a minimum weight of 1600 grams. Calculate the mean and standard deviation of the weight of the bricks.

4. Attempt any **three** parts : (5×3)

(a) Explain the terms population parameter and sample statistic. What is an estimator ? Define any two desirable properties for an estimator.

(b) A sample of 16 observations are taken from a normally distributed population of family daily consumption expenditure. The sample gave a mean of Rs. 260 and a sample standard deviation of Rs. 25. Compute a 95% confidence interval for the mean daily family expenditure.

(c) Two samples of sizes 50 and 100 were taken from a production process before and after introduction of a new technology. The time taken to produce a unit of output from the earlier sample is 23 minutes while it is 21 minutes from the later sample. The corresponding standard deviations are 6 and 9 minutes respectively. Test the hypothesis that the new technology lowers the time taken to produce a unit of output at 1% level of significance.

(d) Define Type II error. For a population with standard deviation 20, a sample of size 100 is taken to test the null hypothesis H_0: m = 435 against an alternative hypothesis H_a: m = 440. If the statistician decides to reject the null hypothesis H_0 if $\overline{X} > 437$ and accept H_0 if $\overline{X} < 437$. Compute the probability of Type II error.

5. Attempt any **two** parts : (5×2)

(a) From the data provided below, calculate the Laspyres' price index for the period 2010 to 2013 with 2012 as base.

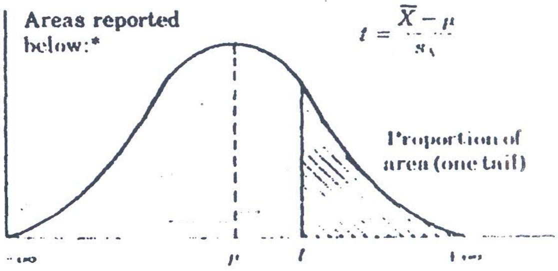
Year	Commodity X		Commodity Y	
	Price	Quantity	Price	Quantity
2010	2	20	10	5
2011	2	25	12	8
2012	3	30	15	10
2013	4	30	15	15

(b) The prices of a certain commodity decreased by 10% from the year 2005 to 2006. The price index in 2007 with 2006 as base was 120. The price index in 2008 with 2005 as base was 150. Calculate the price index series from 2005 to 2008 as 2006 as base.

(c) What is the difference between the Laspeyres' and Paasche price index numbers ? Why does the Laspeyres' price index overestimate a price rise ?

Appendix 5

Proportions of Area for the t Distributions

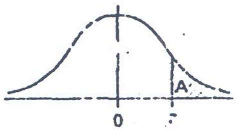


df	0.10	0.05	0.025	0.01	0.005
1	3.078	6.314	12.706	31.821	63.657
2	1.886	2.920	4.303	6.965	9.925
3	1.638	2.353	3.182	4.541	5.841
4	1.533	2.132	2.776	3.747	4.604
5	1.476	2.015	2.571	3.365	4.032
6	1.440	1.943	2.447	3.143	3.707
7	1.415	1.895	2.365	2.998	3.499
8	1.397	1.860	2.306	2.896	3.355
9	1.383	1.833	2.262	2.821	3.250
10	1.372	1.812	2.228	2.764	3.169
11	1.363	1.796	2.201	2.718	3.106
12	1.356	1.782	2.179	2.681	3.055
13	1.350	1.771	2.160	2.650	3.012
14	1.345	1.761	2.145	2.624	2.977
15	1.341	1.753	2.131	2.602	2.947
16	1.337	1.746	2.120	2.583	2.921
17	1.333	1.740	2.110	2.567	2.898
18	1.330	1.734	2.101	2.552	2.878
19	1.328	1.729	2.093	2.539	2.861
20	1.325	1.725	2.086	2.528	2.845
21	1.323	1.721	2.080	2.518	2.831
22	1.321	1.717	2.074	2.508	2.819
23	1.319	1.714	2.069	2.500	2.807
24	1.318	1.711	2.064	2.492	2.797
25	1.316	1.708	2.060	2.485	2.787
26	1.315	1.706	2.056	2.479	2.779
27	1.314	1.703	2.052	2.473	2.771
28	1.313	1.701	2.048	2.467	2.763
29	1.311	1.699	2.045	2.462	2.756
30	1.310	1.697	2.042	2.457	2.750
40	1.303	1.684	2.021	2.423	2.704
60	1.296	1.671	2.000	2.390	2.660
120	1.289	1.658	1.980	2.358	2.617
∞	1.282	1.645	1.960	2.326	2.576

*Example: For the shaded area to represent 0.05 of the total area of 1.0, value of t with 10 degrees of freedom is 1.812.

Source: From Table III of Fisher and Yates, *Statistical Tables for Biological, Agricultural and Medical Research*, 6th ed., 1974, published by Longman Group Ltd., London (previously published by Oliver & Boyd, Edinburgh), by permission of the authors and publishers.

APPENDIX 5
Areas under the standard normal curve



The tables give the area A under one tail:

z	0.00	0.01	0.02	0.03	0.04	0.05	0.06	0.07	0.08	0.09
0.0	0.5000	0.4960	0.4920	0.4880	0.4840	0.4801	0.4761	0.4721	0.4681	0.4641
0.1	0.4602	0.4562	0.4522	0.4483	0.4443	0.4404	0.4364	0.4325	0.4286	0.4247
0.2	0.4207	0.4168	0.4129	0.4090	0.4052	0.4013	0.3974	0.3936	0.3897	0.3859
0.3	0.3821	0.3783	0.3745	0.3707	0.3669	0.3632	0.3594	0.3557	0.3520	0.3483
0.4	0.3446	0.3409	0.3372	0.3336	0.3300	0.3264	0.3228	0.3192	0.3156	0.3121
0.5	0.3085	0.3050	0.3015	0.2981	0.2946	0.2912	0.2877	0.2843	0.2810	0.2776
0.6	0.2743	0.2709	0.2676	0.2643	0.2611	0.2578	0.2546	0.2514	0.2483	0.2451
0.7	0.2420	0.2389	0.2358	0.2327	0.2296	0.2266	0.2236	0.2206	0.2177	0.2148
0.8	0.2119	0.2090	0.2061	0.2033	0.2005	0.1977	0.1949	0.1922	0.1894	0.1867
0.9	0.1841	0.1814	0.1788	0.1762	0.1736	0.1711	0.1685	0.1660	0.1635	0.1611
1.0	0.1587	0.1562	0.1539	0.1515	0.1492	0.1469	0.1446	0.1423	0.1401	0.1379
1.1	0.1357	0.1335	0.1314	0.1292	0.1271	0.1251	0.1230	0.1210	0.1190	0.1170
1.2	0.1151	0.1131	0.1112	0.1093	0.1075	0.1056	0.1038	0.1020	0.1003	0.0985
1.3	0.0968	0.0951	0.0934	0.0918	0.0901	0.0885	0.0869	0.0853	0.0838	0.0823
1.4	0.0808	0.0793	0.0778	0.0764	0.0749	0.0735	0.0721	0.0708	0.0694	0.0681
1.5	0.0668	0.0655	0.0643	0.0630	0.0618	0.0606	0.0594	0.0582	0.0571	0.0559
1.6	0.0548	0.0537	0.0526	0.0516	0.0505	0.0495	0.0485	0.0475	0.0465	0.0455
1.7	0.0446	0.0436	0.0427	0.0418	0.0409	0.0401	0.0392	0.0384	0.0375	0.0367
1.8	0.0359	0.0351	0.0344	0.0336	0.0329	0.0322	0.0314	0.0307	0.0301	0.0294
1.9	0.0287	0.0281	0.0274	0.0268	0.0262	0.0256	0.0250	0.0244	0.0239	0.0233
2.0	0.02275	0.02222	0.02169	0.02118	0.02068	0.02018	0.01970	0.01923	0.01876	0.01831
2.1	0.01786	0.01743	0.01700	0.01659	0.01618	0.01578	0.01539	0.01500	0.01463	0.01426
2.2	0.01390	0.01355	0.01321	0.01287	0.01255	0.01222	0.01191	0.01160	0.01130	0.01101
2.3	0.01072	0.01044	0.01017	0.00990	0.00964	0.00939	0.00914	0.00889	0.00866	0.00842
2.4	0.00820	0.00798	0.00776	0.00755	0.00734	0.00714	0.00695	0.00676	0.00657	0.00639
2.5	0.00621	0.00604	0.00587	0.00570	0.00554	0.00539	0.00523	0.00508	0.00494	0.00480
2.6	0.00466	0.00453	0.00440	0.00427	0.00415	0.00402	0.00391	0.00379	0.00368	0.00357
2.7	0.00347	0.00336	0.00326	0.00317	0.00307	0.00298	0.00289	0.00280	0.00272	0.00264
2.8	0.00256	0.00248	0.00240	0.00233	0.00226	0.00219	0.00212	0.00205	0.00199	0.00193
2.9	0.00187	0.00181	0.00175	0.00169	0.00164	0.00159	0.00154	0.00149	0.00144	0.00139
3.0	0.00135									
3.1	0.00097									
3.2	0.00069									
3.3	0.00048									
3.4	0.00034									
3.5	0.00023									
3.6	0.00016									
3.7	0.00011									
3.8	0.00007									
3.9	0.00005									
4.0	0.00003									

This table is based on Table 3 of *Statistical Tables for Science, Engineering, Management and Business Studies* by J. Murdoch and J. A. Barnes, published by Macmillan, London and Basingstoke.