

KATHMANDU UNIVERSITY
End Semester Examination
August, 2018

Mark Scored:

Level : B.Sc./B. Pharm./B. Tech.
Year : I

Course : MATH 102
Semester: II

Exam Roll No. :

Time: 30 mins.

F. M. : 20

Registration No.:

Date **AUG 17 2018**

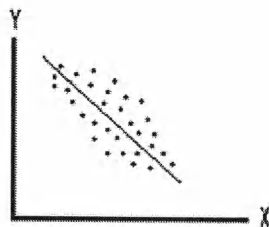
SECTION "A"
[10Q × 1 = 10 marks]

1. For a symmetric distribution _____, _____ and _____ coincide.
2. _____ measures peakedness and flatness of data distribution in the middle part.
3. The set of all possible outcomes of a random experiment is called _____.
4. Two or more events are said to be _____ events if occurrence of any one of them excludes the occurrence of all other events in the same experiment.
5. The total number of possible samples of size 2 that can be drawn from a population containing 5 units if simple random sampling with replacement is performed is _____.
6. If the probability distribution of a random variable X is modeled as $B(5, 0.24)$, then $V(X) =$ _____.
7. The points of inflexion of $N(\mu, \sigma^2)$ distribution lies at _____ and _____.
8. For testing $H_0: \mu = 4.25$, for $N(\mu, 1.2^2)$ population, the value of test statistic, if mean from a sample of 15 records is observed to be 4.1 is _____.
9. The value of correlation coefficient lies between _____ and _____.
10. If _____ of simple regression model between X and Y is calculated to be 0.92, then it means that 92% of variation in Y is explained by X and remaining 8% of variation is caused by other factors not mentioned in the regression model.

SECTION "B"
[10Q × 1 = 10 marks]

11. Which of the following is true?
 - (i) $P(B|A) + P(\bar{B}|A) = 1$
 - (ii) $P(B|\bar{A}) + P(B|A) = 1$
 - (iii) $P(B|A) + P(\bar{B}|\bar{A}) = 1$
 - (iv) $P(B|\bar{A}) + P(\bar{B}|A) = 1$

12. If X is random variable then $P(X \leq x)$ is a non-decreasing function of X . It is denoted by $F_X(x)$ and is called _____.
- (i) probability mass function (ii) probability density function
(iii) probability distribution function (iv) cumulative distribution function
13. _____ can be used as a model if one needs to study the number of accidents that takes place in different months at a junction of two roads.
- (i) Binomial distribution (ii) Poisson distribution
(iii) Hypergeometric distribution (iv) Normal distribution
14. _____ distribution is used to draw inference on population mean when population variance is not known and sample size is large.
- (i) Normal distribution (ii) t – distribution
(iii) F – distribution (iv) Chi-square distribution
15. _____ theorem states that if sample size is sufficiently large then for any statistic 't' $\frac{t-E(t)}{\sqrt{V(t)}}$, has normal distribution.
- (i) Baye's theorem (ii) Central limit theorem
(iii) Chebyshev's theorem (iv) Multiplication theorem
16. In construction of confidence interval $1 - \alpha$ is called _____.
- (i) level of significance (ii) confidence level
(iii) confidence limit (iv) confidence interval
17. A sample statistic 't' is said to be _____ for parameter θ of population if $E(t) = \theta$.
- (i) consistent (ii) sufficient (iii) unbiased (iv) efficient
18. Let V be normal approximation of binomial random variable X , then $P(X \geq 12) =$
- (i) $P(V \geq 11.5)$ (ii) $P(V > 11.5)$ (iii) $P(V \leq 12.5)$ (iv) $P(V < 12.5)$
19. _____ type of correlation is exhibited by scatter plot shown below.



- (i) strong positive (ii) strong negative
(iii) weak positive (iv) weak negative
20. The regression line of Y on X is given by $Y = 29 + 0.67X$. If observed value for Y when $X = 10$ is 34, then error in estimation is _____.
- (i) 1.7 (ii) - 1.7 (iii) 29 (iv) 0.67

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Level : B.Sc./B. Pharm./B. Tech.
Year : I
Time : 2 hrs. 30 mins.

Course : MATH 102
Semester: II
F. M. : 55

SECTION "C"
[3Q × 7 = 21 marks]

1. What is range and coefficient of the range in a data set? What the range and coefficient of the range indicates in a data set? [3+4]
Spider can cause small growths, called 'galls', on the leaves of trees. The number of galls found on 45 leaves of a tree are given below-

5	19	21	4	17	10	0	61	3	31	15	39	16	27	48
51	69	32	1	25	51	22	28	29	73	14	23	9	2	0
1	37	31	95	10	24	7	89	1	2	50	33	22	0	75

 - (a) Construct stem-and-leaf plot of above data.
 - (b) Use the stem-and-leaf plot created in part (a) to arrange data in order.
 - (c) Classify data into a grouped frequency distribution with class interval of 10.
 - (d) Use the grouped frequency distribution created in part (c) to draw histogram and state whether the number of galls produced on leaves of trees by spider follow normal distribution.

2. (a) A class consists of seven boys and nine girls. Two different students are chosen at random. Let A be event the first selected student is a girl and B be event that second selected student is a girl. Find (i) $P(B|A)$, (ii) $P(B|\bar{A})$.
 (b) At a +2 science college 60% of students are of Physics stream and 40% are of Biology stream. Mathematics is compulsory to all Physics students and for Biology students it is optional, however, 75% of Biology students take Mathematics as an additional course. A student in the college is randomly selected, find probability that he/she is studying Mathematics. If the student is known to take Mathematics, find probability that he/she is of Biology stream. [3+4]

3. To draw inference on means of two normal populations in which cases are Z-test used and in which cases are t-test used? Elaborate it. [3+4]
 30 micrograms of vitamin B12 were given intramuscularly every fourth week to six patients of pernicious anaemia during periods of remission. The results are given below. Do the data indicate real improvement in haemoglobin level?

Individual No.	Haemoglobin g, %	
	Before Therapy	After 3 months therapy
1	12.2	13.0
2	11.3	13.4
3	14.7	16.0
4	11.4	13.6
5	11.5	14.0
6	12.7	13.8

Also construct 95% confidence interval for actual difference in mean haemoglobin level before and after the therapy.

OR

As part of an industrial training program, some trainees are instructed by Method A, which is straight computer-based instruction, and some are instructed by Method B, which also involves the personal attention of an instructor. If random samples of size 10 are taken from large groups of trainees instructed by each of these two methods and the scores which they obtained in an appropriate achievement test are

Method A : 71, 75, 65, 69, 73, 66, 68, 71, 74, 68

Method B: 72, 77, 84, 78, 69, 70, 77, 73, 65, 75

Use the 0.05 level of significance to test the claim that method B is more effective.

Assume that the populations sampled can be approximated closely with normal distributions having the same variance.

Also construct 95% confidence interval for difference in means of two industrial training programs Method A and Method B. Assume that the populations sampled can be approximated closely with normal distributions having the same variance.

SECTION "D"

[6Q × 4 = 24 marks]

4. Following data relate to a study of increment/ decrement of blood sugar of 237 persons due to a kind of mushroom.

Change in blood sugar	-10 to 0	0 to 10	10 to 20	20 to 30	30 to 40	40 to 50
No. of persons	19	24	49	87	31	27

Calculate the mean and standard deviation of change in blood sugar due to the mushroom.

5. The probability distribution of a random variables is given by

X	-3	6	9
p(x)	1/6	1/2	1/3

Find: (i) $E(X)$
(ii) $E(X^2)$
(iii) $E(3X + 4)$

6. It is observed that in a hospital out of 80 births one is the case of twins. Calculate the probability of 2 or more twins on a day when 30 births occur by using binomial distribution.
7. A hospital has an average of 4 emergency calls in 10 minutes interval. Assuming number of emergency calls in the hospital to follow Poisson distribution, calculate the probability that there are at the most 7 emergency calls in the interval of 20 minutes.
8. The weights of eggs of Penguins is modeled by $X \sim N(85.0, 0.36)$. The eggs are classified as large, medium or small, where a large egg weighs 90.0 grams or more. What percentage of eggs are classified as large? If 25% of eggs are classified as small, what is the maximum weight of a small egg?

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9. Hydrocarbon level and purity of air are measured at 5 different locations with following results-

Hydrocarbon Level/ x	0.99	1.02	1.15	1.29	1.46
Purity (%) / y	90.01	89.05	91.43	93.74	96.73

- (a) Develop a regression line to model relationship between purity of air and hydrocarbon level.
(b) Estimate the purity of air at a location where hydrocarbon level is 1.5.

OR

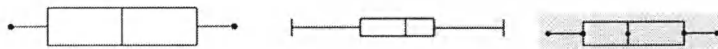
The study of a set of 10 paired data on (X, Y) give following results: $\sum x = 15$, $\sum y = 30$, $\sum x^2 = 55$, $\sum y^2 = 226$ and $\sum xy = 110$.

- (a) Find correlation coefficient between X and Y.
(b) Develop a regression line to model a relationship between X and Y.

SECTION "E"

[5Q × 2 = 10 marks]

10. The box-and-whisker plots of three data distributions are shown below-



Explain nature of the three data distributions, mentioning relationship among 1st quartile, 3rd quartile and median of individual distribution.

11. An importer is offered a shipment of machine tools for Rs. 140,000. The probabilities that he will be able to sell them for Rs. 180,000, Rs. 170,000 or Rs. 150,000 are 0.32, 0.55, 0.23 respectively. What is the expected gross profit of the importer?
12. A discrete random variable X has binomial distribution with mean 6 and variance 2. Find $P(5 < X < 7)$.
13. A nutritionist wants to study mean amount of calorie intake required for rabbits per week. The standard deviation of actual amount of calorie for rabbits per week is known to be 0.3. Find the sample size required for the study, if maximum error is not to exceed 3 gm.
14. Write a note on two types of errors in test of hypothesis.

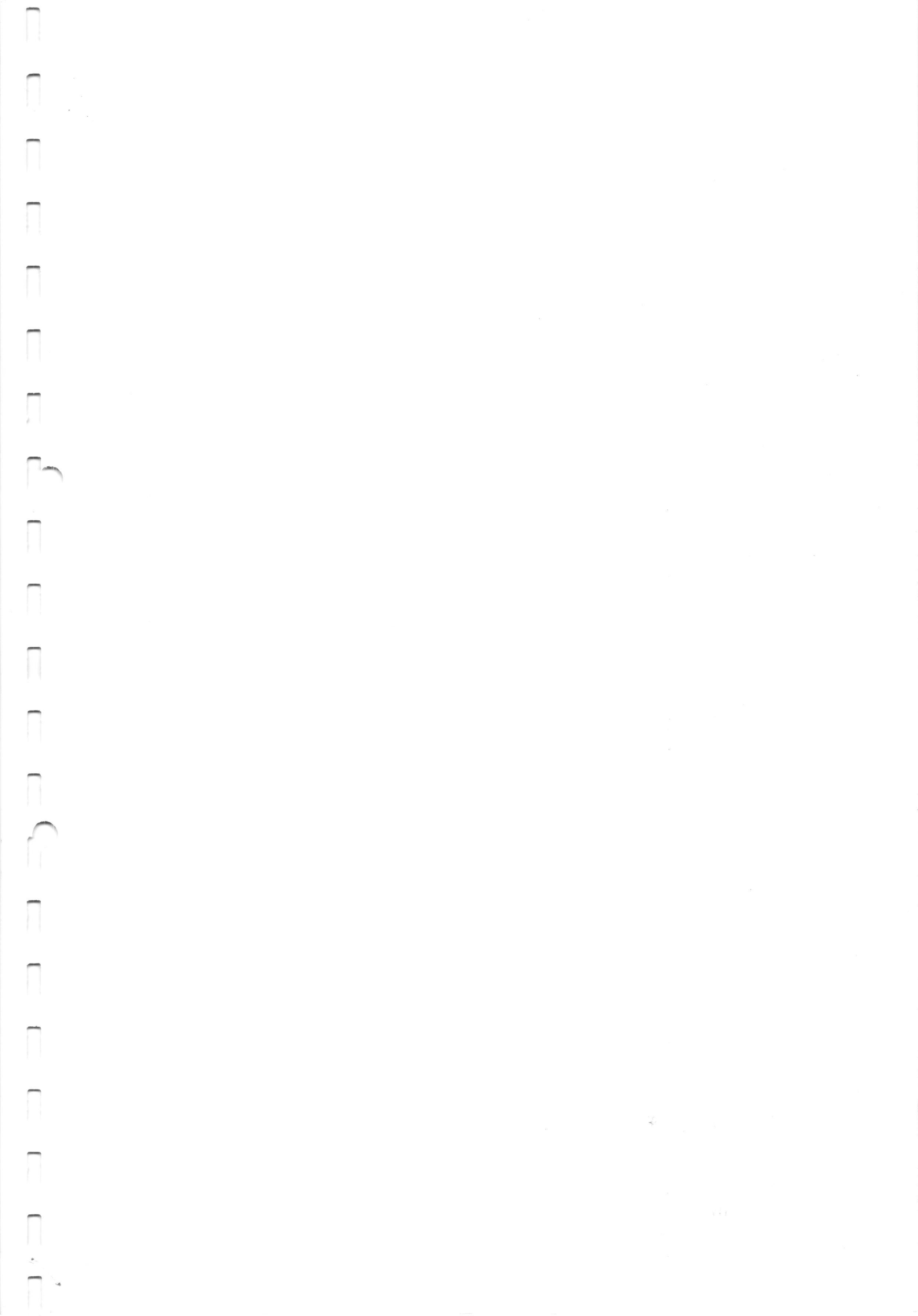


Table
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Table IV Percentage Points of the t Distribution

ν	α	0.40	0.25	0.10	0.05	0.025	0.01	0.005	0.0025	0.001	0.0005
1		0.325	1.000	3.078	6.314	12.706	31.821	63.657	127.32	318.31	636.62
2		0.289	0.816	1.886	2.920	4.303	6.965	9.925	14.089	23.326	31.598
3		0.277	0.765	1.638	2.353	3.182	4.541	5.841	7.453	10.213	12.924
4		0.271	0.741	1.533	2.132	2.776	3.747	4.604	5.598	7.173	8.610
5		0.267	0.727	1.476	2.015	2.571	3.365	4.032	4.773	5.893	6.869
6		0.265	0.718	1.440	1.943	2.447	3.143	3.707	4.317	5.208	5.959
7		0.263	0.711	1.415	1.895	2.365	2.998	3.499	4.029	4.785	5.408
8		0.262	0.706	1.397	1.860	2.306	2.896	3.355	3.833	4.501	5.041
9		0.261	0.703	1.383	1.833	2.262	2.821	3.250	3.690	4.297	4.781
10		0.260	0.700	1.372	1.812	2.228	2.764	3.169	3.581	4.144	4.587
11		0.260	0.697	1.363	1.796	2.201	2.718	3.106	3.497	4.025	4.437
12		0.259	0.695	1.356	1.782	2.179	2.681	3.055	3.428	3.930	4.318
13		0.259	0.694	1.350	1.771	2.160	2.650	3.012	3.372	3.852	4.221
14		0.258	0.692	1.345	1.761	2.145	2.624	2.977	3.326	3.787	4.140
15		0.258	0.691	1.341	1.753	2.131	2.602	2.947	3.286	3.733	4.073
16		0.258	0.690	1.337	1.746	2.120	2.583	2.921	3.252	3.686	4.015
17		0.257	0.689	1.333	1.740	2.110	2.567	2.898	3.222	3.646	3.965
18		0.257	0.688	1.330	1.734	2.101	2.552	2.878	3.197	3.610	3.922
19		0.257	0.688	1.328	1.729	2.093	2.539	2.861	3.174	3.579	3.883
20		0.257	0.687	1.325	1.725	2.086	2.528	2.845	3.153	3.552	3.850
21		0.257	0.686	1.323	1.721	2.080	2.518	2.831	3.135	3.527	3.819
22		0.256	0.686	1.321	1.717	2.074	2.508	2.819	3.119	3.505	3.792
23		0.256	0.685	1.319	1.714	2.069	2.500	2.807	3.104	3.485	3.767
24		0.256	0.685	1.318	1.711	2.064	2.492	2.797	3.091	3.467	3.745
25		0.256	0.684	1.316	1.708	2.060	2.485	2.787	3.078	3.450	3.725
26		0.256	0.684	1.315	1.706	2.056	2.479	2.779	3.067	3.435	3.707
27		0.256	0.684	1.314	1.703	2.052	2.473	2.771	3.057	3.421	3.690
28		0.256	0.683	1.313	1.701	2.048	2.467	2.763	3.047	3.408	3.674
29		0.256	0.683	1.311	1.699	2.045	2.462	2.756	3.038	3.396	3.659
30		0.256	0.683	1.310	1.697	2.042	2.457	2.750	3.030	3.385	3.646
40		0.255	0.681	1.303	1.684	2.021	2.423	2.704	2.971	3.307	3.551
60		0.254	0.679	1.296	1.671	2.000	2.390	2.660	2.915	3.232	3.460
120		0.254	0.677	1.289	1.658	1.980	2.358	2.617	2.860	3.160	3.373
∞		0.253	0.674	1.282	1.645	1.960	2.326	2.576	2.807	3.090	3.291

Source: This table is adapted from *Biometrika Tables for Statisticians*, Vol. 1, 3rd edition, 1966, by permission of the Biometrika Trustees.

