THE INSTITUTE OF CHARTERED ACCOUNTANTS OF SRI LANKA

No. of Pages - 18
No of Questions - 08

SCHOOL OF ACCOUNTING AND BUSINESS
BSc. (APPLIED ACCOUNTING) GENERAL / SPECIAL DEGREE PROGRAMME

YEAR I SEMESTER II (Intake IV – Group A)

END SEMESTER EXAMINATION – JANUARY 2016

QMT 10230 Business Statistics

Date	:	20th January 2016
Time	:	9.00 a.m. – 12.00 p.m.
Duration	:	Three (03) hours

Instructions to Candidates:

- Answer only **FIVE** (05) questions **including Question No. 01**
- Question No. 01 - Answer **ALL** questions in the separate sheet provided
- The total marks for the paper is 100.
- All questions carry equal marks.
- Use of scientific calculator is allowed.
- Standard Normal Z-table and Key Statistical Formulas are provided.
- Graph Sheets are provided on request.
- Answers should be written neatly and legibly.

Question No. 01

Multiple Choice Questions; Choose the one alternative that best completes the statement or answers the question.

i. Which of the following are examples of ratio data?
   a. Gender of each family member {F-female, M-male},
   b. Product quality rating {1 excellent, 2 good, 3 fair,4 poor, 5 very poor},
   c. Place of birth (Country),
   d. Number of customers in a city,
   e. Current e-mail or contact number,

ii. Which of the following are examples of ordinal data?
   a. Gender of customers; male **or** female,
   b. Current e-mail or contact number
   c. Mode of purchasing (Cash/Credit)
   d. Monthly family income of each family in a city,
   e. Level of customer satisfaction {1 dissatisfied, 2 satisfied, 3 well satisfied},

iii. When calculating the median for a data set consisting of an even number of scores which of the following is correct?
   a. Cannot be determined,
   b. Calculate the average value of the three middle ranked scores,
   c. Calculate the average value of the two middle ranked scores,
   d. Must be equal to the mean
   e. None of the above answers is correct,

iv. In case there are number of outliers in the data set, the most representative average value is,
   a. Simple arithmetic mean,
   b. Mode,
   c. Median,
   d. Weighted arithmetic mean
   e. None of these

v. Measures of central tendency are ,

   a. inferential statistics that identify the best single value for representing a set of data,
   b. descriptive statistics that identify the best single value for representing a set of data,
   c. inferential statistics that identify the spread of the scores in a data set,
   d. descriptive statistics that identify the spread of the scores in a data set,
   e. None of the above answers is correct.

vi. The measure of dispersion that is influenced most by extreme values is,

   a. the variance,
   b. the standard deviation,
   c. the range,
   d. the interquartile range,
   e. None of the above answers is correct.

vii. The coefficient of determination can be interpreted a number of ways. Which of the following is one of them? (one correct choice)

   a. Proportion of explained variation,
   b. Proportion of unexplained variation (i.e. residual),
   c. Proportion of mean variation,
   d. Proportion of variance variation,
   e. Proportion of points on the line.

viii. Two events are mutually exclusive if

   a. They are exclusively connected,
   b. They cannot occur together,
   c. They exclusively include mutuality,
   d. They are interrelated,
   e. None of these.

ix. A numerical value used as a summary measure for a sample, such as sample mean, is known as a

a. population parameter,
b. sample parameter,
c. sample statistic,
d. population mean,
e. None of the above answers is correct.

x. By taking a level of significance of 5% it is the same as saying

a. We are 5% confident the results have occurred by chance
b. We are 5% confident the results have not occurred by chance
c. We are 95% confident that the results have not occurred by chance
d. We are 95% confident that the results have occurred by chance
e. We are 99% confident that the results have occurred by chance

(Total 20 Marks)

<u>Question No. 02</u>

i. Evaluate the merits and demerits of the following descriptive measures of statistics,

a. Mean
b. Median
c. Standard Deviation,

(06 Marks)

ii. "The relative measures of dispersion are better than absolute measures of dispersion". Comment.

(04 Marks)

iii. Monthly wages (Rs'000) of **125** employees in two companies **P** and **Q** are given below.

Monthly wage in Rs.'000	**Number of Workers**	
	Company-P	**Company-Q**
11 - 25	05	11
26 - 40	10	15
41 - 55	21	18
56 - 70	31	21
71 - 85	27	27
86 - 100	21	19
101 - 115	10	14
Total	**125**	**125**

Using the above data compute the following measures for company P and Q and compare the results.

a. Arithmetic mean,

b. Median,

c. Mode,

d. Standard deviation, and

e. Relative variability of wages

(10 Marks)

(Total 20 Marks)

Question No. 03

i. Define the following, giving one appropriate example of each.

   a. Discrete and Continuous random variables,

   b. Mutually exclusive events and independent events,

   c. Experiments and Sample space

(06 Marks)

ii. Annual estimated return of **Project-A** and **Project-B** under different possible economic conditions, along with the probability that each of these economic conditions will occur over the life time of the projects are given by the following table.

Possible Conditions	**Probability**	**Net Return/Loss**	
		Project-A (Rs. Mn)	**Project-B (Rs.Mn)**
Extreme Recession	**0.08**	-15	-35
Recession	**0.18**	-05	-15
Stagnation	**0.38**	50	80
Growth	**0.22**	75	100
High growth	**0.14**	120	160

Compute and compare the risk and return level of two projects.

(06 Marks)

iii. The quality control assistant takes a sample of 12 units at a particular workstation of a production line and inspects them one by one. Based on the past experience, he has estimated that the probability of one unit will be defective is 0.025. Find the probability that,

   a. No unit in the sample is defective,

   b. Two units in the sample will be defective,

   c. At most three units will be defective,

   d. At least three units will be defective.

(08 Marks)

(Total 20 Marks)

Question No. 04

i. Explain the importance of normal probability distribution in business decisions making using examples.

(03 Marks)

ii. The arrival rate of customers arriving at a bank counter follows Poisson distribution with a mean arrival rate of 12 per 30 minutes interval. Find the probability that,

a. Exactly no (0) customer will arrive in 30 minutes interval,

b. Exactly five customers will arrive in 30 minutes interval,

c. At least four customers will arrive in 30 minutes interval,

(06 Marks)

iii. Quarterly family expenses for education of 480 families in an urban area of a district is normally distributed with a mean annual expenses of Rs. 48,000 and standard deviation of Rs.3, 600. If a family of the urban city is selected randomly,

a. What is the probability that the quarterly family expenses for education is greater than Rs. 55, 000?

b. What is the probability that the quarterly family expenses for education is in between Rs. 45,000 and Rs.51, 000.

c. What is the probability that the quarterly family expenses for education is in between Rs. 51,000 and Rs.56, 000.

d. Determine the number of families who will be spent quarterly family expenses for education is in between Rs. 41 000 and Rs. 45, 000?

e. What is the probability that the quarterly family expenses for education is less than Rs. 43, 000?

(11 Marks)

(Total 20 Marks)

Question No. 05

i. "It is better to consider the scale of measurement before selecting an appropriate statistical method for measuring the relationship between two variables." Examine using relevant examples.

(04 Marks)

ii. The evaluation of two education specialists on fifteen education programs in different television channels are given by the following table.

Program	Education Specialist -**X**	Education Specialist -**Y**
A	4	6
B	3	5
C	7	7
D	2	3
E	5	4
F	13	10
G	12	9
H	14	15
I	9	11
J	1	2
K	15	12
L	6	1
M	10	13
N	11	14
O	8	8

Determine whether there is a relationship between the level of preference **Specialist-X** and **Specialist-Y** on reality programs in different television channels.

(08 Marks)

iii. The relationship between the current salary of 474 employees and other selected variables is measured through the Karl Pearson's correlation coefficient. The SPSS correlation matrix is given below.

Correlations

		Current Salary	Beginning Salary	Previous Experience (months)	Educational Level (years)
Current Salary	Pearson Correlation	1	.880**	-.097*	.661**
	Sig. (2-tailed)		.000	.034	.000
	N	474	474	474	474
Beginning Salary	Pearson Correlation	.880**	1	.045	.633**
	Sig. (2-tailed)	.000		.327	.000
	N	474	474	474	474
Previous Experience (months)	Pearson Correlation	-.097*	.045	1	-.252**
	Sig. (2-tailed)	.034	.327		.000
	N	474	474	474	474
Educational Level (years)	Pearson Correlation	.661**	.633**	-.252**	1
	Sig. (2-tailed)	.000	.000	.000	
	N	474	474	474	474

**. Correlation is significant at the 0.01 level (2-tailed).

*. Correlation is significant at the 0.05 level (2-tailed).

You are required to,

a. Construct three hypotheses to test the relationship between current salary of employees and other selected independent variables namely, beginning salary, previous experience and education level.

b. Test each hypothesis using the above information in the correlation matrix and discuss the nature and degree of relationship between the relationship between current salary of employees and other selected variables.

(08 Marks)

(Total 20 Marks)

Question No.06

i. "Graphical methods as well as mathematical method (formulae) can be used to determine the nature and degree of relationship between two variables." Examine

(04 Marks)

ii. A simple random sample of 10 families in a large city yielded the following information on monthly family income and monthly expenditure on food (Rs.' 000).

Family Number	Family Income (Rs. '000)	Family Expenses for Foods (Rs. '000)
1	60	20
2	85	30
3	65	25
4	95	35
5	85	35
6	80	30
7	88	25
8	50	22
9	70	25
10	99	45

Using the above data, **you are required to;**

a. Draw a scatter diagram for showing the nature of relationship between monthly family income and monthly family expenditure for foods.

(03 Marks)

b. Compute the Karl Pearson's correlation coefficient between the monthly family income and monthly family expenditure for foods and interpret your result.

(05 Marks)

c. Construct a regression line to show the net profit of the company on total sales and predict the monthly family expenditure for foods for next year when expected monthly family income is Rs. 90 000.

(05 Marks)

d. Determine the coefficient of determination and interpret your result.

(03 Marks)

(Total 20 Marks)

<u>Question No. 07</u>

i. "A time series can be decomposed into a number of components." State the components of time series using examples.

(04 Marks)

ii. Explain how seasonally adjusted and trend estimates are derived from a time series.

(03 Marks)

iii. The values of quarterly sales of **"Sinha"** Furniture Company over a four year period are shown in the table.

Year	Quarterly Sales Rs. '000			
	Q1	**Q2**	**Q3**	**Q4**
2012	220	250	75	125
2013	305	330	185	235
2014	405	455	275	320
2015	440	485	325	405

Using the above data, **you are required to;**

a. Construct a time-series plot and state what type of pattern exist in the data.

b. Construct the linear trend equation for this time series data by using the ordinary least square method.

c. Forecast the annual sales of **"Sinha"** company limited for the first quarter and second quarter of year 2016.

d. Calculate the average seasonal variations (seasonal index) for the four quarters, using multiplicative model and determine depersonalized sales.

(13 Marks)

(Total 20 Marks)

Question No. 08

i. Briefly explain the key steps of hypothesis testing process.

(05 Marks)

ii. Critically evaluate the simple random sampling, stratified sampling and systematic sampling methods by indicating the benefits and drawbacks of each method in collecting data.

(07 Marks)

iii. A random sample of 200 middle level managers in the manufacturing industry is taken and each middle level manager asked their annual income (in Rs.). These 200 mangers have a mean income of Rs. 105 000, with a standard deviation of Rs. 6500. You may assume that annual income of middle level managers is normally distributed.

a. What is your estimate for the average annual income of all managers at 95% confidence level?

b. According to the director general of the chamber of commerce, the underlying mean income of a middle level manger is exactly Rs. 120, 000. Perform an appropriate test of the claim of the director general of the chamber at the 5% significance level.

(08 Marks)

(Total 20 Marks)

Statistics Formulas

Binomial Distribution

$P(x=x_1) = nC_x\, p^x\, q^{(n-1)}$

Poisson distribution

$$P(X=0) = \frac{e^{-\lambda}\lambda^{x}}{x!}$$

Standard Normal

$$Z = \frac{X - \mu}{\sigma}$$

Corrélation Coefficient (Karl pearson's) =

$$\frac{n(\Sigma XY) - (\Sigma X)(\Sigma Y)}{\sqrt{[n(\Sigma X^2) - (\Sigma X)^2]\,[n(\Sigma Y^2) - (\Sigma Y)^2]}}$$

Regression Line (Y on X)

$$\beta_1 = \frac{n\,\Sigma XY - (\Sigma X)(\Sigma Y)}{n\,\Sigma X^2 - (\Sigma X)^2}$$

$$\beta_0 = \Sigma Y/n - \beta 1\,(\Sigma X/n)$$

Median = $L_1 + \left(\frac{N/2 - F_m}{f_m}\right) * C$

Where,

L_1 is the lower boundary of the median class.

F is the cumulative total frequency below the median class.

f is the frequency of the median class.

N is the sum of the frequency

C is the width of the median class.

Standard Deviation

$$S.D = \sqrt{\frac{\sum_{j=1}^{c} f\,(m_j - \overline{X})^2}{N}}$$

Variance

$$\sigma^2 = \frac{\sum_{i=1}^{N} (X_i - \mu)^2}{N}$$

$$\textbf{Mode} = \mathbf{L_1} + \left(\frac{\Delta_1}{\Delta_1 + \Delta_2} \right) * \mathbf{C}$$

Where,

L_1 = Lower boundary of the model class

Δ_1 = Difference of frequencies of Model class and the previous class (Lower)

Δ_2 =Difference of frequencies of Model class and the preceding class (Higher)

C = Class Size

Arithmetic Mean

$$\overline{X} = \frac{\sum_{i=1}^{n} X_i}{n} = \frac{X_1 + X_2 + \cdots + X_n}{n}$$

$$\overline{X} = A + \frac{\Sigma fd}{\Sigma f}$$

$$\overline{X} = \frac{\sum_{j=1}^{c} m_j f_j}{n}$$

Where n = number of values or sample size

c = number of classes in the frequency distribution

m_j = midpoint of the j^{th} class

f_j = number of values in the j^{th} class

Combined Mean

$$\overline{X}_{12} = \frac{N1\,\overline{X}_1 + N_2\,\overline{X}_2}{N_1 + N_2}$$

Combined Standard Deviation:

$$\sigma_{12} = \sqrt{\frac{N_1\,\sigma_1^2 + N_2\,\sigma_2^2 + N_1 d_1^2 + N_2 d_2^2}{N_1 + N_2}}$$

Spearman's Rank Correlation Coefficient $= 1 - \dfrac{6\ \Sigma d^2}{n\,(n^2 - 1)}$

Confidence Interval for μ (σ Known)

$$\overline{X} \pm Z_{\alpha/2} \frac{\sigma}{\sqrt{n}}$$

Confidence Interval for μ (σ Unknown)

$$\overline{X} \pm t_{\alpha/2} \frac{S}{\sqrt{n}}$$

Confidence Intervals for the Population Proportion, p

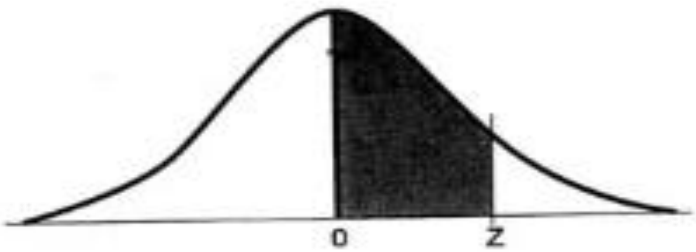
$$\bar{p} \pm z_{\alpha/2}\sqrt{\frac{\bar{p}(1-\bar{p})}{n}}$$

Test Statistics for Z-Distribution

$$z = \frac{\bar{x}-\mu}{\frac{\sigma}{\sqrt{n}}}$$

Test Statistics for t-Distribution

$$t_{n-1} = \frac{\bar{x}-\mu}{\frac{s}{\sqrt{n}}}$$



This table presents the area between the mean and the Z score . When Z=1.96, the shaded area is 0.4750.

Areas Under the Standard Normal Curve

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	.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	.4554	.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
3.1	.4990	.4991	.4991	.4991	.4992	.4992	.4992	.4992	.4993	.4993
3.2	.4993	.4993	.4994	.4994	.4994	.4994	.4994	.4995	.4995	.4995
3.3	.4995	.4995	.4995	.4996	.4996	.4996	.4996	.4996	.4996	.4997
3.4	.4997	.4997	.4997	.4997	.4997	.4997	.4997	.4997	.4997	.4998
3.6	.4998	.4998	.4999	.4999	.4999	.4999	.4999	.4999	.4999	.4999
3.9	.5000									

Source: Adapted by permission from *Statistical Methods* by George W. Snedecor and William G. Cochran, sixth editic

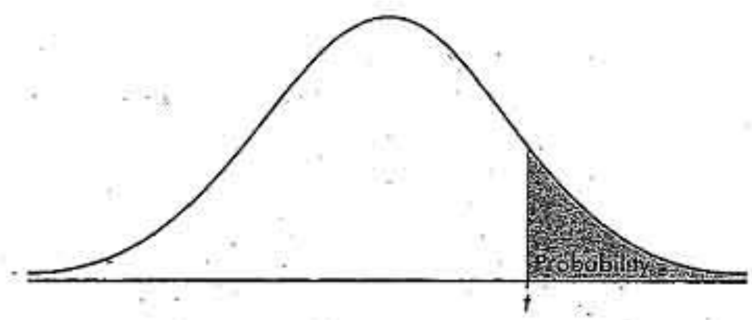


TABLE B: *t*-DISTRIBUTION CRITICAL VALUES

	Tail probability p											
df	.25	.20	.15	.10	.05	.025	.02	.01	.005	.0025	.001	.0005
1	1.000	1.376	1.963	3.078	6.314	12.71	15.89	31.82	63.66	127.3	318.3	636.6
2	.816	1.061	1.386	1.886	2.920	4.303	4.849	6.965	9.925	14.09	22.33	31.60
3	.765	.978	1.250	1.638	2.353	3.182	3.482	4.541	5.841	7.453	10.21	12.92
4	.741	.941	1.190	1.533	2.132	2.776	2.999	3.747	4.604	5.598	7.173	8.610
5	.727	.920	1.156	1.476	2.015	2.571	2.757	3.365	4.032	4.773	5.893	6.869
6	.718	.906	1.134	1.440	1.943	2.447	2.612	3.143	3.707	4.317	5.208	5.959
7	.711	.896	1.119	1.415	1.895	2.365	2.517	2.998	3.499	4.029	4.785	5.408
8	.706	.889	1.108	1.397	1.860	2.306	2.449	2.896	3.355	3.833	4.501	5.041
9	.703	.883	1.100	1.383	1.833	2.262	2.398	2.821	3.250	3.690	4.297	4.781
10	.700	.879	1.093	1.372	1.812	2.228	2.359	2.764	3.169	3.581	4.144	4.587
11	.697	.876	1.088	1.363	1.796	2.201	2.328	2.718	3.106	3.497	4.025	4.437
12	.695	.873	1.083	1.356	1.782	2.179	2.303	2.681	3.055	3.428	3.930	4.318
13	.694	.870	1.079	1.350	1.771	2.160	2.282	2.650	3.012	3.372	3.852	4.221
14	.692	.868	1.076	1.345	1.761	2.145	2.264	2.624	2.977	3.326	3.787	4.140
15	.691	.866	1.074	1.341	1.753	2.131	2.249	2.602	2.947	3.286	3.733	4.073
16	.690	.865	1.071	1.337	1.746	2.120	2.235	2.583	2.921	3.252	3.686	4.015
17	.689	.863	1.069	1.333	1.740	2.110	2.224	2.567	2.898	3.222	3.646	3.965
18	.688	.862	1.067	1.330	1.734	2.101	2.214	2.552	2.878	3.197	3.611	3.922
19	.688	.861	1.066	1.328	1.729	2.093	2.205	2.539	2.861	3.174	3.579	3.883
20	.687	.860	1.064	1.325	1.725	2.086	2.197	2.528	2.845	3.153	3.552	3.850
21	.686	.859	1.063	1.323	1.721	2.080	2.189	2.518	2.831	3.135	3.527	3.819
22	.686	.858	1.061	1.321	1.717	2.074	2.183	2.508	2.819	3.119	3.505	3.792
23	.685	.858	1.060	1.319	1.714	2.069	2.177	2.500	2.807	3.104	3.485	3.768
24	.685	.857	1.059	1.318	1.711	2.064	2.172	2.492	2.797	3.091	3.467	3.745
25	.684	.856	1.058	1.316	1.708	2.060	2.167	2.485	2.787	3.078	3.450	3.725
26	.684	.856	1.058	1.315	1.706	2.056	2.162	2.479	2.779	3.067	3.435	3.707
27	.684	.855	1.057	1.314	1.703	2.052	2.158	2.473	2.771	3.057	3.421	3.690
28	.683	.855	1.056	1.313	1.701	2.048	2.154	2.467	2.763	3.047	3.408	3.674
29	.683	.854	1.055	1.311	1.699	2.045	2.150	2.462	2.756	3.038	3.396	3.659
30	.683	.854	1.055	1.310	1.697	2.042	2.147	2.457	2.750	3.030	3.385	3.646
40	.681	.851	1.050	1.303	1.684	2.021	2.123	2.423	2.704	2.971	3.307	3.551
50	.679	.849	1.047	1.299	1.676	2.009	2.109	2.403	2.678	2.937	3.261	3.496
60	.679	.848	1.045	1.296	1.671	2.000	2.099	2.390	2.660	2.915	3.232	3.460
80	.678	.846	1.043	1.292	1.664	1.990	2.088	2.374	2.639	2.887	3.195	3.416
100	.677	.845	1.042	1.290	1.660	1.984	2.081	2.364	2.626	2.871	3.174	3.390
1000	.675	.842	1.037	1.282	1.646	1.962	2.056	2.330	2.581	2.813	3.098	3.300
∞	.674	.841	1.036	1.282	1.645	1.960	2.054	2.326	2.576	2.807	3.091	3.291
	50%	60%	70%	80%	90%	95%	96%	98%	99%	99.5%	99.8%	99.9%
	Confidence level C											