ROYAL CIVIL SERVICE COMMISSION
BHUTAN CIVIL SERVICE EXAMINATION (BCSE) 2016
EXAMINATION CATEGORY: TECHNICAL

PAPER III: SUBJECT SPECIALIZATION PAPER FOR STATISTICS

Date:	2 October 2016
Total Marks:	100
Examination Time:	150 minutes (2.5 hours)
Reading Time:	15 minutes *(prior to examination time)*

GENERAL INSTRUCTIONS

1. Write your Registration Number clearly and correctly on the Answer Booklet.
2. The first 15 minutes is being provided to check the number of pages, printing error, clarify doubts and to read instructions in Question Paper. You are NOT permitted to write during this time.
3. This paper consists of **TWO Sections, namely Section A and Section B.**

   Section A has two parts: Part I - **30 Multiple Choice Questions.**
   Part II - **4 Short Answer Questions.**

   All questions under **Section A** are **COMPULSORY.**

   Section B consists of 2 case studies. Choose only **ONE** case study and answer the questions under your choice.
4. All answers should be written on the Answer Booklet provided to you. Candidates are not allowed to write anything on the question paper. If required, ask for additional Answer Booklet.
5. All answers should be written with correct numbering of Section, Part and Question Number in the Answer Booklet provided to you. Note that any answer written without indicating correct Section, Part and Question Number will NOT be evaluated and no marks would be awarded.
6. Begin each Section and Part in a fresh page of the Answer Booklet.
7. You are not permitted to tear off any sheet(s) of the Answer Booklet as well as the Question Paper.
8. Use of any other paper including paper for rough work is not permitted.
9. You are required to hand over the Answer Booklet to the Invigilator before leaving the examination hall.
10. The Question paper has 7 printed pages including this Instruction Page.

GOOD LUCK!

SECTION A

PART I – Multiple Choice Questions (30 marks)

Choose the correct answer and write down the letter of your chosen answer in the AnswerBooklet against the question number e.g. 31 (c). Each question carries ONE mark. Any double writing, smudgy answers or writing more than one choice shall not be evaluated.

1. Which of the following is not a method applied in collecting primary data?
   a. Direct personal interviews
   b. Information from correspondents
   c. Mailed questionnaire method
   d. Information from published sources

2. The mean of the distribution is 23, the median is 24 and mode is 25. It is most likely that the distribution is
   a. Positively skewed
   b. Symmetric
   c. Asymptotic
   d. Negatively Skewed

3. A chance variation in an observation process is
   a. Dispersion
   b. Measurement error
   c. Random error
   d. Instrument error

4. Which of the following would be most likely to produce selection bias in a survey?
   a. Using questions with biased wording.
   b. Only receiving responses from half of the people in the sample.
   c. Conducting interviews by telephone instead of in person.
   d. Using a random sample of students at a college to estimate the proportion of people who think the legal drinking age should be lowered.

5. A chi-square test involves a set of counts called "expected counts." What are the expected counts?
   a. Hypothetical counts that would occur of the alternative hypothesis were true.
   b. Hypothetical counts that would occur if the null hypothesis were true.
   c. The actual counts that did occur in the observed data.
   d. The long-run counts that would be expected if the observed counts are representative.

6. Which of the following is not a component of a time series?
   a. Secular trend
   b. Seasonal variations
   c. Cyclical Variations
   d. Regular variations

7. Which of the following is not a property of a good estimator?
   a. Biasedness
   b. Consistency
   c. Efficiency
   d. Sufficiency

8. Which of the following statement(s) is or are true?

   I. All variables can be classified as quantitative or categorical variables
   II. Categorical variables can be continuous variables
   III. Quantitative variables can be discrete variables

   a. I only
   b. II only
   c. III only
   d. I and III

9. Which of the following statement(s) is or are true?

   I. The mean of a population is denoted by x
   II. Sample size is never bigger than population size
   III. The population mean is a statistic

   a. I only
   b. II only
   c. III only
   d. None of the above

10. In hypothesis testing, which of the following statement is always true?
    a. The P-value is greater than the significance level.
    b. The P-value is computed from the significance level.
    c. The P-value is a probability.
    d. The P-value is a test statistic.

11. Which of the following is not true about probability?
    a. Two events are mutually exclusive or disjoint if they cannot occur at the same time.
    b. The probability that Event A occurs, given that Event B has occurred, is called a conditional probability.
    c. The probability that Events A and B *both* occur is the probability of the union of A and B
    d. If the occurrence of Event A changes the probability of Event B, then Events A and B are dependent.

12. Which of the following is not true about standard error?
    a. It is used to measure the spread of values of statistic about the expected value of that statistic.
    b. It is used to construct confidence intervals.
    c. It is used to test the null hypothesis about the population parameter(s).
    d. It is identical to the standard deviation, except that it uses parameter while standard deviation uses statistics.

13. If mean is 25 and standard deviation is 5, then C.V (coefficient of variation) is
    a. 5%
    b. 20%
    c. 25%
    d. 500%

14. Second moment about mean is
    a. Mean
    b. Standard deviation
    c. Coefficient of Variation
    d. Variance

15. Whenever using the t distribution in estimation, we must assume that
    a. the sample size is at least 30.
    b. the sampling distribution is approximately normal.
    c. the population is approximately normal.
    d. the finite population correction factor is necessary.

16. The ANOVA procedure is a statistical approach for determining whether or not
    a. the means of two samples are equal.
    b. the means of two or more samples are equal.
    c. the means of more than two samples are equal.
    d. the means of two or more populations are equal.

17. Which of the following is not a property of a binomial experiment?
    a. The experiment consists of a sequence of n identical trials.
    b. Each outcome can be referred to as a success or a failure.
    c. The probabilities of the two outcomes can change from one trial to the next.
    d. The trials are independent.

18. Convenience sampling is an example of
    a. Probabilistic sampling
    b. Stratified sampling
    c. Non-probabilistic sampling
    d. Cluster sampling

19. The level of significance is the
    a. maximum allowable probability of Type II error.
    b. maximum allowable probability of Type I error.
    c. same as the confidence coefficient.
    d. same as the p-value.

20. What is the distinctions between a population parameter and a sample statistic?
    a. A population parameter is only based on conceptual measurements, but a sample statistic is based on a combination of real and conceptual measurements.
    b. A sample statistic changes each time you try to measure it, but a population parameter remains fixed.
    c. A population parameter changes each time you try to measure it, but a sample statistic remains fixed across samples.
    d. The true value of a sample statistic can never be known but the true value of a population parameter can be known.

21. Two types of errors associated with hypothesis testing are Type I and Type II. Type II error is committed when
    a. we reject the null hypothesis whilst the alternative hypothesis is true.
    b. we fail to reject a null hypothesis when it is not true.
    c. we reject a null hypothesis when it is true.
    d. None of the above.

22. Parametric test, unlike the non-parametric tests, make certain assumptions about
    a. The population size
    b. The underlying distribution
    c. The sample size
    d. All of the above

23. Consumer Price Index (CPI) falls in the category of
    a. A simple index
    b. An aggregate index
    c. A Inflationary index
    d. None of the above

24. Another name for the regression method is
    a. Linear method
    b. Univariate method
    c. Time series method
    d. Causal method

25. Two events are mutually exclusive if
    a. they are exclusively connected.
    b. they cannot occur together.
    c. they exclusively include mutuality.
    d. they occur simultaneously.

26. The mean of the sample means is
    a. a biased estimator of the population.
    b. an unbiased estimator of the population mean.
    c. an unbiased estimator of the population variance.
    d. All of the above

27. The most commonly used formula to describe linear relationship is
    a. $\hat{y} = b_0 + b_1x + b_2x^2$
    b. $\hat{y} = b_0 + b_1x$
    c. $\hat{y} = b_0 + b_1x + b_2x^3$
    d. $\hat{y} = b_0 + b_1x^2$

28. For the chi-square test to be effective, the expected value for each cell in the contingency table has to be at least
    a. 3
    b. 5
    c. 10
    d. 30

29. The null hypothesis of the sign test is that
    a. Half the ranks to be less than the median and half greater than the median.
    b. Half the ranks to be less than the mean and half greater than the mean.
    c. The lower half the ranks to have the same mean as the upper half.
    d. The lower half the ranks to have the same standard deviation as the upper half.

30. Ten pairs of piglets were selected to test the effect of a vitamin supplement on early growth. The piglets in each pair were siblings of high birth weight. One piglet in each pair was given the supplement and the other was not. After two months, the weight of each piglet was recorded. The researcher would like to test the research hypothesis that the supplement increases the growth rate of piglets against the null hypothesis that it has no effect. The most appropriate test would be
    a. The normal test
    b. The paired-sample Student-t test
    c. The Student-t test for two independent samples
    d. The chi-squared test of homogeneity

PART II: Short Answer Questions (20 marks)

This part has 4 Short Answer Questions. Answer ALL the questions. Each question carries 5 marks.

1. Consider the data set {52, 55, 58, 59, 63, 66, 68, 70, 74, 83, 87, 88, 89, 90, 91, 92, 93, 95, 99}. Draw stem and leaf plot of this data set.

2. Consider the data set {5,6,7,10, 12}. Compute the sum of squares of this data set. *[Hint:* $SS=\sum x^2=\sum(X-\bar{X})^2$*]*

3. What is a Completely Randomized Design? Explain with an example.

4. Explain Type I and Type II errors in testing of a hypothesis.

SECTION B
Case Study

Choose either Case 1 or 2 from this section. Each case study carries 50 marks.

Case 1

Assume that there is a fund available to conduct a study on alcohol abuse. Your task is to come up with a good proposal. You may use the following structure when writing your proposal.

- Title [3 marks]
- Background information/brief summary of existing literature [10 marks]
- The hypothesis and the objectives [8 marks]
- Methodology (e.g. techniques, sample size, target population and data analysis) [20 marks]
- Ethical considerations [4 marks]
- Dissemination plan [5 marks]

OR

Case 2

From appropriately selected samples, two sets of IQ scores are obtained. For group 1, $\bar{X}$ =104, S=10, and n=16; for group 2, $\bar{X}$ =112, S=8, and n=14. At the 5% significance level is there a significant difference between the two groups? Show all the steps to support your answer. [Note: t-table on the next page].

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t Table

cum. prob	$t_{.50}$	$t_{.75}$	$t_{.80}$	$t_{.85}$	$t_{.90}$	$t_{.95}$	$t_{.975}$	$t_{.99}$	$t_{.995}$	$t_{.999}$	$t_{.9995}$
one-tail	0.50	0.25	0.20	0.15	0.10	0.05	0.025	0.01	0.005	0.001	0.0005
two-tails	1.00	0.50	0.40	0.30	0.20	0.10	0.05	0.02	0.01	0.002	0.001
df											
1	0.000	1.000	1.376	1.963	3.078	6.314	12.71	31.82	63.66	318.31	636.62
2	0.000	0.816	1.061	1.386	1.886	2.920	4.303	6.965	9.925	22.327	31.599
3	0.000	0.765	0.978	1.250	1.638	2.353	3.182	4.541	5.841	10.215	12.924
4	0.000	0.741	0.941	1.190	1.533	2.132	2.776	3.747	4.604	7.173	8.610
5	0.000	0.727	0.920	1.156	1.476	2.015	2.571	3.365	4.032	5.893	6.869
6	0.000	0.718	0.906	1.134	1.440	1.943	2.447	3.143	3.707	5.208	5.959
7	0.000	0.711	0.896	1.119	1.415	1.895	2.365	2.998	3.499	4.785	5.408
8	0.000	0.706	0.889	1.108	1.397	1.860	2.306	2.896	3.355	4.501	5.041
9	0.000	0.703	0.883	1.100	1.383	1.833	2.262	2.821	3.250	4.297	4.781
10	0.000	0.700	0.879	1.093	1.372	1.812	2.228	2.764	3.169	4.144	4.587
11	0.000	0.697	0.876	1.088	1.363	1.796	2.201	2.718	3.106	4.025	4.437
12	0.000	0.695	0.873	1.083	1.356	1.782	2.179	2.681	3.055	3.930	4.318
13	0.000	0.694	0.870	1.079	1.350	1.771	2.160	2.650	3.012	3.852	4.221
14	0.000	0.692	0.868	1.076	1.345	1.761	2.145	2.624	2.977	3.787	4.140
15	0.000	0.691	0.866	1.074	1.341	1.753	2.131	2.602	2.947	3.733	4.073
16	0.000	0.690	0.865	1.071	1.337	1.746	2.120	2.583	2.921	3.686	4.015
17	0.000	0.689	0.863	1.069	1.333	1.740	2.110	2.567	2.898	3.646	3.965
18	0.000	0.688	0.862	1.067	1.330	1.734	2.101	2.552	2.878	3.610	3.922
19	0.000	0.688	0.861	1.066	1.328	1.729	2.093	2.539	2.861	3.579	3.883
20	0.000	0.687	0.860	1.064	1.325	1.725	2.086	2.528	2.845	3.552	3.850
21	0.000	0.686	0.859	1.063	1.323	1.721	2.080	2.518	2.831	3.527	3.819
22	0.000	0.686	0.858	1.061	1.321	1.717	2.074	2.508	2.819	3.505	3.792
23	0.000	0.685	0.858	1.060	1.319	1.714	2.069	2.500	2.807	3.485	3.768
24	0.000	0.685	0.857	1.059	1.318	1.711	2.064	2.492	2.797	3.467	3.745
25	0.000	0.684	0.856	1.058	1.316	1.708	2.060	2.485	2.787	3.450	3.725
26	0.000	0.684	0.856	1.058	1.315	1.706	2.056	2.479	2.779	3.435	3.707
27	0.000	0.684	0.855	1.057	1.314	1.703	2.052	2.473	2.771	3.421	3.690
28	0.000	0.683	0.855	1.056	1.313	1.701	2.048	2.467	2.763	3.408	3.674
29	0.000	0.683	0.854	1.055	1.311	1.699	2.045	2.462	2.756	3.396	3.659
30	0.000	0.683	0.854	1.055	1.310	1.697	2.042	2.457	2.750	3.385	3.646
40	0.000	0.681	0.851	1.050	1.303	1.684	2.021	2.423	2.704	3.307	3.551
60	0.000	0.679	0.848	1.045	1.296	1.671	2.000	2.390	2.660	3.232	3.460
80	0.000	0.678	0.846	1.043	1.292	1.664	1.990	2.374	2.639	3.195	3.416
100	0.000	0.677	0.845	1.042	1.290	1.660	1.984	2.364	2.626	3.174	3.390
1000	0.000	0.675	0.842	1.037	1.282	1.646	1.962	2.330	2.581	3.098	3.300
z	0.000	0.674	0.842	1.036	1.282	1.645	1.960	2.326	2.576	3.090	3.291
	0%	50%	60%	70%	80%	90%	95%	98%	99%	99.8%	99.9%
	Confidence Level										