FEDERAL PUBLIC SERVICE COMMISSION
COMPETITIVE EXAMINATION-2021 FOR RECRUITMENT TO POSTS IN BS-17 UNDER THE FEDERAL GOVERNMENT

Roll Number

STATISTICS

TIME ALLOWED: THREE HOURS	**PART-I (MCQS) MAXIMUM MARKS = 20**
PART-I(MCQS): MAXIMUM 30 MINUTES	**PART-II MAXIMUM MARKS = 80**

NOTE: (i) **Part-II** is to be attempted on the separate **Answer Book.**
(ii) Attempt **ONLY FOUR** questions from **PART-II** by selecting **TWO** questions from **EACH SECTION. ALL** questions carry **EQUAL** marks.
(iii) All the parts (if any) of each Question must be attempted at one place instead of at different places.
(iv) Candidate must write Q. No. in the Answer Book in accordance with Q. No. in the Q.Paper.
(v) No Page/Space be left blank between the answers. All the blank pages of Answer Book must be crossed.
(vi) Extra attempt of any question or any part of the attempted question will not be considered.
(vii) **Use of Calculator is allowed.**
(viii) **Use of statistical table is allowed.**

PART-II
SECTION – A

Q. 2. **(a)** Describe the measures of central tendency. What is the purpose served by it? What are its desirable qualities? (08)

(b) A man gets rise of 10% in salary at the end of his first year of service and further rises of 20% and 25% respectively at the end of second and third years. The rise in each year being calculated on his salary at the beginning of the year. What annual percentage increases in this equivalent? (06)

(c) The following has been obtained from two different frequency distributions of Weights (lb) having 125 and 200 observations after making the substitution. (06) **(20)**

$X = 16 + 5u,\ Y = 20 + 2v,$

(i) $\sum fu = -46,\ \sum fu^2 = 306,\ \sum fu^3 = -242,\ \sum fu^4 = 1962.$

(ii) $\sum fv = 21,\ \sum fv^2 = 1265,\ \sum fv^3 = -627,\ \sum fv^4 = 14169.$

Find (i) Which of the distributions is more consistent? (ii) Which of the distribution is negatively skewed? (iii) Which of the distribution is mesokurtic?

Q. 3. **(a)** Describe the linear regression model. Explain the assumptions underlying the linear regression model. (08)

(b) An instructor of mathematics wished to determine the relationship of grades on a final examination to grades on two quizzes given during the semester. Calling X_1, X_2 and X_3 the grades of a student on the first quiz, second quiz and final examination respectively. He made the following computations for a total of 120 students. (06)

$\bar{X}_1 = 6.8,\ S_1 = 1.0,\ r_{12} = 0.60,\ \bar{X}_2 = 7.0,\ S_2 = 0.8,\ r_{13} = 0.70,\ \bar{X}_3 = 74,\ S_3 = 9.0,$

$r_{23} = 0.65.$

(i) Find the least-squares regression equation of X_3 on X_1 and X_2.

(ii) Estimate the final grades of two students who scored respectively (I) 9 and 7, (II) 4 and 8, on the two quizzes. (iii) Compute $R_{3.12}$.

(c) Why non-parametric tests are important? Describe the run test in detail and give its advantages and disadvantages. (06) **(20)**

Q. 4. **(a)** Describe the random experiment and give its properties. Also discuss the mutually exclusive events with two real life examples. (08)

(b) An urn contains four balls which are known to be either: (i) all white or (ii) two white and two black. A ball is drawn at random and is found to be white. What is the probability that all the balls are white? (06)

(c) Describe the hypergeometric distribution and give its properties. In real life under what situations we can use it? (06) **(20)**

STATISTICS

SECTION-B

Q. 5. **(a)** Describe the probability and non-probability sampling methods. Also differentiate between multiphase and multistage sampling. (08)

(b) A sample of size $n=3$ is selected by using without replacement sampling from a population having $N=5$ units whose values are 0, 3, 6, 9 and 12. (i) Find the sampling distribution of the sample mean $(\bar{X})$. (ii) Calculate the mean and standard deviation of $\bar{X}$, and verify that $\sigma_{\bar{x}}^2 = \frac{\sigma^2}{n}\left(\frac{N-n}{N-1}\right)$. (06)

(c) A population consists of 5 observations 1, 2, 3, 4, 5. Draw all possible samples of size 2 without replacement. Find the mean of the sampling distribution of the variances. Compare it with the variance of the population. (06) **(20)**

Q. 6. **(a)** Differentiate between simple and composite hypothesis. Also describe the importance of type-I and type-II errors. (08)

(b) In a poll of college students in a large state university, 300 of 400 students living in dormitories approved a certain course of action, whereas 200 of 300 students not living in dormitories approved it. Estimate the difference in proportions favoring the course and compare 95% confidence interval for it. (06)

(c) A manufacturer of house-dresses sent out advertising by mail. He sent samples of material to each of 2 groups of 1000 women. For one group, he enclosed a white return envelope and for the other group, a blue envelope. He received orders from 10% to 30% respectively. Do the data indicates that the colour of the envelope has an effect on the sales? Use 5% level of significance. (06) **(20)**

Q. 7. **(a)** Describe the point estimation. Also discuss the properties of good point estimator with two real life examples. (08)

(b) Describe the chi-square test for goodness-of-fit. Also discuss its procedure for analysis. (06)

(c) The following table shows the number of male and female births in 800 families having 4 children. (06) **(20)**

Number of male births	0	1	2	3	4
Families	32	178	290	236	64

Test whether the data are consistent with the hypothesis that the binomial law holds and that the chance of a male birth is equal to that of a female birth i.e. $p = q = 1/2$.

Q.8. **(a)** Describe the importance of vital statistics with its uses and shortcomings. (08)

(b) From the following data, find the gross and net-reproduction rates by assuming sex-ratio at birth to be 105.2%. (06)

Age group (Years)	Female Population	Registered births	Survival among females out of 1000
15-19	8981	1835	634
20-24	5875	2616	602
25-29	3613	2563	568
30-34	3380	1062	530
35-39	3345	558	488
40-44	3248	37	444

(c) Describe the "Nation Income", "Gross and Domestic Product" and "Saving and Wealth" in terms of country's economy. (06) **(20)**

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