FEDERAL PUBLIC SERVICE COMMISSION
COMPETITIVE EXAMINATION-2023 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)** Calculate the Q1, median and Q3 from the following distribution of weight of containers in Kg, and comment on the symmetry of distribution. (10)

Weight (Kg)	18- 26	27- 35	36- 44	45- 53	54- 62	63- 71	72- 80
# of Containers	13	20	39	40	25	6	12

(b) What is frequency distribution? Discuss briefly the steps involve in construction of frequency distribution. (05)

(c) The first three moments of a distribution about the value 2 of the variable are 1, 16 and -40. Show that the mean is 3, the variance 15 and m3 is -86. Also show that the first three moments about x=0 are 3, 24 and 76. (05) (5) **(20)**

Q. 3. **(a)** From the following data, determine the linear regression equations of X_1 on X_3 and of X_2 on X_3. (10)

X_1	07	12	14	17	20
X_2	04	07	08	09	12
X_3	01	02	04	05	08

Find the deviations of observed values of X_1 from the regression, i.e., $X_{1.3}$. Repeat the same of X_2, i.e., obtain $X_{2.3}$. Determine the simple correlation co-efficient between the two sets of deviations $X_{1.3}$ and $X_{2.3}$.

(b) What is meant by: (05)
(i) Regression **(ii)** Regresand **(iii)** Regressor **(iv)** Regressor co-efficient

(c) Describe the Properties of the correlation co-efficient? (05) **(20)**

Q. 4. **(a)** Derive the Poisson distribution as the limiting form of the binomial distribution, stating clearly the assumptions you make. (08)

(b) Enumerate all the possible (i) combinations and (ii) permutations of 3 letters chosen from the four letters A, B, C, and D. (06)

(c) A box contains 4 bad and 6 good tubes. Two tubes are drawn together at random. One of them is tested and found to be good. What is the probability that other one is good? (06) **(20)**

STATISTICS

SECTION-B

Q. 5. **(a)** Draw all possible random sample of size n_1=2 with replacement from a finite population consisting of 4, 6, 8. Similarly draw all possible random samples n_2=2 with replacement from another finite population consisting of 1, 2, 3. (12)

(i) Find the possible difference between the sample means of the two populations.

(ii) Construct the sampling distributions of $\bar{x}_1 - \bar{x}_2$ and compute its mean and variance.

(iii) Verify that $\mu_{\bar{x}_{1-\bar{x}_2}} = \mu_1 - \mu_2$ and $\sigma^2_{\bar{x}_{1-\bar{x}_2}} = \frac{\sigma_1^2}{n_1} + \frac{\sigma_2^2}{n_2}$

(b) Explain sampling and non-sampling errors. What method would you suggest to control each type of error? (08) **(20)**

Q. 6. **(a)** The two samples A and B detailed below, were taken from normal populations of standard deviation 0.8. Test whether the difference of means is significant (12)

A	10.5,	11.6,	12.7,	12.9,	13.5,	13.6,	14.8	
B	11.3,	12.4,	12.4,	13.9,	14.2,	14.7,	14.9,	15.6

(b) Explain with examples the difference between: (08) **(20)**

(i) Null and Alternative hypothesis **(ii)** Simple and composite hypothesis

(iii) Type I-error and Type II-error **(iv)** Critical and non-critical region.

Q. 7. **(a)** The following data represent the result of 3 questions obtained by 3 students in three subjects: (12)

Students	Subjects		
	English	Mathematics	Statistics
1	13	23	22
	18	20	23
	15	16	20
2	21	20	20
	16	14	15
	24	24	22
3	18	17	19
	15	13	21
	12	16	18

Perform an analysis of variance upon these data and test the hypothesis that:

(i) The subjects are of equal difficulty.

(ii) The students are of equal ability, and

(iii) The students and subjects do not interact.

(b) Discuss why using multiple two-sample t-tests is not an appropriate alternative of analysis of variance? (08) **(20)**

Q.8. **(a)** Given the population 1, 1, 1, 3, 4, 5, 6, 6, 6, and 7. Find (10)

(i) The probability that a random sample of size 36 selected with replacement will yield sample mean between 3.26 and 4.74

(ii) The mean and standard deviation for the sampling distribution of means for a sample size of 4 selected at random without replacement. Between what values would you expect at least ¾ of the sample mean to fall?

(b) Explain sampling and non-sampling errors. What methods would you suggest to control each type of error? (05)

(c) Explain with examples the following properties of a point estimator: (05) **(20)**

(i) Unbiasedness, **(ii)** Consistency, and **(iii)** Efficiency.

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