FEDERAL PUBLIC SERVICE COMMISSION
COMPETITIVE EXAMINATION-2020
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)** Two bags A and B contain red and blue marbles. Bag A contains 7 red and 8 blue marbles. Bag B contains 9 red and 7 blue marbles. One bag is selected randomly and one marble is drawn. If the drawn marble is red then what is the probability that this drawn marble is from bag A? (10)

(b) For the given set of observations showing weekly sale of a specific type of refrigerators. (10) **(20)**

35, 56, 43, 21, 43, 56, 78, 12, 56, 47, 76, 23, 52

(i) Find mean and standard deviation.
(ii) Find and describe $\bar{x} \pm 2(sd)$

Q. 3. Raw material used in the production of a synthetic fiber is stored in a place that has no humidity control. Measurements of the relative humidity (y) and moisture control (x), on ten days, are given below. Fit a Least Square model: **(20)**
$y = \beta_1 + \beta_2 x$. Further find and explain coefficient of determination.

Humidity	46	53	37	42	34	29	60	48	41	48
Moisture	12	14	11	13	10	8	17	12	10	15

Q. 4. Three teaching methods were implemented to a homogenous group of school level students. Groups of students, selected randomly, were taught with a particular method and their scores were recorded as given below: **(20)**

Method A 94, 88, 91, 74, 87, 97
Method B 85, 82, 79, 84, 61, 72, 80
Method C 89, 67, 72, 76, 69

Use Kruskal-Wallis Test, at 5% level of significance to test the hypothesis that, on average there is no significant difference between the average score of these teaching methods.

SECTION-B

Q. 5. **(a)** Draw all possible samples of size 3, without replacement, from the population, 6, 12, 3, 9, 15, and 21. Find sample means and prove the following relationships, using usual notations. (15)

(i) $E(\bar{x}) = \mu$ and (ii) $V(\bar{x}) = \frac{\sigma^2}{n}\left(\frac{N-n}{N-1}\right)$

(b) Define Stratified Random sampling method, identify situations where this type of sampling is beneficial. Give an example. (5) **(20)**

Q. 6. **(a)** To compare the effectiveness of two medicines M1 and M2, for headache, a study was conducted. Samples from a homogeneous group of headache patients were selected randomly and administered M1 (six patients) and M2 (8 patients) selected randomly. Recovery times (in minutes) of Patients were recorded as follows: (15)

Medicine M1	12	9	8	11	10	9		
Medicine M2	5	11	7	6	8	6	5	4

Could it be concluded at 5% level of significance that, on average, medicine M2 is better than M1?

(b) While testing hypothesis one may commit errors when we make decisions. State and explain such errors, supporting by real life example. (5) **(20)**

Q.7. **(a)** The following Latin Square layout displays the scores secured by nine college students. Students are of different ethnic background and various professional interests. (15)

Professional Interest	Ethnic Background		
	X	Y	Z
Law	A 75	B 86	C 69
Medicine	B 95	C 79	A 86
Engineering	C 70	A 83	B 93

In this table A, B, and C are the three instructors. Analyze and test following hypotheses, Use $\alpha = 0.05$.

(i) Having a different instructor has no effect on the scores.
(ii) Differences in ethnic backgrounds have no effect on the scores
(iii) Differences in professional interest have no effect on the scores.

(b) Describe the role of Multiple Comparison tests in Analysis of Variance. Name few Multiple Comparison tests and explain one method. (5) **(20)**

Q.8. **(a)** Explain the terms Demography and Vital statistics. List few sources of demographic data both locally and globally. (5)

(b) Using the information given in the following table. Calculate Total Fertility Rate (TFR) and Gross Fertility Rate (GFR). (10)

Age (years)	Women Population	No of births to women
15-19	84790	343
20-24	70010	14541
25-29	72660	16736
30-34	75920	12218
35-39	75100	756
40-44	71620	82
45-49	66660	45

(c) Differentiate between Rates and Ratios. Explain Crude Death Rate and Specific Death Rate. (5) **(20)**

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