

FEDERAL PUBLIC SERVICE COMMISSION **COMPETITIVE EXAMINATION-2019** FOR RECRUITMENT TO POSTS IN BS-17 **UNDER THE FEDERAL GOVERNMENT**

STATISTICS

TIME ALLOWED: THREE HOURS		PART-I (MCQS)	MAXIMUM MARKS = 20			
PART-I(M	CQS): MAXIMUM 30 MINUTES	PART-II	MAXIMUM MARKS = 80			
NOTE: (i)	E: (i) Part-II is to be attempted on the separate Answer Book.					
(ii)	Attempt ONLY FOUR questions from	m PART-II by selecting	TWO questions from EACH			
	SECTION. ALL questions carry EQUAL marks.					
(iii)	All the parts (if any) of each Question must	t be attempted at one place in	nstead of at different places.			

- (iv) 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 question will not be considered.
- (vii) Use of Calculator is allowed.

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<u>PART – II</u> SECTION – I

- What is meant by a frequency distribution? Describe briefly the main steps in the (6) **Q.** 2. **(a)** preparation of a frequency table from raw data.
 - A man travels from A to B at average speed of 30 miles per hour and returns from B **(b)** (6)to A along the same route at an average speed of 60 miles per hour. Find the average speed of the entire journey.
 - (c) Define mean-deviation and its co-efficient. Discuss its advantages and uses. (8)Estimate the mean deviation from the arithmetic mean of the following set of examination marks

narks.								
Marks	0-9	10-19	20-29	30-39	40-49	50-59	60-69	70-79
No. of	2	3	8	24	27	40	11	5
students								

- 0.3. (a) Define mutually exclusive events. State and prove the theorem of addition of (6) probabilities concerning mutually exclusive events.
 - Show that the multiplication law $P(A \land B) = P(A/B)P(B)$, established for two events, may be **(b)** (6)generalized to three events as follows;
 - $P(A \land B \land C) = P(A/B \land C) P(B/C) P(C)$
 - There are three coins, identical in appearance, one of which is ideal and the other (8)(20)(c) two biased with probabilities 1/3 and 2/3 respectively for a head. One coin is taken at random and tossed twice. If a head appears both the times, what is the probability that the ideal coin was chosen?
- (i) Explain briefly how the principle of least squares is used to find a regression (6) **Q.4**. (a) line based on a sample of size n. Illustrate on a rough sketch the distance whose squares are minimized, taking care to distinguish the dependent and independent variables.
 - (ii) Find the least square estimates of parameters in a simple linear regression model $Y_i = \alpha + \beta X_i + e_i$ where e_i s are distributed independently with mean and constant variance. zero

 - What are the properties of least square regression line? (iii)
 - The following means, standard deviations and correlations are found for **(b)** (6) X_1 = Seed-hay crops in owts. Per acre
 - $X_2 =$ Spring rainfall in inches

 X_3 = Accumulated temperature above 42° F in spring in a certain district in England during 20 years.

$$\begin{array}{ll} \bar{X}_1 = 28.02, & S_1 = 4.42, & r_{12} = 0.80, \\ \bar{X}_2 = 4.91, & S_2 = 1.10, & r_{13} = -0.40, \\ \bar{X}_3 = 594, & S_3 = 85, & r_{12} = -0.56, \end{array}$$

Find the partial correlation and the regression equation for hay-crop on spring rainfall and accumulated temperature.

(20)

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(c) What do you understand by nonparametric tests? Why such tests are also called (8) (20) distribution-free tests? Give the advantages and disadvantages of nonparametric tests over parametric tests. Describe the Wilcoxon signed-rank test for one sample. How does it differ from the sign test?

SECTION-II

- **Q.5.** (a) Explain what you understand by the probability sampling and non probability (6) sampling. What are their relative advantages and disadvantages?
 - (b) What is a sampling distribution? Describe the properties of the sampling distribution (6) of the means.
 - (c) A finite population consists of the numbers 2, 4 and 6. Form a sampling distribution (8) (20) of sample mean, when random samples of size 4 is drawn with replacement. Also verify its properties.
- **Q. 6.** (a) Under what condition is the sampling distribution of $\frac{s_1^2}{s_2^2}$ an F-distribution? Explain (6) the relationship between the F and t distributions, between the F and Chi-Square distributions.
 - (b) The proportion of families buying milk from company A in a certain city is believed (6) to be p=0.6. If a random sample of 10 families shows that 3 or less buy milk from company A, we shall reject the hypothesis that p=0.6 in favour of the alternative p<0.6. Evaluate α if p=0.6, evaluate β for the alternatives p=0.3, p=0.4 and p=0.5.
 - (c) Define a Chi-square random variable and its density function. Discuss the important (8) (20) properties of Chi-square distribution. Show that the Chi-square distribution tends to normal distribution for large degrees of freedom.
- Q.7. (a) Describe the Randomized Complete Block Design, its model and analysis. What are (6) its advantages and disadvantages?
 - (b) Compare Randomized Complete Block experiments with Completely Randomized (6) experiments, comparing their respective advantages and relative efficiency, with illustrations.
 - (c) Three varieties A, B and C of a crop are tested in a randomized block design with four (8) (20) replications, the layout being given below. The plot yields in pounds are also indicated therein. Analyze the experimental yields and state your conclusions.

	1	A 32.1	C 34.2	B 31.7
Replications	2	C 30.7	A 17.0	B 32.7
	3	A 40.8	B 25.3	C 48.2
	4	B 47.9	C 59.6	A 26.8

- **Q. 8.** (a) Define gross and net production rates. Explain how would you compute the net (6) production rate and what interpretations can be made if it is 1, less than 1 or greater than 1.
 - (b) Explain with suitable illustrations the object of standardizing various vital statistics (6) relating to births, deaths and marriages.
 - (c) Compute the gross and net reproduction rates for the following data:

Age-group	Female	Female	Probability
(years)	Population (000)	births	of survival
15-19	1558	18900	0.914
20-24	1112	71100	0.899
25-29	1595	96900	0.884
30-34	1629	64200	0.868
35-39	1627	34900	0.852
40-44	1522	10800	0.834
45-49	1401	800	0.813

(8) (20)