# FEDERAL PUBLIC SERVICE COMMISSION

**COMPETITIVE EXAMINATION FOR RECRUITMENT TO POSTS IN BS-17 UNDER THE FEDERAL GOVERNMENT, 2013**

**Roll Number**

## STATISTICS

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|---|---|---|---|
| **TIME ALLOWED: THREE HOURS** | **(PART-I MCQs)** | **30 MINUTES** | **MAXIMUM MARKS: 20** |
| | **(PART-II)** | **2 HOURS & 30 MINUTES** | **MAXIMUM MARKS: 80** |

**NOTE**: **(i)** **First** attempt **PART-I (MCQs)** on separate **OMR Answer Sheet** which shall be taken back after **30** minutes.
**(ii)** **Overwriting/cutting of the options/answers will not be given credit.**
**(iii)** **Use of Calculator is allowed.**

## PART-I ((MCQs) (COMPULSORY)

**Q.1. (i)** Select the best option/answer and fill in the appropriate Circle ◯ on the **OMR Answer Sheet. (20x1=20)**
**(ii)** Answers given anywhere, other than OMR Answer Sheet, shall not be considered.

**1.** Two mutually exclusive events are also:
**(a)** Dependent events **(b)** Independent events **(c)** Exhaustive events **(d)** None of these

**2.** In which definition of probability, the condition of mutually exclusive and equally likely events is imposed?
**(a)** Subjective approach **(b)** Relative frequency **(c)** Classical definition **(d)** None of these

**3.** In Poisson distribution:
**(a)** Mean > Variance **(b)** Mean < Variance **(c)** Mean ≤ Variance **(d)** None of these

**4.** When sample size *n* becomes larger and larger and sample estimate tends to the respective population parameter, this property of estimators is called:
**(a)** Unbiasedness **(b)** Consistency **(c)** Reliability **(d)** None of these

**5.** If the voting preference of 100,000 registered voters are to study, what kind of sampling should be used?
**(a)** Simple Random Sampling **(b)** Quota Sampling **(c)** Stratified Random Sampling **(d)** None of these

**6.** If the sampling frame not available then which of the sampling technique could be adopted with ease:
**(a)** Simple Random Sampling **(b)** Stratified Random Sampling
**(c)** Cluster Random Sampling **(d)** None of these

**7.** The complete list of the sampling units is called:
**(a)** Sampling Frame **(b)** Unit List **(c)** Sample Space **(d)** None of these

**8.** A cricket captain wins the toss for three consecutive matches. What is the probability that he will call correctly for the fourth match?
**(a)** 1/2 **(b)** 1/4 **(c)** 1/8 **(d)** None of these

**9.** If *X* has binomial distribution with parameter *p* and *n* then the variance of *X* is:
**(a)** $n^2 pq$ **(b)** $np$ **(c)** $pq / n^2$ **(d)** None of these

**10.** Suppose, we have a Poisson distribution with $\lambda$ equals to 5 then the probability of having exactly 10 occurrences is:
**(a)** $\dfrac{5^{-10} e^{-10}}{10!}$ **(b)** $\dfrac{5^{10} e^{-5}}{5!}$ **(c)** $\dfrac{5^{10} e^{-5}}{10!}$ **(d)** None of these

**11.** Which of the following statement is true for Normal distribution?
**(a)** It is skewed to the right **(b)** It has always a mean of zero and a standard deviation of one
**(c)** Its mean, median and mode are equal **(d)** None of these

**12.** Which of the following statement is true?
**(a)** The slope coefficient in regression and the correlation coefficient always have the same sign
**(b)** A regression line always passes through origin **(c)** The correlation coefficient can exceed than 1
**(d)** None of these

**13.** Testing of hypotheses is a phase to check the validity of:
**(a)** Population parameter **(b)** Sample estimate **(c)** Population **(d)** None of these

**14.** Any set of outcomes of a random experiments is called:
**(a)** Event **(b)** Event space **(c)** Sample points **(d)** None of these

**15.** When a difference between two groups is statistically significant this means that:
**(a)** The difference is statistically real but of little practical significance
**(b)** The difference is probably the result of sampling variation
**(c)** The difference is not likely to be due to chance variation **(d)** None of these

**16.** The degree of freedom for two independent samples will be based on:
**(a)** d.f = $n_1 + n_2 - 2$ **(b)** d.f = $n - 1$ **(c)** d.f = $n_1 + n_2 + 2$ **(d)** None of these

**17.** As the sample size increases:
**(a)** The standard deviation of the population decreases **(b)** The population means increases
**(c)** The standard error of the mean decreases **(d)** None of these

**18.** With a lower level of significance, the probability of rejecting a true null hypothesis:
**(a)** Remains same **(b)** Increases **(c)** Decrease **(d)** None of these

**19.** Which one is NOT the characteristic of a random experiment:
**(a)** It has at least two outcomes **(b)** The number of all possible outcomes are not known in advance
**(c)** It can be repeated any number of times under similar conditions **(d)** None of these

**20.** A 95% C.I for population mean is:
**(a)** $\bar{X} \pm 1.96\sigma^2 / \sqrt{n}$ **(b)** $\mu \pm 1.96\sigma / \sqrt{n}$ **(c)** $\bar{X} \pm 1.96\sigma / n$ **(d)** None of these

## PART-II

**NOTE**: **(i)** **Part-II** is to be attempted on the separate **Answer Book.**
**(ii)** Candidate must write **Q. No.** in the **Answer Book** in accordance with **Q. No.** in the **Q. Paper.**
**(iii)** Attempt **ONLY FIVE** questions from **PART-II. ALL** questions carry **EQUAL marks.**
**(iv)** Extra attempt of any question or any part of the attempted question will not be considered.
**(v)** **Use of Calculator is allowed.**

**Q.No.2.** **(a)** Explain the classical definition of probability. **(04)**

**(b)** Three companies are bidding on a contract. The relative qualities of the companies are such that Company A is twice as good as Company B, and Company B is three times as good as Company C. what is the probability of each company winning the contract? **(06)**

**(c)** Given P(A)= 0.5 and P(A $\cup$ B) = 0.7:
(i) Find P(B) if A and B are independent.
(ii) Find P(B) if A and B are mutually exclusive.
(iii) Find P(B) if P(A | B) = 0.5. **(06)**

**Q.No.3.** **(a)** Two machines A and B produce 45% and 55%, respectively of the total number of ball bearings produced by a certain factory. The percentages of defective output of these machines are 3% and 6%, respectively. If a ball bearing is randomly selected, find the probability that the item is defective. Find the probability that it was produced by the machine A. **(10)**

**(b)** Suppose that the probability of success in an oral interview for civil services is 0.32. If 10 candidates are being interviewed,
(i) What is the probability that none of these will be succeeded?
(ii) What is the probability that at least half of the candidates will be succeeded? **(06)**

**Q.No.4.** **(a)** Assume that the weights (in pounds) of papers discarded each week by different offices in a large secretariat, are normally distributed with mean 9.43 and standard deviation 4.17 pounds. Find the probability that 5 randomly selected offices have mean discarded papers between 10 and 15 pounds. If an office is selected at random, what is the probability that it discarded less than 2 pounds paper during the last week? **(08)**

**(b)** The number of traffic accidents that occur on a particular stretch of road during a month follows a Poisson distribution with a mean of 6. What is the probability that on a randomly selected month, there are just 2 accidents on that road? Find the probability that the next two months will both result in four accidents each occurring on this stretch of road. **(08)**

## STATISTICS

**Q.No.5.** **(a)** Differentiate between Type-I and Type-II errors. **(04)**

**(b)** A sociologist develops a test to measure attitudes about public transportation, and 27 randomly selected subjects are given the test, Their mean score is 76.2 and their standard deviation is 21.4. Construct the 95% confidence interval for the mean score of all such subjects. **(06)**

**(c)** A researcher claims that not more than 65% officers in the public offices come on time in their offices. A random sample of 60 officers was taken on a random working day, It was observed that 37 officers were in time. Test the claim of the researcher at 5% level of significance. **(06)**

**Q.No.6.** **(a)** In an insurance study of worker's deaths in a heavy mechanical complex of a country, monthly fatalities are analysed for two different time periods. Sample data from the both time periods are summarized by the following statistics:

$n_1 = 12$, $\bar{x}_1 = 46.42$, $s_1 = 11.07$; $n_2 = 15$, $\bar{x}_2 = 51.06$, $s_2 = 10.39$;

At 0.05 level of significance, test the claim that both time periods have the same mean. **(06)**

**(b)** An exercise physiologist wants to decide whether a certain type of running program will reduce heart rates. He measures the heart rates of 10 randomly selected people who are then placed on the running program. One month later the exercise physiologist again measures the heart rates of the 10 people. The heart rates, both before and after the running program, are displayed as below:

Before Program: 68, 76, 74, 71, 71, 72, 75, 83, 75, 74;
After Program: 67, 77, 71, 70, 69, 70, 71, 77, 71, 74.

Do the data provide sufficient evidence to conclude that the running program will reduce heart rates? (Use 5% level of significance.) **(10)**

**Q.No.7.** **(a)** What is the difference between a correlation problem and a regression problem? Also give the situation where we have to use partial correlation rather than simple correlation. **(06)**

**(b)** The general manager of an engineering firm wants to know whether a draftsman's experience influences the quality of his work? He selects 10 draftsmen at random and records their years of work experiences and their work quality rating (excellent = 5, very good = 4, good = 3, average = 2 and poor =1).The data recorded are given as follows:

| | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|
| Experience: | 1 | 17 | 20 | 9 | 2 | 13 | 9 | 23 | 7 | 10 |
| Rating: | 1 | 4 | 4 | 5 | 2 | 4 | 3 | 5 | 2 | 5 |

Find correlation coefficient between experience and rating. Also interpret the result. **(10)**

**Q.No.8.** **(a)** What are the advantages of sampling? Differentiate between random and non-random sampling. **(06)**

**(b)** What do you understand by sampling distribution? For a population of with elements 2, 4, 6, 8, 10, draw all possible random sample of size 2 without replacement and compute sample means. **(10)**

**Q.No.9.** Write note on any **FOUR** of the following: **(04 each)** **(16)**

- **(a)** Mathematical expectation of a random variable
- **(b)** Applications of the Chi-square distribution
- **(c)** Analysis of variance (ANOVA)
- **(d)** Stratified random sampling
- **(e)** Applications of Statistics in the public health issues
- **(f)** Applications of Statistics in economic development

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