STATISTICS

FEDERAL PUBLIC SERVICE COMMISSION
COMPETITIVE EXAMINATION FOR
RECRUITMENT TO POSTS IN BPS-17 UNDER
THE FEDERAL GOVERNMENT, 2010

Roll Number

STATISTICS

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

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

PART – I (MCQs)
(COMPULSORY)

Q.1. Select the best option/answer and fill in the appropriate box on the Answer Sheet. (20)

(i) Four coins are tossed simultaneously, in how many distinct ways these coin can show up?
(a) 8 (b) 4 (c) 16 (d) 32 (e) None of these

(ii) In how many ways five people can fill five distinct posts?
(a) 60 (b) 120 (c) 25 (d) 50 (e) None of these

(iii) Let X be a random variable distributed like Binomial with n=10 and p=0.345, then what will be E(X)?
(a) 34.5 (b) 3.45 (c) 0.0345 (d) None of these

(iv) What is $P(A \cup B)$ equals to, when A and B are mutually exclusive events?
(a) P(A)+P(B) (b) P(A) x P(B) (c) P(A)+P(B)-P(AB) (d) None of these

(v) What is $P(A \cap B)$ equals to when A and B are two independent events?
(a) P(A)+P(B) (b) P(A) x P(B) (c) P(A)+P(B)-P(AB) (d) None of these

(vi) For which probability distribution function mean and variance are equal?
(a) Normal (b) Binomial (c) Poisson (d) Gamma (e) None of these

(vii) How many ways all possible distinct committees of 3 students can be formed from a class of 10 students?
(a) 30 (b) 120 (c) 125 (d) 720 (e) None of these

(viii) Let Y be a random variable distributed like Binomial with n=5 and p=0.70, then what will be the variance of Y?
(a) 0.105 (b) $(0.105)^2$ (c) 3.5 (d) 0.14 (e) None of these

(ix) Let $Y= \alpha + \beta X +$ error. What β is called?
(a) mean of X (b) Y-intercept (c) slope (d) variance of Y (e) None of these

(x) If the standard deviation of a random variable X is 5, then what will be the standard deviation of Y=4x+2?
(a) 400 (b) 20 (c) 22 (d) 402 (e) None of these

(xi) A question was asked, whose answer is either YES or NO, to 150 individuals from a section of population, of them 90 gave YES answer. What will be the value of Chi-square if the hypothesis to be tested is P(YES)=P(NO)?
(a) 5 (b) 6 (c) 15 (d) 25 (e) None of these

(xii) What does the probability of "rejecting null hypothesis when it is true'' called?
(a) Type-I error (b) Type-II error (c) Level of confidence
(d) Least error (e) None of these

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(xiii) Let $x_1, x_2, \ldots, x_n$ be a random sample from $N(\mu,\sigma^2)$. What is the sampling distribution of $\frac{(\bar{X}-\mu)}{S/\sqrt{n}}$?

(a) F-distribution (b) Normal distribution (c) Z-distribution
(d) t-distribution (e) None of these

(xiv) A researcher wishes to draw sample of individuals from poor, middle and rich economic class. Which type of sampling method is appropriate?
(a) Simple random sampling (b) Stratified sampling (c) Systematic sampling
(d) convenient sampling (e) None of these

(xv) What test statistics is used in the Analysis of variance?
(a) F-statistics (b) T-statistics (c) Chi-square statistics
(d) Z-statistics (e) None of these

(xvi) What is the sampling distribution of sample mean if the random sample of size n=50000 is drawn form a Poisson distribution?
(a) Normal distribution (b) Standard normal distribution (c) T-distribution
(d) F-distribution (e) None of these

(xvii) How many distinct all possible random samples, with replacement, each of size n=3 can be drawn from a finite population of size N=50?
(a) 125000 (b) 19000 (c) 750 (d) 127500 (e) None of these

(xviii) P(A/B)=? When A and B are non-independent events.
(a) P(A) /P(B) (b) P(B) + P(B) (c) P(AB) P(B) (d) P(AB)/P(B) (e) None of these

(xix) To test the hypothesis $H_0 : \mu_1 = \mu_2 = \ldots = \mu_k$ one can apply:
(a) Analysis variance (b) Regression analysis (c) Analysis mean
(d) t-test (e) None of these

(xx) What is the range of coefficient of determination R^2 ?
(a) (-1, 1) (b) (0,1) (c) $(0, \infty)$ (d) $(-\infty, \infty)$ (e) None of these

PART – II

NOTE:	**(i)** **PART-II** is to be attempted on the separate **Answer Book.** **(ii)** Attempt **ONLY FOUR** questions from **PART-II**. All questions carry **EQUAL** marks. **(iii)** Extra attempt of any question or any part of the attempted question will not be considered.

Q.2. In a small town only three news papers, A, B, and C, are available for the readers. Suppose that 60% of the readers subscribe to newspaper A, that 40% subscribe to newspaper B, and that 30% to newspaper C. Suppose also that 20% of them subscribe to both A and B, that 10% subscribe to both A and C, that 20% subscribe to both B and C, and that 5% subscribe to all three newspapers.

(a) Construct Venn diagram to present the above situation. **(8)**
(b) What percentage of newspaper readers subscribe at least one of the three newspapers? **(8)**
(c) What percentage of newspaper readers subscribe none of the three newspapers? **(4)**

Q.3. Suppose that in a certain drug the concentration of a particular chemical is a random variable with the following continuous distribution:

$$g(x) = (3/8)x^2 \quad \text{for } 0 \le x \le 2 \ \& \ 0 \text{ elsewhere.}$$

Suppose that the concentrations X and Y of the chemical in two separate batches of the drug are independent random variables each with the same p.d.f *g*. Determine:

(a) the joint p.d.f of X & Y **(6)**
(b) $P(X > Y)$ **(6)**
(c) $P(X+Y \le 1)$ **(8)**

Q.4. Let X be Binomial random variable with parameters "n" and "p". Find mean and variance
(a) by expectation method **(10)**
(b) Using moment generating function **(10)**

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Q.5. (a) Describe and explain the principal of least square. Also find the least square estimates of linear regression model. **(8)**

(b) A study was conducted on the amount of converted sugar (Y) in a certain process at various temperature (X). The data were recorded as follows:

X	1.0	1.1	1.2	1.3	1.4	1.5	1.6	1.7	1.8	1.9	2.0
Y	8.1	7.8	8.5	9.8	9.5	8.9	8.6	10.2	9.3	9.2	1.5

Fit linear regression model of Y on X . Also estimate the amount of converted sugar produced when the coded temperature is 1.78. Comment on the result. **(12)**

Q.6. (a) To study the relationship between eye and hand literality, the data on 413 subject were presented in the following table:

	Left-eyed	Ambiocular	Right-eyed
Left-handed	34	62	28
Ambidextrous	27	28	20
Right-handed	57	105	52

Test, at 5% of level of significance, the hypothesis that eye and hand literalities are independent. Also compute the coefficient of contingency. Comment. **(12)**

(b) In 180 throws of a die the observed frequency of the values 1 to 6 are 34, 27, 41, 18, 35. By using appropriate testing method, test whether the die is unbiased. (Use α=.05) **(8)**

Q.7. (a) An antipyretic is being tested as a replacement for aspirin. A total of nine experimental animals are given artificially high temperature and the drug is administered. Given before and after temperatures, test the hypothesis that the drug is effective; use the 0.05 level of significance. **(8)**

Before	107.2	111.5	109.3	106.5	113.7	108.4	107.7	111.9	109.3
After	106.1	111.4	105.4	107.2	109.8	108.8	106.9	109.6	110.5

(b) Two independent random samples of sizes 60 and 72 have means and standard deviations, respectively, $\bar{x}_1 = 112.6,\ s_1 = 24.8,\ \bar{x}_2 = 103.9,\ s_1 = 19.7,$ test the hypothesis that $\mu_1 = \mu_2$ at α=.05 and construct a 95% confidence interval for $\mu_1 - \mu_2$. **(12)**

Q.8. Write brief notes on **ANY FOUR** of the following: **(5+5+5+5)**

(i) The relationship between regression and correlation.
(ii) Latin Square Design.
(iii) Conditional Probability.
(iv) Use of Statistics in social science.
(v) Mathematical expectation.

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