FEDERAL PUBLIC SERVICE COMMISSION
COMPETITIVE EXAMINATION FOR RECRUITMENT TO POSTS IN BS-17 UNDER THE FEDERAL GOVERNMENT, 2014
STATISTICS

Roll Number

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

NOTE: **(i)** **Part-II** is to be attempted on the separate **Answer Book.**
(ii) Attempt **ONLY FIVE** questions from **PART-II. ALL questions carry EQUAL marks.**
(iii) Candidate must write **Q. No.** in the **Answer Book** in accordance with **Q. No.** in the **Q. Paper.**
(iv) No Page/Space be left blank between the answers. All the blank pages of Answer Book must be crossed.
(v) Extra attempt of any question or any part of the attempted question will not be considered.
(vi) Use of Scientific calculator is allowed and Statistical Tables will be provided.

PART-II

Q. No. 2. **(a)** Differentiate between the "Classical" definition of probability and the "Axiomatic" definition of probability and define them. **(05)**

(b) Four married couples have bought 8 seats in a row for a concert. In how many different ways can they be seated **(i)** with no restrictions? **(ii)** if each couple is to sit together? **(iii)** if all men sit together to the right of all the women? **(05)**

(c) A box contains 5 red, 3 white and 2 blue marbles. A sample of 6 marbles is drawn with replacement. Find the probability that (i) 3 are red, 2 are white and 1 is blue, (ii) 2 are red, 3 are white and 1 is blue, (iii) 2 of each color appears. **(06)**

Q. No. 3. **(a)** An irregular six faced die is thrown and the expectation that in 10 throws it will give five even numbers is twice the expectation that it will give four even numbers how many times 10000 sets of 10 throws would you expect it to give one even number? **(4 each) (16)**

(b) Drive the Poisson distribution as the limiting form of the binomial distribution, stating clearly the assumptions you make.

(c) To avoid detection at customs, a traveller has placed seven narcotic tablets in a bottle containing nine vitamin pills that are similar in appearance. If the customs official selects 3 of the tablets at random for analysis, what is the probability that the traveller will be arrested for illegal possession of narcotics?

(d) A doctor receives an average of 5 telephone calls from 9 p.m. until 9 a.m. the next morning. Assuming arrivals of calls are a Poisson process, what is the probability that the doctor will not be disturbed by a call if she goes to bed 10 p.m. and rises at 6 a.m.

Q. No. 4. **(a)** A study of time spends on housework found that men who are employed spend an average of 8.2 hours per week doing housework (Americans' Use of Time Project, University of Maryland, American Demographics, November 1998). Assume that the amount of time spend on housework per week by all employed men in the United States is normally distributed with a mean of 8.2 hours and a standard deviation of 2.1 hours. **(09)**

(i) Find the probability that a randomly selected employed man spends between 6 and 10 hours per week on housework.

(ii) What is the probability that a randomly selected employed man spends 9 or more hours per week on house work?

(iii) Below what value do we get the smallest 25% of time spend by employee?

(b) A collection of human skulls is divided into three classes A, B and C according to the value of a "length-breadth index" X. Skulls with $X < 75$ are classified as A(long-headed), those with $75 < X < 80$ as B (medium) and those with $X > 80$ as C (short-headed). The percentages in the three classes in this collection are 58, 38 and 4. Find approximately the mean and the standard deviation of X, on the assumption that X is normally distributed. **(07)**

Q. No. 5. **(a)** Explain the "Principle of Least Squares". Also obtain the least square estimates of slope and y-intercept of simple linear regression model. **(04)**

(b) The following table gives the experience (in years) and the number of computers sold during the previous three months by seven salespersons. **(12)**

Experience	4	12	9	6	10	16	7
Computer sold	19	42	28	33	40	37	23

(i) Do you think experience depends on the number of computer sold or the number of computers sold depends on experience?

(ii) Find the least square regression line. Predict the number of computers sold during the past three months by a salesperson with 11 years of experience.

(iii) Give a brief interpretation of the values of the y-intercept and slope calculated in part ii.

(iv) Compute r and r^2 and explain what they mean.

(v) Construct a 99 % confidence interval for b.

(vi) Testing at the 1 % significance level, can you conclude that B is positive?

Q. No. 6. **(a)** What is a joint probability density function? How does a marginal probability function differ from a conditional probability function? **(05)**

(b) The random variables X and Y are jointly distributed as **(06)**

$$f(x, y) = 24x^2 y(1-x) \qquad 0 \le x, y \le 1$$

Obtain the marginal distribution of X, and the conditional distribution of Y. Are X and Y independent?

(c) The probability that Ms. Brown will sell a price of property at a profit of Rs. 3,00,000 is $\frac{3}{20}$, the probability that she will sell it at a profit of Rs. 1,50,000 is $\frac{7}{20}$ the probability that she will break even is $\frac{7}{20}$ and the probability that she will lose Rs. 1,50,000 is $\frac{3}{20}$. What is her expected profit? **(05)**

Q. No. 7. **(a)** Explain what is meant by (i) statistical hypothesis, (ii) Power of a test (iii) Significance level. **(03)**

(b) According to a survey, the starting salary for an entry-level position in investment banking was $ 37,120 in 1998 (Newsweek, February 1, 1999) Assume that $ 37, 120 was the 1998 mean starting salary for all such positions. A recently taken random sample of 100 such position found a mean starting salary for all such positions. A random sample of 100 such positions found a mean starting salary of $ 38,050 with a standard deviation of $ 442. **(06)**

(i) Test the hypothesis that the mean starting salary for such positions exceeds $ 37,120.

(ii) Would you reject the null hypothesis at a significance level of 1% instead of α =.05?

(c) A sample of 500 male registered voters showed that 57 % of them voted in the last presidential election. Another sample of 400 female registered voters showed that 55 % of them voted in the same election. **(07)**

(i) Construct a 97 % confidence interval for the difference between the proportion of all male and all female registered voters who voted in the last presidential election.

(ii) Test at the 1% significance level whether the proportion of all male voters who voted in the last presidential election is different from that of all female voters.

Q. No. 8. **(a)** A sample of 9 parts produced by certain production process are measured as 5, 7, 2, 4, 8, 9, 8, 6, and 5 inches respectively. Test the hypothesis that the process has the variance equal to 4 $(\text{inches})^2$ at the 5 % level of significance. **(05)**

(b) The following table gives the two-way classification of 1000 persons who have been married at least once. They are classified by educational level and marital status. **(05)**

	Educational Level			
	Less Than High School	High School Degree	Some College	College Degree
Divorced	173	158	95	53
Never divorced	162	126	110	123

Test at the 1% significance level whether educational level and ever being divorced are dependent.

(c) The following table gives the hourly wages of computer programmers for samples taken from three cities. **(06)**

New York	Boston	Los Angeles
$19	$23	$31
28	18	11
36	29	29
33	30	33
31		24

Using the 1 % significance level, test the null hypothesis that the mean hourly wages for all computer programmers in each of these three cities are the same (Table value of F:01(2,11)=7.206)

Q. No. 9. Writer short NOTES on the following: **(4 each)** **(16)**

(a) Multiple and Partial correlations

(b) Comparison of Stratified and cluster Sampling schemes

(c) Maximum likelihood estimator

(d) Properties of a good estimator

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