# FEDERAL PUBLIC SERVICE COMMISS[...]

### COMPETITIVE EXAMINATION FOR
### RECRUITMENT TO POSTS IN BS-17
### UNDER THE FEDERAL GOVERNMENT, 2012

## STATISTICS

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

**NOTE**: 
(i) Candidate must write **Q.No.** in the **Answer Book** in accordance with **Q.No.** in the **Q.Paper**.
(ii) Attempt **ONLY Five** 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.
(iv) Use of Scientific calculator is allowed.

# PART-II

**Q.2.** A candy company distribute boxes of chocolates with a mixture of creams, toffees and nuts coated in both light and dark chocolate. For a randomly selected box, let X and Y, respectively, be the proportion of the light and dark chocolates that are creams and suppose that the joint density function is:

$$f(x,y) = 2/3\ (2x + 3y), \qquad 0 \le x \le 1, \quad 0 \le y \le 1 \text{ and } 0 \text{ e.w.}$$

(a) Verify that join integration with respect to x and y is one. **(05)**

(b) Let 'A' is defined as the region $\{(x,y) \mid 0 \le x \le 1/2,\ 0 \le y \le 1/4\}$. Find $P[(X,Y) \mathcal{E} A]$ **(06)**

(c) Fin g(x) and h(y) **(05)**

**Q.3.** (a) In how many ways can 8 people be lined up get on bus? **(04)**

(b) If three specific persons insist on following each other? **(04)**

(c) If two specific person refuse to follow each other? **(04)**

(d) If 4 persons are male and 4 are females, in how many ways they can line up? **(04)**

**Q.4.** Determine if the use of z-test or t-test is appropriate, giving reason, for the following hypothesis. Also find the critical region for the test.

(a) n=19, $\sigma$ is unknown and the population distribution is normal, left tail test $\alpha$ =0.05 **(04)**

(b) n=11, $\sigma$ is known and the population distribution is normal, right tail test $\alpha$ =0.01 **(04)**

(c) n=56, $\sigma$ is unknown, two tail test $\alpha$ =0.10 **(04)**

(d) n=12, $\sigma$ is unknown and the population distribution is normal, left tail test $\alpha$ =0.05 **(04)**

**Q.5.** (a) Show that the sample mean $\overline{X}$ of random sample of size 'n' from a distribution having p.d.f. $f(x;\theta)=(1/\theta)\,e^{-(x/\theta)}$, $0 < x < \infty$, $0 < \theta < \infty$, zero elsewhere, is unbiased estimator of $\theta^2/n$. **(10)**

(b) Let $X_1$, $X_2$,.......,$X_n$ be a random sample from a Bernoulli distribution. Find the maximum likelihood estimator of probability of success. **(06)**

**Q.6.** (a) For the following 2x2 table compute Chi-square value for test of independence: **(10)**

| Attribute A | Attribute B | |
|---|---|---|
| | + | - |
| + | $n_{++}$ | $n_{+-}$ |
| - | $n_{-+}$ | $n_{--}$ |

## STATISTICS

**(b)** A die is tossed 180 times with the following results: **(06)**

| x | 1 | 2 | 3 | 4 | 5 | 6 |
|---|---|---|---|---|---|---|
| f | 28 | 36 | 36 | 30 | 27 | 23 |

Is this a balanced die? Use 0.05 level of significance.

**Q.7.** (a) Describe and explain the "Principal of Least Square". Also obtain the least square **(08)** estimates of slope and y-intercept of simple linear regression model.

(b) The following are 15 readings of traffic volume (X cars/ hour) and carbon monoxide concentration (PPM) taken at a metropolitan air quality sampling sight:

| X | 100 | 110 | 125 | 150 | 175 | 190 | 200 | 225 | 250 | 275 | 300 | 325 | 350 | 375 | 400 |
|---|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|
| Y | 8.8 | 9.5 | 10 | 10.5 | 10.5 | 10.5 | 10.6 | 11 | 12.1 | 12.1 | 12.5 | 13 | 13.2 | 14 | 14.5 |

Fit a linear Regression model of Y on X. Also plot error vs X. **(08)**

**Q.8.** (a) Describe the situation where one way ANOVA can be applied. Also state the relevant **(06)** hypotheses.

(b) Researchers wish to know if the two populations differ with respect to the mean value of **(10)** total serum complement activity ($C_{H50}$). Samples of size $n_1=10$ and $n_2=20$ are taken from diseased and normal subjects. The sample means and standard deviations are:

$$\bar{x}_1=62.6 \qquad s_1=33.8 \qquad \bar{x}_2=47.2 \qquad s_2=10.1$$

Using appropriate test give your opinion on what the researchers wish.

**Q.9.** Writer short notes on any FOUR of the following: **(4 X 4=16)**

    (i) Difference between simple and partial correlation.

    (ii) Multiple regression

    (iii) Use of statistics in electoral politics.

    (iv) Test for equality two variance

    (v) Joint probability distribution.

    (vi) Mathematical expectation.

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