INDIAN FOREST SERVICE P (EXAM)-2014

C–HENT–N–RUZUB

STATISTICS

PAPER—II

Time Allowed : Three Hours

Maximum Marks : 200

QUESTION PAPER SPECIFIC INSTRUCTIONS

Please read each of the following instructions carefully before attempting questions

There are EIGHT questions in all, out of which FIVE are to be attempted.

Question Nos. **1** and **5** are compulsory. Out of the remaining SIX questions, THREE are to be attempted selecting at least ONE question from each of the two Sections A and B.

Attempts of questions shall be counted in chronological order. Unless struck off, attempt of a question shall be counted even if attempted partly. Any page or portion of the page left blank in the Question-cum-Answer Booklet must be clearly struck off.

All questions carry equal marks. The number of marks carried by a question/part is indicated against it.

Answers must be written in ENGLISH only.

Unless otherwise mentioned, symbols and notations have their usual standard meanings.

Assume suitable data, if necessary and indicate the same clearly.

SECTION—A

1. Answer the following : 8×5=40

(a) Generate 10 random numbers from uniform (0, 1) using *(i)* mixed congruential and *(ii)* multiplicative congruential methods.

(b) Distinguish between Product control and Process control.

(c) Show that the problem of two-person zero-sum game can be viewed as a particular case of LPP.

(d) Illustrate one application each on MTTF and MTBF.

(e) Describe CUSUM chart and write the procedure of constructing V-mask.

2. *(a)* *(i)* Maximize $Z = 3x + 2y$ subject to

$$-2x + 3y \leq 9$$
$$3x - 2y \leq -20$$
$$x, y \geq 0$$

(ii) Write the algorithm of solving a two-person zero-sum game when $\max \min \neq \min \max$. 15

(b) Explain the use of AOQL and LTPD as a measure for constructing any sampling plan. 10

(c) Define the following : 15

(i) Reliability function

(ii) Hazard function

(iii) Reliability of a series system

(iv) Reliability of a parallel system

(v) Use of bathtub model

3. *(a)* Explain the procedure of constructing *(i)* control chart for fraction defectives and *(ii)* control chart for number of defectives. Also list out the applications for C-chart. 15

(b) A company has a demand of 1200 units/year for an item and it can produce 2000 such items per month. The cost of one setup is ₹ 400 and the holding cost/unit/month is 15 paise. Find the following : 10

(i) Optimum lot size

(ii) Total inventory cost/year assuming the cost of 1 unit as ₹ 4

(iii) Maximum inventory

(c) A new scooter costs ₹ 6,000. The running cost and salvage (sale price) value at the end of the year are as under :

Year	:	1	2	3	4	5	6	7
Running cost (in ₹)	:	1,200	1,400	1,600	1,800	2,000	2,400	3,000
Salvage value (in ₹)	:	4,000	2,666	2,000	1,500	1,000	600	600

If the interest rate is 10% per year and running costs are assumed to have occurred at midyear, find when the scooter should be replaced. 15

4. (a) Draw a 5-point OC curve for the single sampling plan

$$N = 1000,\ n = 150 \text{ and } c = 2$$

Also mention the merits and demerits of single and double sampling plans. 15

(b) A shipping company has a single unloading dock with ships arriving in a Poisson fashion at an average rate of 3 per day. The unloading time distribution for a ship with n unloading crews is found to be exponential with average unloading time $\frac{1}{2n}$ days. The company has a large labour supply without regular working hours and to avoid long waiting times, the company has a policy of using as many unloading crews as there are ships waiting in line or being unloaded. Find the following : 10

(i) Average number of unloading crews working at any time

(ii) Probability that > 4 crews will be needed

(c) Write on the following : 15

(i) Dam models

(ii) Transportation problem is a particular case of LPP

(iii) Statistical graphs using SPSS

SECTION—B

5. Answer the following : 8×5=40

(a) The average wage of a labour worker for a day was ₹ 255 in 2000 and ₹ 410 in 2014. If the consumer price indexes for these years were 155 and 240 respectively, find the money wage increase in 2014 compared to 2000.

(b) Define Net Reproduction Rate (NRR) and Total Fertility Rate (TFR), and explain their importance in understanding the growth of a population.

(c) Mention and discuss a test for homoscedasticity.

(d) Define life table. Explain various columns of abridged life table and their inter-relationships.

(e) Explain the application of chi-square test in psychometry. In a study of 100 voters polled on an issue, sixty voted 'YES' and forty voted 'NO'. Test the hypothesis that proportion–$p_{prop} = 0 \cdot 70$.

(Given, the critical value of chi-square at 0·5 level is 3·841)

6. *(a)* Mention underlying assumption of multiple linear regression model. Derive the ordinary least square estimator of the regression parameter in the multiple linear regression model. 15

(b) *(i)* What are chain index numbers? How are they constructed?

(ii) In the construction of a certain cost of living index number, the following group index numbers were found. Calculate the cost of living index number by using the weighted arithmetic mean and also by using the weighted geometric mean :

Group	*Index Number*	*Weight*
Food	350	5
Fuel and lighting	200	1
Clothing	240	1
House rent	160	1
Miscellaneous	250	2

15

(c) Explain the sampling design and method of estimation for estimating yield estimation of major crops through crop cutting experiments. 10

7. *(a)* Discuss various steps involved in forecasting using ARMA model. 10

(b) Define Infant Mortality Rate (IMR) and its importance. Also describe various methods of measuring corrected IMR. 15

(c) State the importance of population projection and outline component method (Frejka's) of population projection. 15

8. *(a)* Distinguish between Stable and Stationary population growth. Through stable population analysis, deduce that both birthrate ($b(t)$) and age distribution ($c(x, t)$) are independent of time. 15

(b) Explain Reed-Merrell method of constructing abridged life table and state its limitations. 10

(c) Describe the multicollinearity problem in a generalized linear model. Outline Silvey's approach for tackling this problem. 15

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