INDIAN STATISTICAL INSTITUTE

CHENNAI CENTRE

M-STAT. I YEAR: 2015-16.

MID SEMESTRAL EXAMINATION

SAMPLE SURVEYS

Date: 2 February 2016 Max. Score: 40 Duration: 10:20 to 11:45

1 a) Define 'Sampling Design' and 'Sampling Scheme'.

b) Show that $\sum_{j \neq i}^{N} \sum_{i}^{N} \pi_{ij} = n(n-1) + V(n(s))$, where $n(s)$ stands for the distinct units in the sample s and $n = E(n(s))$. Further, show that a lower bound for $V(n(s)) = f(1-f)$, where $n = [n] + f$, f being the fractional part.

c) When does the equality occur in the relation $\pi_i + \pi_j - \pi_{ij} \leq 1$.

d) Show that $\sum_{i=1}^{N} \pi_i = n$ and explain its practical significance.

[2+(4+2)+1+2] = [11]

2. Consider the following population of 4 zones in chennai city with the following data on number of degree colleges (x) and the amount spent on computer education y (in hundreds)

Zones	U_1	U_2	U_3	U_4
x	10	9	12	20
y	52	46	61	99

For a pilot survey, it is desired to draw a sample of 2 units (zones) by probability proportional to x data and without replacement.

[p.t.o.

a) Explain your selection clearly giving reference to random numbers chosen.

b) Write down Des Raj's ordered estimators (both orders) for $Y = \sum_{i=1}^{4} Y_i$ and the corresponding pooled estimators.

c) From (b) calculate Lahiri-Murthy's (Symmetrized Des Raj) Estimator.

d) Using (b) obtain an unbiased estimate of $V(\hat{Y})$.

$[2+((3+1)+(3+1))+5+2] = [17]$

3 a) Write down the Horvitz-Thompson (HT) estimator for the population total $Y = \sum_{1}^{N} Y_i$, explaining the symbols used.

b) Obtain an expression for $\hat{V}(\hat{Y}_{HT})$ due to Sen-Yates-Grundy.

$[2+10] = [12]$