Assignment 4

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Download latex-tikz codes from

https://github.com/Nik123−cpp/Assignment−4/blob/main/main.tex

1 Problem UGC—MATH 2019,Q.58

A sample of size n =2 is drawn from a population of size N=4 using probability proportional to size without replacement scheme , Where the probabilities proportional to size are

i :	1	2	3	4
p_i	0.4	0.2	0.2	0.2

The probability of inclusion of unit (1) in the sample is

(1)0.4 (2)0.6

(3)0.7 (4)0.75

2 Solution

Let number of samples with size n out of size N are be $f_N(n)$

$$f_N(n) = \binom{N}{n} \tag{2.0.1}$$

In this case

$$N = 4 \tag{2.0.2}$$

$$n = 2 \tag{2.0.3}$$

Let $P_i(j)$ represent the probability for selecting unit (j) as second unit after selecting unit (i)

$$P_i(j) = \frac{p_j}{1 - p_i} \tag{2.0.4}$$

Let Probability of selecting sample i,j is $\Pr(i, j)$,using (2.0.4) $\Pr(i, j)$ is

$$\Pr(i, j) = P_i(j) + P_j(i) \tag{2.0.5}$$

$$= (p_i \times \frac{p_j}{1 - p_i}) + (p_j \times \frac{p_i}{1 - p_j}) \tag{2.0.6}$$

Total samples(Size n=2)are

Case	1	2	3	4	5	6
Sample	1,2	1,3	1,4	2,3	2,4	3,4

TABLE 0: list of samples

Let P be the probability of inclusion of unit (1). Favourable cases for inclusion of unit(1) are case (1,2,3),So

$$\mathrm{P} = \Pr(1, 2) + \Pr(1, 3) + \Pr(1, 4) \tag{2.0.7}$$

using (2.0.6) and p_i from question ,

$$\mathrm{P} = \frac{7}{30} + \frac{7}{30} + \frac{7}{30} \tag{2.0.8}$$

$$= 0.7 \tag{2.0.9}$$

Therefore Option (3)is correct.