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

Table : Probability vs Size

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

$$P_i(j) = \frac{p_j}{1 - p_i} \tag{2.0.1}$$

Let $\Pr(i, j)$ be probability of selecting sample {i,j} ,using (2.0.1) is

$$\Pr(i, j) = P_i(j) + P_j(i) \tag{2.0.2}$$

$$= (p_i \times \frac{p_j}{1 - p_i}) + (p_j \times \frac{p_i}{1 - p_j}) \tag{2.0.3}$$

Total samples(Size $n = 2$)are

Case	1	2	3	4	5	6
Sample(size $n = 2$)	{1,2}	{1,3}	{1,4}	{2,3}	{2,4}	{3,4}

TABLE 0: list of samples

Let P_i be the probability of inclusion of unit (i) in the sample(size $n = 2$),Now i will calculate P_i ,Favourable cases for inclusion of unit(1) are case (1,2,3),So

$$P_1 = \Pr(1, 2) + \Pr(1, 3) + \Pr(1, 4) \tag{2.0.4}$$

using (2.0.3) and p_i from question ,

$$P_1 = \frac{7}{30} + \frac{7}{30} + \frac{7}{30} \tag{2.0.5}$$

$$= 0.7 \tag{2.0.6}$$

Therefore Option (3)is correct.