ASSIGNMENT : 02

Course : Computational Statistics And Probability

Submitted By,

Group A

Section : K

Date of Submission : 15th July, 2021

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Subject : Date :

① transition probability

$$P = \begin{bmatrix} p & 1-p \\ 1-p & p \end{bmatrix} = \begin{bmatrix} 0.2 & 0.8 \\ 0.8 & 0.2 \end{bmatrix}$$

~~So~~ This will reach destination $(4-1) = 3$ steps

We need P_{00}^3 in P^3

$$P^2 \begin{bmatrix} 0.2 & 0.8 \\ 0.8 & 0.2 \end{bmatrix} \times \begin{bmatrix} 0.2 & 0.8 \\ 0.8 & 0.2 \end{bmatrix} = \begin{bmatrix} 0.68 & 0.32 \\ 0.32 & 0.68 \end{bmatrix}$$

$$P^3 = \begin{bmatrix} 0.68 & 0.32 \\ 0.32 & 0.68 \end{bmatrix} \times \begin{bmatrix} 0.2 & 0.8 \\ 0.8 & 0.2 \end{bmatrix} = \begin{bmatrix} 0.392 & 0.608 \\ 0.608 & 0.392 \end{bmatrix}$$

So, the probability is 0.392

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(2) a) $P(T>1) = e^{-\lambda t} = e^{-3\times1} = 0.0498$

b) $P(T<1) = 1-e^{-\lambda t} = 1-e^{-3\times1} = 0.950$

c) $P(2<T<3) = e^{-\lambda 2} - e^{-\lambda 3} = e^{-3\times2} - e^{-3\times3}$

$= 0.0025 - 0.0001$

$= 0.0024$

$E(S_n) = \frac{n}{\lambda} = \frac{9}{3} = 3$

(3) Transition probability $P = \begin{bmatrix} 0.6 & 0.4 \\ 0.8 & 0.2 \end{bmatrix}$

Need (9-10, 10-11, 11-12, 12-1, 1-2) 5 steps to reach 2pm from 9am

We need P^5_{00} in P^5

$P^2 = \begin{bmatrix} 0.6 & 0.4 \\ 0.8 & 0.2 \end{bmatrix} \times \begin{bmatrix} 0.6 & 0.4 \\ 0.8 & 0.2 \end{bmatrix} = \begin{bmatrix} 0.68 & 0.32 \\ 0.64 & 0.36 \end{bmatrix}$

$P^4 = \begin{bmatrix} 0.68 & 0.32 \\ 0.64 & 0.36 \end{bmatrix} \times \begin{bmatrix} 0.68 & 0.32 \\ 0.64 & 0.36 \end{bmatrix} = \begin{bmatrix} 0.6672 & 0.3328 \\ 0.6656 & 0.3344 \end{bmatrix}$

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$$P^5 = \begin{bmatrix} 0.6672 & 0.3328 \\ 0.6656 & 0.3344 \end{bmatrix} \times \begin{bmatrix} 0.6 & 0.4 \\ 0.8 & 0.2 \end{bmatrix}$$

$$\begin{bmatrix} 0.6666 & 0.3334 \\ 0.6669 & 0.3331 \end{bmatrix}$$

(4) if t is the time between the entrance of 10^{th} and 11^{th} customer.

a) $P(T \leq 2) = 1 - e^{-5\times 2} = 0.99995$

b) $P(T > 5) = e^{-5\times 5} = 1.3888 \times 10^{-11}$

c) $P(3 < T < 5) = e^{-5\times 3} - e^{-5\times 5} = 30.0589 \times 10^{-7}$

$E(S_n) = \frac{50}{5} = 10$ hours.

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Subject :

Date :

(5) Sampling is a technique to select a representative part of population units, where units are investigated to study the characteristics of population unit.
Sometimes in ~~rela~~ real life we always can not use population in that time we use the sample blood sample collection is a example of sampling.

6. Simple random sampling is a technique where every unit in the population has an even chance and likelihood of being selected in the sample.
Selecting class monitor among 40 students of a class is a example of simple random sampling.

(7) Systematic sampling is a type of probability sampling method in which same members from a larger population larger population are selected according to a random starting point but with a fixed, periodic, interval.

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Subject :

Date :

(8) Circular systematic Sampling:
We assume the listing to be in a circle such that ~~that~~ the last unit is followed by the first. A random start is chosen 1 to N. We then add the intervals k until exactly n ~~elemt~~ elements are chosen, if we come to the end of the list, you continue from the beginning.

(9) Sample size $n = \frac{z^2 pq}{d^2} = \frac{(1.69)^2 \times 0.6 \times 0.4}{(0.1)^2}$

$= 92.12$

(10) Sample size $n = \frac{z^2 v(x)}{d^2} = \frac{(1.69)^2 (10)}{(0.2)^2}$

$= 960.4$

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Ans to the Qus No: 1

The transition probability matrix $P = \begin{bmatrix} P & 1-P \\ 1-P & P \end{bmatrix}$

$$= \begin{bmatrix} 0.2 & 0.8 \\ 0.8 & 0.2 \end{bmatrix}$$

It will reach the destination $(4-1) = 3$ steps.

$$P^2 = \begin{bmatrix} 0.2 & 0.8 \\ 0.8 & 0.2 \end{bmatrix} \times \begin{bmatrix} 0.2 & 0.8 \\ 0.8 & 0.2 \end{bmatrix} = \begin{bmatrix} 0.68 & 0.32 \\ 0.32 & 0.68 \end{bmatrix}$$

$$P^3 = \begin{bmatrix} 0.68 & 0.32 \\ 0.32 & 0.68 \end{bmatrix} \times \begin{bmatrix} 0.2 & 0.8 \\ 0.8 & 0.2 \end{bmatrix} = \begin{bmatrix} 0.392 & 0.608 \\ 0.608 & 0.392 \end{bmatrix}$$

So the required probability is 0.392

Ans to the Qus No: 2

Let T be the elapsed time between the entrance of $(n-1)$th and n^{th} signal & S_n be the waiting time until the n^{th} signal reaches to the destination.

Sub:

Date: / /

ⓐ $P(T>1) = e^{-\lambda t} = e^{-3\times1} = 0.0498$

ⓑ $P(T<1) = 1-e^{-\lambda t} = 1-e^{-3\times1} = 0.9502$

ⓒ $P(2<T<3) = e^{-\lambda t_1} - e^{-\lambda t_2}$

$= e^{-3\times2} - e^{-3\times3}$

$= 0.0024$

$E(S_n) = \frac{n}{\lambda} = \frac{9}{3} = 3$ hours Ans.

Ans to the qustion No : 3

The transition probability matrix

$$P = \begin{bmatrix} 0.6 & 0.4 \\ 0.8 & 0.2 \end{bmatrix}$$

To reach upto 2pm from 9am. we need
$(9-10,\ 10-11,\ 11-12,\ 12-1,\ 1-2) = 5$ steps
we need P^5_{00} in P^5

Sub:

Sun Mon Tue Wed Thu Fri Sat

Date: / /

$$P^2 = \begin{bmatrix} 0.6 & 0.4 \\ 0.8 & 0.2 \end{bmatrix} \times \begin{bmatrix} 0.6 & 0.4 \\ 0.8 & 0.2 \end{bmatrix} = \begin{bmatrix} 0.68 & 0.32 \\ 0.64 & 0.36 \end{bmatrix}$$

$$P^4 = \begin{bmatrix} 0.68 & 0.32 \\ 0.64 & 0.36 \end{bmatrix} \times \begin{bmatrix} 0.68 & 0.32 \\ 0.64 & 0.36 \end{bmatrix}$$

$$= \begin{bmatrix} 0.6672 & 0.3328 \\ 0.6656 & 0.3344 \end{bmatrix}$$

$$P^5 = \begin{bmatrix} 0.6672 & 0.3328 \\ 0.6656 & 0.3344 \end{bmatrix} \times \begin{bmatrix} 0.6 & 0.4 \\ 0.8 & 0.2 \end{bmatrix}$$

$$= \begin{bmatrix} 0.6666 & 0.3334 \\ 0.6668 & 0.3331 \end{bmatrix}$$

The require probability in 0.6666 A.

Ans to the Qus No: 4

let, T be the time between the entrance of 10th and 11th customers. We and $\lambda = 5/$ hour

(i) $P(T<2) = 1 - e^{-5\times 2} = 0.999$

(ii) $P(T>5) = e^{-5\times 5} = 1.38\times 10^{-11}$

(iii) $P(3<T<5) = e^{-5\times 3} - e^{-5\times 5} = 3.058\times 10^{-7}$

$E(S_n) = \frac{n}{\lambda} = \frac{50}{5} = 10$ hour.

Sub:

Sun Mon Tue Wed Thu Fri Sat

Date: / /

Ans to the Qus No: 5

It is a technique to select a representative part of population units where units are investigate to study the characteristic of population units.

In cooking rice we check the status of the rice by ~~investing~~ inserting a spoon until it touches the bottom of the pot out the spoon. some rice will stick to it (sample) and taste the rice.

The objective of sample are;

i) we don't need to work with the total population.

ii) Makes data collection easier.

iii) Gives us a short idea about the population.

Sub:

Sun Mon Tue Wed Thu Fri Sat

Date: / /

Ans to the QUS NO: 6

Simple random sampling: it is a Sampling tecnique where every unit in the population has an even chance and likelihood of being selected in the sample.

There are 40 students in a Math class at AIUB. The teacher wants to select a student as the CR monitor. He makes 40 slips. write the ID, of the student on them distinctly and put them in a box. After shuffling the slips. he picks one up randomly and declare the student whose ID in there on the selected slip as the class monitor here each and every single student has equal probability $\frac{1}{40}$ of being selected as the class monitor.

Sub:

Sun Mon Tue Wed Thu Fri Sat

Date: / /

Ans to the qus No: 7

Systematic sampling: it is a type of probability sampling method in which sample members from a larger population are selected according to a random starting point (R) but with a fixed periodic interval. This interval called the sampling interval ($k = \frac{N}{n}$) is calculated by dividing the population size by the desired sample size.

if total students are 40. and we take 10 students as sample then the interval ($k = \frac{N}{n}$) = 4. if we select a random number from 1-4. like if we choose 2 then starting with 2 and take every 4th unit.

Sub:

Date: / /

Ans to the Qus No: 8

Circular Systematic Sampling: In this method we assume the listings to be in a circle such that the last unit is followed by the first. A random start is chosen from 1 to N. then we add the intervals k until exactly n elements are chosen. if we come to the end of the list. you continue from the beginning.

Ans to the Qus No: 9

given, $z = 1.96$, ~~v(x) = 10~~ $d = 0.1$ ~~d = 0.2~~ $P = 0.6$, $q = 0.4$

$$\text{sample size } n = \frac{z^2 pq}{d^2} = \frac{(1.96)^2 \times 0.6 \times 0.4}{(0.1)^2}$$

$$= 92.198 \text{ A}$$

Ans to the Qus No: 10

given, $z = 1.96$ $v(x) = 10$ $d = 0.2$

$$\text{Sample size } n = \frac{z^2 v(x)}{d^2}$$

$$= \frac{(1.96)^2 \times 10}{(0.2)^2} = 960.9 \text{ A}$$

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Ans to the Q.no.-1

Probability matrix = $\begin{bmatrix} p & 1-p \\ 1-p & p \end{bmatrix}$ $\begin{bmatrix} 0.2 & 0.8 \\ 0.8 & 0.2 \end{bmatrix}$

it will reach the destination at (4-1) = 3 step

So, we need P^3_{00} in P^3_{00} in $P3$

$$P^2 = \begin{bmatrix} 0.2 & 0.8 \\ 0.8 & 0.2 \end{bmatrix} \times \begin{bmatrix} 0.2 & 0.8 \\ 0.8 & 0.2 \end{bmatrix} = \begin{bmatrix} 0.68 & 0.32 \\ 0.32 & 0.68 \end{bmatrix}$$

$$P^2 = \begin{bmatrix} 0.68 & 0.32 \\ 0.32 & 0.68 \end{bmatrix} \times \begin{bmatrix} 0.2 & 0.8 \\ 0.8 & 0.2 \end{bmatrix} = \begin{bmatrix} 0.392 & 0.608 \\ 0.608 & 0.392 \end{bmatrix}$$

The probability is 0.392 (Ans)

Ans: to the Q. no - 2

Let, T be the elapsed time between the entrance of $(n-1)^{th}$ and n^{th} signal and S_n be the waiting time until the n^{th} signal reaches the destination.

a) $P(T>1) = e^{-\lambda t} = e^{-3\times 1} = 0.0498$

b) $P(T<1) = 1 - e^{-\lambda t} = 1 - e^{-3\times 1} = 0.9502$

c) $P(2<T<3) = e^{-\lambda t_1} - e^{-\lambda t_2} = e^{-3\times 2} - e^{-3\times 3}$

$= 0.0025 - 0.0001$

$= 0.0024$

$E(S_n) = \frac{n}{\lambda} = \frac{9}{3} = 3$ hour (Ans)

Ans. to the Q.no - 3 :

Transition ~~probability~~ matrix : $P = \begin{bmatrix} 0.6 & 0.4 \\ 0.8 & 0.2 \end{bmatrix}$

To reach upto 2 pm from 9 am we need

9-10, 10-11, 11-12, 12-1, 1-2) 5 step

Thus we need p^5 in p^5

$$p^2 = \begin{bmatrix} 0.6 & 0.4 \\ 0.8 & 0.2 \end{bmatrix} \times \begin{bmatrix} 0.6 & 0.4 \\ 0.8 & 0.2 \end{bmatrix} = \begin{bmatrix} 0.68 & 0.32 \\ 0.64 & 0.36 \end{bmatrix}$$

$$p^4 = \begin{bmatrix} 0.68 & 0.32 \\ 0.64 & 0.36 \end{bmatrix} \times \begin{bmatrix} 0.68 & 0.32 \\ 0.64 & 0.36 \end{bmatrix} = \begin{bmatrix} 0.667 & 0.332 \\ 0.665 & 0.334 \end{bmatrix}$$

$$p^5 = \begin{bmatrix} 0.667 & 0.333 \\ 0.665 & 0.334 \end{bmatrix} \times \begin{bmatrix} 0.6 & 0.4 \\ 0.8 & 0.2 \end{bmatrix} = \begin{bmatrix} 0.66 & 0.3[illegible] \\ 0.66 & 0.[illegible] \end{bmatrix}$$

Ans: to the Q. no- 4

Let 'T' be the time between the entrance of 10^{th} and 11^{th} customers. Here $\lambda = 5/$hour

i) $P(T<2) = 1 - e^{-5\times2} = 0.999$

ii) $P(T>5) = e^{-5\times5} = 1.388 \times 10^{-11}$

iii) $P(3<T<5) = e^{-5\times3} - e^{-5\times5} = 0.0589\times10^{-7}$

$E(1/\lambda) = \frac{5}{0} = 10$ hour

Ans. to the Qns - 5

Samping: It is a teeniqwe to select a repreasentative part of population unites. where unites are we investigal In cooking rice, we chect the status of the rice by inserting a pan until it touches the bottom of the pot pull out the spoon, some rice with it

The objective of sampling are:

(i) We dont need to work with large number

(ii) Make data collection easier

(iii) Gives us a short idea about the population

Ans to the Q.no - 6

It is a ~~m~~ sampling teenie where every unit in the population has an even chance and likelihood of being selected in the sample

Selecting a class representative among 40 Student in a class is a example of sample random Sampling.

Ans: to the Q.no - 7

Systenake samoling is a type if probability sampling method in which same members from ~~of~~ a lanear population larger population are selected according to a random starting point last unt a fixed preiodic interval

Am to the Q. no-8

In this method we assume the listings to be ina circle such that last unit is followed by the first.

Start with a random number from 1 to k then add the interval k and if we come end then start with beginning

Ans to the Q no- 9

Sample size $n = \frac{z^2 pq}{d^2} = \frac{(1.69)^2 \times 0.6 \times 0.4}{(0.1)^2}$

~~= 92.12~~

$= 92.12$

Ans to the Q. no - 10

Sample size $n = \frac{z^2 v(x)}{d^2}$

$= \frac{(1.69)^2 \times 10}{(0.2)^2}$

$= 960.4$

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Protick, Hasin Khan

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Ans. 1

The transition probability matrix: $P = \begin{bmatrix} p & 1-p \\ 1-p & p \end{bmatrix}$

$= \begin{bmatrix} 0.2 & 0.8 \\ 0.8 & 0.2 \end{bmatrix}$

It will reach the destination at $(4-1) = 3$ steps

$$P^2 = \begin{bmatrix} 0.2 & 0.8 \\ 0.8 & 0.2 \end{bmatrix} \begin{bmatrix} 0.2 & 0.8 \\ 0.8 & 0.2 \end{bmatrix} = \begin{bmatrix} 0.68 & 0.32 \\ 0.32 & 0.68 \end{bmatrix}$$

$$P^3 = \begin{bmatrix} 0.68 & 0.32 \\ 0.32 & 0.68 \end{bmatrix} \times \begin{bmatrix} 0.2 & 0.8 \\ 0.8 & 0.2 \end{bmatrix} = \begin{bmatrix} 0.392 & 0.608 \\ 0.608 & 0.392 \end{bmatrix}$$

so, the required probability is 0.392

Ans. 2

Let T be the elapsed time between the entrance of $(n-1)^{th}$ and n^{th} signal and S_n be the waiting time until the n^{th} signal reaches to the destination.

i) $P(T>1) = e^{-\lambda t} = e^{-3\times 1} = 0.0497$

ii) $P(T<1) = 1-e^{-\lambda t} = 1-e^{-3\times 1} = 0.95021$

iii) $P(2<T<3) = e^{-\lambda t_1} - e^{-\lambda t_2} = e^{-3\times 2} - e^{-3\times 3} = 0.0023$

$E(S_n) = \frac{n}{\lambda} = \frac{9}{3} = 3$ hour

Ans. 3

The transition probability matrix $P = \begin{bmatrix} P_{00} & P_{01} \\ P_{10} & P_{11} \end{bmatrix}$

$$= \begin{bmatrix} 0.6 & 0.4 \\ 0.8 & 0.2 \end{bmatrix}$$

We need P^5_{00} in P^5

$$P^2 = \begin{bmatrix} 0.6 & 0.4 \\ 0.8 & 0.2 \end{bmatrix} \begin{bmatrix} 0.6 & 0.4 \\ 0.8 & 0.2 \end{bmatrix} = \begin{bmatrix} 0.68 & 0.32 \\ 0.64 & 0.36 \end{bmatrix}$$

$$P^4 = \begin{bmatrix} 0.68 & 0.32 \\ 0.64 & 0.36 \end{bmatrix} \begin{bmatrix} 0.68 & 0.32 \\ 0.64 & 0.36 \end{bmatrix} = \begin{bmatrix} 0.66 & 0.33 \\ 0.66 & 0.33 \end{bmatrix}$$

$$P^5 = \begin{bmatrix} 0.66 & 0.33 \\ 0.66 & 0.33 \end{bmatrix} \begin{bmatrix} 0.6 & 0.4 \\ 0.8 & 0.2 \end{bmatrix} = \begin{bmatrix} 0.66 & 0.33 \\ 0.66 & 0.33 \end{bmatrix}$$

The required probability is 0.66

Ans. 4

i) $P(T<2) = 1-e^{-\lambda t} = 1-e^{-5\times 2} = 0.99$

ii) $P(T>5) = e^{-\lambda t} = e^{-5\times 5} = 1.38\times 10^{-11}$

iii) $P(3<T<5) = e^{-\lambda t_1} - e^{-\lambda t_2} = e^{-5\times 3} - e^{-5\times 5} = 3.05\times 10^{-7}$

$E(S_n) = \frac{n}{\lambda} = \frac{50}{5} = 10$ hour

5. Sampling: It is a technique to select a representative part of population units, where units are investigated to study the characteristics of population units.

Objective of Sampling:

- To obtain the optimum results
- To obtain the best possible estimates of the population parametres

Ans. 6

There are 40 students in a math class at AIUB. The teacher wants to select a student as the class monitor. He makes 40 slips. Write the ID's of the students on them distinctly and put them in a box. After shuffling the slips, he picks one up randomly and declare the student whose ID is there on the selected slips as the class monitor. Here, each and every single student has equal probability $\frac{1}{40}$ of being selected as the class monitor.

Ans. 7

There are 1000 people. We want to choose 25 people from them. Here,

Total population, N = 1000, Sample size, n = 25

So, sampling interval i = 1000/25 = 40

We select a random number from 1-40.

Suppose we chose 40. So start with 40 and take every 5th unit. That's systematic sampling.

Ans. 8

There are 20 people. We want to chose 4 people from them.

So, sampling interval $k = 20/4 = 5$

Now, we randomly chose from 6. Then $(6+5) = 11$, $(11+5) = 16$ and $(16+5) = 21$ means 1.

Ans. 9

Sample size $n = \dfrac{z^2 pq}{d^2}$

$= \dfrac{(1.96)^2 \times 0.6 \times 0.4}{(0.1)^2}$

$= 92.198$

$z = 1.96$

$p = 0.6$

$q = 0.4$

$d = 0.1$

Ans. 10

Sample size $n = \dfrac{z^2 v(x)}{d^2}$

$= \dfrac{(1.96)^2 \times 10}{(0.2)^2}$

$= 960.4$

$z = 1.96$

$v(x) = 10$

$d = 0.2$

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P : 1

Saikat Mahmud

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1. $P = \begin{bmatrix} p & 1-p \\ 1-p & p \end{bmatrix} = \begin{bmatrix} 0.2 & 0.8 \\ 0.8 & 0.2 \end{bmatrix}$ will reach to the destination at $(4-1) = 3$ steps.

$$P^2 = \begin{bmatrix} 0.2 & 0.8 \\ 0.8 & 0.2 \end{bmatrix} \begin{bmatrix} 0.2 & 0.8 \\ 0.8 & 0.2 \end{bmatrix}$$

$$P^3 = \begin{bmatrix} .68 & .32 \\ .32 & .68 \end{bmatrix} \begin{bmatrix} 0.2 & 0.8 \\ 0.8 & 0.2 \end{bmatrix}$$

$$= \begin{bmatrix} 0.392 & 0.608 \\ 0.608 & 0.392 \end{bmatrix} = 0.392$$

(Ans.)

2. (i) $P(T>1) = e^{-\lambda t} = e^{-3\times1} = 0.0497$

(ii) $P(T<1) = 1 - e^{-3} = 0.9502$

(iii) $P(2<T<3) = e^{-3\times2} - e^{-3\times3}$

$= 0.0024 - 0.00012$

$= 0.00228$

$E(S_n) = \frac{9}{3} = 3$ hour

(Ans.)

3. $P = \begin{bmatrix} 0.6 & 0.4 \\ 0.8 & 0.2 \end{bmatrix}$. we need P_{00}^5

~~$P^2 = \begin{bmatrix} 0.6 & 0.4 \\ 0.8 & 0.2 \end{bmatrix} \begin{bmatrix} 0.6 & 0.4 \\ 0.8 & 0.2 \end{bmatrix}$~~

$$P^5 = \begin{bmatrix} 0.66656 & 0.33344 \\ 0.66688 & 0.33312 \end{bmatrix}$$

$= 0.66656$

(Ans.)

4. (i) $P(T<2) = 1 - e^{-5\times 2} = 0.9865$

(ii) $P(T>5) = e^{-5\times 5} = 0.0336$

~~(iii) P(T~~

(iii) $P(3<T<5) = e^{-5\times 3} - e^{-5\times 5} = 3.05\times 10^{-7}$

~~$= 0.0202 - 0.0336$~~

$E(S_n) = \frac{50}{5} = 10$

(Ans.)

5. It is a technique to select a ~~representative~~ representative ~~pat~~ part of population units, where units are investigated to study the characteristics of population ~~uni~~ units.
Example: Blood test.

We can not work ~~the~~ with the whole population for analysing data or finding a ~~pro~~ probability. That's why we work with some random data from the whole population, which is called sample.

6. Simple random sampling is a sampling technique where every unit in the population has an even chance and likelihood of being selected in the sample.
Example: Method of lottery.

(7.) Systematic sampling is a type of probability method in which sample members from a larger population are selected according to a random starting point but with a fixed, periodic interval. This interval called the sampling interval is calculated by dividing the population size by the desired sample size.

Example: Shop owner can take a survey from every fifth customer that comes into the shop.

(8.) In cicular systematic sampling, we assure the listing to be in a circle such that the last unit is followed by the first. A random start is choosen from

1 to N. Then we add the intervals K untill exactly n elements are choosen. If we found the end of the list, we continue from the begining.

(9) The sample size n is given by,

$$n = \frac{z^2 pq}{d^2} = \frac{(1.96)^2 \times 0.6 \times 0.4}{(0.1)^2}$$

$$= 92.1984$$

(Ans.)

(10.) The sample size n is given by,

$$n = \frac{z^2 v(x)}{d^2} = \frac{(1.96)^2 10}{(0.2)^2}$$

$$= 960.4$$

(Ans.)

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Assignment - 2

Problem : 1

Sol^n: The transition probability matrix: $P = \begin{bmatrix} p & 1-p \\ 1-p & p \end{bmatrix}$

$= \begin{bmatrix} 0.2 & 0.8 \\ 0.8 & 0.2 \end{bmatrix}$

it will reach the destination at $(4-1) = 3$ steps.

We need P^3_{00} in P^3

$$P^2 = \begin{bmatrix} 0.2 & 0.8 \\ 0.8 & 0.2 \end{bmatrix} \times \begin{bmatrix} 0.2 & 0.8 \\ 0.8 & 0.2 \end{bmatrix} = \begin{bmatrix} 0.68 & 0.32 \\ 0.32 & 0.68 \end{bmatrix}$$

$$P^3 = \begin{bmatrix} 0.68 & 0.32 \\ 0.32 & 0.68 \end{bmatrix} \times \begin{bmatrix} 0.2 & 0.8 \\ 0.8 & 0.2 \end{bmatrix} = \begin{bmatrix} 0.392 & 0.608 \\ 0.608 & 0.392 \end{bmatrix}$$

The required probability is 0.392

Problem : 2

Sol^n: Let, T be the elapsed time between the entrance of $(n-1)^{th}$ and n^{th} signal and S_n be the waiting time until the n^{th} signal reaches to the destination.

ⓐ $P(T > 1) = e^{-\lambda t} = e^{-3 \times 1} = 0.0498$

ⓑ $P(T < 1) = 1 - e^{-\lambda t} = 1 - e^{-3 \times 1} = 0.9502$

ⓒ $P(2<T<3) = e^{-\lambda t_1} - e^{-\lambda t_2} = e^{-3\times 2} - e^{-3\times 3} = 0.0025 - 0.0001$

$= 0.0024$

$E(S_n) = \frac{n}{\lambda} = \frac{9}{3} = 3$ hour.

Problem: 3

Soln:

Transition probability matrix, $P = \begin{bmatrix} 0.6 & 0.4 \\ 0.8 & 0.2 \end{bmatrix}$

To reach upto 2 p.m. from 9 a.m. we need (9-10, 10-11, 11-12, 12-1, 1-2) 5 steps.

We need P^5_{00} in P^5

$$P^2 = \begin{bmatrix} 0.6 & 0.4 \\ 0.8 & 0.2 \end{bmatrix} \times \begin{bmatrix} 0.6 & 0.4 \\ 0.8 & 0.2 \end{bmatrix} = \begin{bmatrix} 0.68 & 0.32 \\ 0.64 & 0.36 \end{bmatrix}$$

$$P^4 = \begin{bmatrix} 0.68 & 0.32 \\ 0.64 & 0.36 \end{bmatrix} \times \begin{bmatrix} 0.68 & 0.32 \\ 0.64 & 0.36 \end{bmatrix} = \begin{bmatrix} 0.6672 & 0.3328 \\ 0.6656 & 0.3344 \end{bmatrix}$$

$$P^5 = \begin{bmatrix} 0.6672 & 0.3328 \\ 0.6656 & 0.3344 \end{bmatrix} \times \begin{bmatrix} 0.6 & 0.4 \\ 0.8 & 0.2 \end{bmatrix} = \begin{bmatrix} 0.6666 & 0.3334 \\ 0.6669 & 0.3331 \end{bmatrix}$$

The required probability is 0.6666.

Problem: 4

Soln: Let T be the time between the entrance of 10^{th} and 11^{th} customer.

Here, $\lambda = 5$/hour

(i) $P(T<2) = 1 - e^{-5\times2} = 0.99995$

(ii) $P(T>5) = e^{-5\times5} = 1.3888\times10^{-11}$

(iii) $P(3<T<5) = e^{-5\times3} - e^{-5\times5} = 3.0589\times10^{-7}$

$$E(S_n) = \frac{50}{5} = 10 \text{ hour.}$$

Question : 5

Soln:

Sampling: It is a technique to select a representative part of population units, where units are investigated to study the characteristics of population units.

When we test our blood we test a sample, we don't give our whole blood.

Objective of sampling:

(i) Makes data collection easier.

(ii) No need to work with the total population.

(iii) Gives us a short idea about the population.

Question: 6

Simple random sampling: is a ~~sampli~~ sampling technique where every unit in the population has an even chance and likelihood of being selected in the sample.

There are 40 students in a Math class at AIUB. The teacher wants to select a student as the class monitor. He makes 40 slips, write the IDs of the students on them ~~distn~~ distincly and put them in a box. After shuffling the slips, he picks one up randomly and declare the student whose ID is there on the selected slip as the monitor. Here each and ~~vary~~ every single student have equal probability $\frac{1}{40}$ of being selected as the class monitor.

Question: 7

Systematic sampling: is a type of probability sampling method in which sample members from a larger population are selected according to a random starting poing (R) but with a fixed, periodic interval. The interval, called the sampling interval ($k = \frac{N}{n}$), is calculated by dividing the population size by the desired sample size.

If total student are 40 and we take 10 Students as a sample then the interval ($\frac{N}{n}$) = 4. If we select a random number from 1-4, like if we choose 2. Then starting with 2 and take every 4th unit.

Question : 8

Circular Systematic sampling:

In this method, we assume the listings to be in a circle such that the last unit is followed by the first. A random start is choosen from 1 to N. We then add the intervals k ~~unit~~ until exactly n elements are choosen. If we come to the end of the list, you continue from ~~begining~~ beginning.

Question : 9

Sample size, n is given by, $n = \frac{z^2 pq}{d^2} = \frac{(1.96)^2 \times 0.6 \times 0.4}{(0.1)^2}$

$= 92.1984$

Question : 10

Sample size, n is given by, $n = \frac{z^2 V(x)}{d^2}$

$= \frac{1.96^2 (10)}{(0.2)^2}$

$= 960.4$

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Ans to the Q No- 1

The trensiting probability matrix: $P = \begin{bmatrix} p & 1-p \\ 1-p & p \end{bmatrix}$

$= \begin{bmatrix} 0.2 & 0.8 \\ 0.8 & 0.2 \end{bmatrix}$

It will reach the destination at $(4-1) = 3$ steps

Thus, we need P^3_{00} in P^3

$$P^2 = \begin{bmatrix} 0.2 & 0.8 \\ 0.8 & 0.2 \end{bmatrix} \times \begin{bmatrix} 0.2 & 0.8 \\ 0.8 & 0.2 \end{bmatrix} = \begin{bmatrix} 0.68 & 0.32 \\ 0.32 & 0.68 \end{bmatrix}$$

$$P^3 = \begin{bmatrix} 0.68 & 0.32 \\ 0.32 & 0.68 \end{bmatrix} \times \begin{bmatrix} 0.2 & 0.8 \\ 0.8 & 0.2 \end{bmatrix} = \begin{bmatrix} 0.392 & 0.608 \\ 0.608 & 0.392 \end{bmatrix}$$

The required probability is 0.392 (Ans.)

Ans to the Q No- 2

Let, T be the elepsed time between the entrence of $(n-1)^{th}$ and n^{th} signal and S_n be the waiting time untill the n^{th} signal reach to the destination.

(a) $P(T>1) = e^{-\lambda t} = e^{-3\times 1} = 0.0498$

(b) $P(T<1) = 1-e^{-\lambda t} = 1-e^{-3\times 1} = 0.9502$

(c) $P(2<T<3) = e^{-\lambda t_1} - e^{-\lambda t_2} = e^{-3\times 2} - e^{-3\times 3}$

$= 0.0025 - 0.0001$

$= 0.0024$

$E(S_n) = \frac{n}{\lambda} = \frac{9}{3} = 3$ hour. (Ans)

Ans to the Q No-3

Transition probability matrix, $P = \begin{bmatrix} 0.6 & 0.4 \\ 0.8 & 0.2 \end{bmatrix}$

To reach upto 2pm from 9am. We need (9-10, 10-11, 11-12, 12-1, 1-2) 5 steps

Thus we need P_{00}^5 in P^5

$$P^2 = \begin{bmatrix} 0.6 & 0.4 \\ 0.8 & 0.2 \end{bmatrix} \times \begin{bmatrix} 0.6 & 0.4 \\ 0.8 & 0.2 \end{bmatrix} = \begin{bmatrix} 0.68 & 0.32 \\ 0.64 & 0.36 \end{bmatrix}$$

$$P^4 = \begin{bmatrix} 0.68 & 0.32 \\ 0.64 & 0.36 \end{bmatrix} \times \begin{bmatrix} 0.68 & 0.32 \\ 0.64 & 0.36 \end{bmatrix} = \begin{bmatrix} 0.6672 & 0.3328 \\ 0.6656 & 0.3344 \end{bmatrix}$$

$$P^5 = \begin{bmatrix} 0.6672 & 0.3328 \\ 0.6656 & 0.3344 \end{bmatrix} \times \begin{bmatrix} 0.6 & 0.4 \\ 0.8 & 0.2 \end{bmatrix}$$

$$= \begin{bmatrix} 0.6666 & 0.3334 \\ 0.6669 & 0.3331 \end{bmatrix}$$

The required probability is 0.6666 (Ans.)

Ans. to the Q No. - 4

Let T be the time between the entrance of 10^{th} and 11^{th} customers, Here $\lambda = 5/\text{hour}$

i) $P(T<2) = 1 - e^{-5\times2} = 0.99995$

ii) $P(T>5) = e^{-5\times5} = 1.3888\times10^{-11}$

iii) $P(3<T<5) = e^{-5\times3} - e^{-5\times5} = 3.0589\times10^{-7}$

$E(S_n) = \frac{50}{5} = 10\text{hour}$

Ans to the Q No = 5

Sampling: It is a technique to select a representative part of population units where units are investigated to study the characteristics of population units. In cooking rice we check the status of the rice by ~~int~~ insertion a spoon until it touches the bottom of the pot out the spoon some rice will stick to it (sample) and taste the rice and test the rice.

~~The~~ The objective of sampling are:

i) we don't need to work with the total population

ii) Make data collection easier

iii) Gives us a short idea about the population.

Ans to the Q No.- 6

Simple random sampling: It is a sampling technique where every unit the population has an even chance and likelihood of bring selected in the sample.

There are 40 students in a Math class at AIUB. The teacher wants to select a student as the CR. He makes 40 slips. If we write ID's of the students on them distinctly and put them in a box. After shuffling the sips, he picks up one slip randomly and declare the student whose ID is there on that slip as CR. Here each and every single students has equal probability ~~to~~ of being selected as CR.

Ans to the Q No-7

Sysmatic sampling:- It is a type of probability sampling method in which sample members from a learger population are selected according to a random starting point (R) but with a fixed interval. This interval called the sampling interval ($k = \frac{N}{n}$) is calculated by dividing the population size by the disired sample size.

If total students are 40 and we take 10 students as sample then the interval ($= \frac{N}{n}$) = 4. If we select a random number from 1-4 like if we choose 2. Then starting with 2 and take every 4th unit.

Ans to the Q No-8

circular systematic sampling: In this method we assume the listings to be in a circle such that the last unit is followed by the first. A random start is chosen from 1 to N. we then add the intervals k unit exactly elements are chosen. If we come to the end of the list you continue from the beginning.

Ans to the Q No -9

Sample size n is given by $n = \frac{z^2 pq}{d^2}$

$$= \frac{(1.96)^2 \times 0.6 \times 0.4}{(0.1)^2}$$

$$= 92.1984 \text{ (Ans)}$$

~~Ans to the~~ Ans to the Q No-10

Sample size n is given by $n = \frac{z^2 V(x)}{d^2}$

$$= \frac{(1.96)^2 (10)}{(0.2)^2}$$

$$= 960.4 \text{ (Ans)}$$

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Name: Jannatuil Ferdouse
ID : 19-41735-3 P-1

(1) The trasition probability matrix $p = \begin{bmatrix} p & 1-p \\ 1-p & p \end{bmatrix}$

$$= \begin{bmatrix} 0.2 & 0.8 \\ 0.8 & 0.2 \end{bmatrix}$$

It will reach the destination $(4-1)=3$ steps.

We need p^3_{00} in p^3

$$p^2 = \begin{bmatrix} 0.2 & 0.8 \\ 0.8 & 0.2 \end{bmatrix} \times \begin{bmatrix} 0.2 & 0.8 \\ 0.8 & 0.2 \end{bmatrix} = \begin{bmatrix} 0.68 & 0.32 \\ 0.32 & 0.68 \end{bmatrix}$$

$$p^3 = \begin{bmatrix} 0.68 & 0.32 \\ 0.32 & 0.68 \end{bmatrix} \times \begin{bmatrix} 0.2 & 0.8 \\ 0.8 & 0.2 \end{bmatrix} = \begin{bmatrix} 0.392 & 0.608 \\ 0.608 & 0.392 \end{bmatrix}$$

The required probability is 0.392

P-2

(2) a) $P(T>1) = e^{-\lambda t} = e^{-3\times 1} = 0.0497$

b) $P(T<1) = 1-e^{-\lambda t} = 1-e^{-3\times 1} = 0.950$

c) $P(2<T<3) = e^{-\lambda t} = e^{-3\lambda 2} = e^{-3\times 2} - e^{-3\times 3}$

$= 0.0025 - 0.0001$

$= 0.0024$

$E(S_n) = \frac{n}{\lambda} = \frac{9}{3} = 3$ hour

(3) Transition probability $P = \begin{bmatrix} 0.6 & 0.4 \\ 0.8 & 0.2 \end{bmatrix}$

We need (9-10, 10-11, 11-12, 12-1, 1-2)

5 step to reach upto 2 pm from 9am

We need P_{00}^5 in P^5

$P^2 = \begin{bmatrix} 0.6 & 0.4 \\ 0.8 & 0.2 \end{bmatrix} \times \begin{bmatrix} 0.6 & 0.4 \\ 0.2 & 0.2 \end{bmatrix} = \begin{bmatrix} 0.68 & 0.32 \\ 0.64 & 0.36 \end{bmatrix}$

$P^4 = \begin{bmatrix} 0.68 & 0.32 \\ 0.64 & 0.36 \end{bmatrix} \times \begin{bmatrix} 0.68 & 0.32 \\ 0.64 & 0.36 \end{bmatrix} = \cancel{\begin{bmatrix} 0.6672 \\ 0.6656 \end{bmatrix}}$

$= \begin{bmatrix} 0.6672 & 0.3320 \\ 0.6656 & 0.3344 \end{bmatrix}$

P-3

$$p^5 = \begin{bmatrix} 0.6672 & 0.3328 \\ 0.6656 & 0.3344 \end{bmatrix} \times \begin{bmatrix} 0.6 & 0.4 \\ 0.8 & 0.2 \end{bmatrix}$$

$$= \begin{bmatrix} 0.6666 & 0.3334 \\ 0.6669 & 0.3331 \end{bmatrix}$$

The required probability is 0.6666

(4) Let T be the time between the entrance of 10th an 11th customer.

Here, $\lambda = 5/\text{hour}$

(i) $P(T<2) = 1-e^{-5\times2} = 0.99995$

ii) $P(T>5) = e^{-5\times5} = 1.3888\times10^{-11}$

iii) $P(3<T<5) = e^{-5\times3} - e^{-5\times5} = 3.0589\times10^{-7}$

$E(S_n) = \frac{50}{5} = 10 \text{ hour}$

(5) Sampling is a technique to select a representative part of population units where units are investigated to study the charactaeristics of populations units.

When we test our blood we test a sample, we dont give our whole blood.

Objective of sampling:

a) Makes a data collection easier

b) No need to work with the total population.

(6) Simple random sampling is a technique where every unit in the population has an even chance and likehood of being ~~Se~~ selected in the sample

Selecting class monitor among 40 student of a class in a example of simple random. sampling.

⑦ Systematic sampling is a type of probability sampling method in which sample members from a larger population are selected according to a random starting point (R) but with a fixed, periodic interval. The interval, called the sampling interval $(K = \frac{N}{n})$ is calculated by dividing the population size by the disired sample size

If total student are 40 an we take 10 students an a sample then the internal $\left(\frac{N}{n}\right) = 4$. If we select a ~~ran~~ random number from 1-4. Like if we choose 2. The starting with 2 and take every

P-6

4th unit,

8) circular systematic sampling:

In this method, we assume the listing to be in a circle such that last ~~list~~ unit is followed by the first. A random start is chosen from 1 to N. we then add the intervals k until exactly n elements are chosen. If we come to the end of the list, you continue from the beginning.

P-7

(5) Sample size, n is given by, $n = \frac{z^2 pq}{d^2}$

$$= \frac{(1.96)^2 \times 0.6 \times 0.4}{(0.1)^2}$$

$= 92.1984 = 92$
(Ans)

(6) sample size, n is given by.

$$n = \frac{z^2 V(x)}{d^2}$$

$$= \frac{1.96^2 (10)}{(0.2)^2}$$

$= \cancel{360.4}$

$= 960$
(Ans)

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Assignment 02

Ans to the Q. 1

The transition probability matrix: P

$$P = \begin{bmatrix} p & 1-p \\ 1-p & p \end{bmatrix} = \begin{bmatrix} 0.2 & 0.8 \\ 0.8 & 0.2 \end{bmatrix}$$

It will reach the destination at $(4-1) = 3$ steps.

$$P^2 = \begin{bmatrix} 0.2 & 0.8 \\ 0.8 & 0.2 \end{bmatrix} \times \begin{bmatrix} 0.2 & 0.8 \\ 0.8 & 0.2 \end{bmatrix}$$

$$= \begin{bmatrix} 0.68 & 0.32 \\ 0.32 & 0.68 \end{bmatrix}$$

$$P^3 = \begin{bmatrix} 0.68 & 0.32 \\ 0.32 & 0.68 \end{bmatrix} \times \begin{bmatrix} 0.2 & 0.8 \\ 0.8 & 0.2 \end{bmatrix}$$

$$= \begin{bmatrix} 0.392 & 0.608 \\ 0.608 & 0.392 \end{bmatrix}$$

So, the required probability is 0.392.

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Ans to the Q.2

Let,
T be the elapsed time between the entrance of $(n-1)^{th}$ and n^{th} signal & S_n be the waiting time until the n^{th} signal reaches to the destination.

(a) $P(T>1) = e^{-\lambda t} = e^{-3\times1} = 0.049$

(b) $P(T<1) = 1-e^{-\lambda t} = 1-e^{-3\times1} = 0.95$

(c) $P(2<T<3) = e^{-\lambda t_1} - e^{-\lambda t_2}$

$= e^{-3\times2} - e^{-3\times3}$

$= 0.00235$

$E(S_n) = n/\lambda = \frac{9}{3} = 3$ hour.

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Ans to the Q.3

The transition probability matrix

$$P = \begin{bmatrix} P_{00} & P_{01} \\ P_{10} & P_{11} \end{bmatrix} = \begin{bmatrix} 0.6 & 0.4 \\ 0.8 & 0.2 \end{bmatrix}$$

We need P^5_{00} in P^5

$$P^2 = \begin{bmatrix} 0.6 & 0.4 \\ 0.8 & 0.2 \end{bmatrix} \begin{bmatrix} 0.6 & 0.4 \\ 0.8 & 0.2 \end{bmatrix}$$

$$= \begin{bmatrix} 0.68 & 0.32 \\ 0.64 & 0.36 \end{bmatrix}$$

$$P^4 = \begin{bmatrix} 0.68 & 0.32 \\ 0.64 & 0.36 \end{bmatrix} \begin{bmatrix} 0.68 & 0.32 \\ 0.64 & 0.36 \end{bmatrix}$$

$$= \begin{bmatrix} 0.6672 & 0.3328 \\ 0.6656 & 0.3344 \end{bmatrix}$$

$$P^5 = \begin{bmatrix} 0.6672 & 0.3328 \\ 0.6656 & 0.3344 \end{bmatrix} \begin{bmatrix} 0.6 & 0.4 \\ 0.8 & 0.2 \end{bmatrix}$$

$$= \begin{bmatrix} 0.66656 & 0.33344 \\ 0.66688 & 0.33312 \end{bmatrix}$$

The required probability is 0.66656.

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Ans to the Q-4

i) $P(T<2) = 1-e^{-\lambda t} = 1-e^{-5\times2} = 0.99$

ii) $P(T>5) = e^{-\lambda t} = e^{-5\times5} = 1.38\times10^{-11}$

iii) $P(3<T<5) = e^{-\lambda t_1} - e^{-\lambda t_2}$

$= e^{-5\times3} - e^{-5\times5}$

$= 3.05\times10^{-7}$

b) $E(S_n) = n/\lambda = 50/5$

$= 10$ hour.

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Ans to the Q.5

Sampling: It is a technique to select a representative part of population units, where units are investigat to study the characteristics of population un

In cooking rice, we check the status of the ric by inserting a poon until it touches the bottom of th pot, pull out the spoon, some rice will stich to it (s & taste the rice.

The objective of sampling are:

(i) We don't need to work with the total population.

(ii) Makes data collection easier.

(iii) Gives us a short idea about the population.

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Ans to the Q. 6

Simple random sampling: It is a sampling technique where every unit in the population has an even chance and likelihood of being selected in the sample

There are 40 students in a Math class at AIUB. The teacher wants to select a student as the CR. He makes 40 slips. Write the IDs of the students on them distinctly & put them in a box. After shutting the slips, he picks one up randomly and declare the student whose ID is there on the selected slip ~~student~~ as the monitor. Here each & every single student has equal probability $\frac{1}{40}$ of being selected as ~~the~~ the class monitor

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Ans to the Q. 7

Systematic sampling: is a type of probability sampling method in which sample members from a larger population are selected according to a random starting point (R) but with a fixed, periodic interval. The interval, called the sampling interval $(K = \frac{N}{n})$, is calculated by dividing the population size by the desired sample size.

If total student are 40 & we take 10 students as sample then the interval $(\frac{N}{n}) = 4$. If we select a random number from 1-4. Like if we choose 2. Then starting with 2 & take every 4th unit.

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Ans to the Q. 8

Circular systematic sampling: In this method, we assume the listings to be in a circle such that the last unit is followed by the first. A random start is chosen from 1 to N. We then add the intervals K ~~unit~~ until exactly in elements are chosen. If we come to the end of the list, you continue from the beginning.

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Ans to the Q.9

Sample size $n = \dfrac{z^2 pq}{d^2}$

$= \dfrac{(1.96)^2 \times 0.6 \times 0.4}{(0.1)^2}$

$= 92.198$

$= 92$

(Ans)

$z = 1.96$
$p = 0.6$
$q = 0.4$
$d = 0.1$

Ans to the Q.10

Sample size $n = \dfrac{z^2 V(x)}{d^2}$

$= \dfrac{(1.96)^2 \times 10}{(0.2)^2}$

$= 960.$

(Ans)

$z = 1.96$
$V(x) = 10$
$d = 0.2$

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Ans. to the Q. No. 1

The transition probability matrix : $P = \begin{bmatrix} p & 1-p \\ 1-p & p \end{bmatrix} = \begin{bmatrix} 0.2 & 0.8 \\ 0.8 & 0.2 \end{bmatrix}$

it will reach the destination at $(4-1) = 3$ steps

we know P^3_{00} in P^3

$$P^2 = \begin{bmatrix} 0.2 & 0.8 \\ 0.8 & 0.2 \end{bmatrix} \times \begin{bmatrix} 0.2 & 0.8 \\ 0.8 & 0.2 \end{bmatrix} = \begin{bmatrix} 0.68 & 0.32 \\ 0.32 & 0.68 \end{bmatrix}$$

$$P^3 = \begin{bmatrix} 0.68 & 0.32 \\ 0.32 & 0.68 \end{bmatrix} \times \begin{bmatrix} 0.2 & 0.8 \\ 0.8 & 0.2 \end{bmatrix} = \begin{bmatrix} 0.392 & 0.608 \\ 0.608 & 0.392 \end{bmatrix}$$

The required probality is 0.392

Ans: to the Q. No. 2

Let T be the elapsed time between the entrance of $(n-1)^{th}$ and n^{th} singal and S_n be the waiting time until the n^{th} singanl reaches to the destination.

(a) $P(T>1) = e^{-\lambda t} = e^{-3\times1} = 0.0498$

(b) $P(T<1) = 1-e^{-\lambda t} = 1-e^{-3\times1} = 0.9502$

(c) $P(2<T<3) = e^{-\lambda t} - e^{-\lambda t_2} = e^{-3\times2} - e^{-3\times3} = 0.0025 - 0.0001 = 0.0024$

$$E(S_n) = \frac{n}{\lambda} = \frac{9}{3} = 3 \text{ hours.}$$

Ans: to the Q. No. 3

Transition probability matrix, $P = \begin{bmatrix} 0.6 & 0.9 \\ 0.8 & 0.2 \end{bmatrix}$

To reach upto 2 pm from 9 am. we need

(9-10, 10-11, 11-12, 12-1, 1-2) 5 steps.

We know, P^5_{00} in P^5

$$P^2 = \begin{bmatrix} 0.6 & 0.9 \\ 0.3 & 0.2 \end{bmatrix} \times \begin{bmatrix} 0.6 & 0.9 \\ 0.8 & 0.2 \end{bmatrix} = \begin{bmatrix} 0.68 & 0.32 \\ 0.64 & 0.36 \end{bmatrix}$$

$$P^4 = \begin{bmatrix} 0.68 & 0.32 \\ 0.69 & 0.36 \end{bmatrix} \times \begin{bmatrix} 0.68 & 0.32 \\ 0.64 & 0.36 \end{bmatrix} = \begin{bmatrix} 0.6672 & 0.3328 \\ 0.6656 & 0.3399 \end{bmatrix}$$

$$P^5 = \begin{bmatrix} 0.6672 & 0.3328 \\ 0.6656 & 0.3399 \end{bmatrix} \times \begin{bmatrix} 0.6 & 0.9 \\ 0.3 & 0.2 \end{bmatrix} = \begin{bmatrix} 0.6666 & 0.3334 \\ 0.6669 & 0.3331 \end{bmatrix}$$

The required Probability is 0.6666

Ans: to the Q. No. 4

Let T be the time between the entrance to 10^{th} and 11^{th} customer.

Here, $\lambda = 5$/hours

① $P(T<2) = 1 - e^{-5\times2} = 0.9995$

⑪ $P(T>5) = e^{-5\times5} = 1.3888 \times 10^{-11}$

⑪ $P(3<T<5) = e^{-5\times3} - e^{-5\times5} = 3.0589 \times 10^{-7}$

$$E(S_n) = \frac{50}{5} = 10 \text{ hours.}$$

Ans: to the Q. No. 5

Sampling: It is a techinique to select a reprensentative part of population units, where units are insentigated to study the characteristies of population units.

when we test our blood we test a sample, we don't give our whole blood.

objective of sampling:

(i) Makes data collection easier.
(ii) No need to with the total population.
(iii) Gives us a short idea about the population.

Ans: to the Q No. 6

Simple random Sampling: Is a sampling technique where every unit in the population has an even chance and likedood ~~to~~ of being selected in the sample.

There are 40 students in a math class at AIUB. The teacher wants to select a student as the class monitor. He makes 40 slips, write the ID to the students After shutting distincely and put then in a box. The student selected ID slip as the moniton. Here each and every single student have equal probability $\frac{1}{40}$ of being selected as the class moniton.

Ans: to the Q. No. 7

Systematic Sampling: Is a type of probability sampling method in which sample members them a large population are selected according to a random starting point but with a fixed, periodic internal. The internal, called the sampling interval $(k = \frac{N}{n})$ is calculated by dividing the population size by the desired sample size.

If total student are 40 and we take 10 students as a sample then the interval $(\frac{N}{n}) = 4$. Then starting with 2 and take every 4th unit.

Ans: to the Q. No. 8

Circular Systemtic Sampling: In this method, we assume listings to be in a circle such that the last list is followed by the first. A random start is choose from 1 to N. We then add the interval k Unitel exactly n elements are choosen. If we come to the and of the list, you continue from beginning.

Ans: to the Q. No. 9

Sample Size, n is given by $n = \frac{z^2 pq}{d^2}$

$$= \frac{(1.96)^2 \times 0.6 \times 0.4}{(0.1)^2}$$

$$= 92.1984$$

Ans: to the Q. No. 10

Sample size, n is given by, $n = \frac{z^2 V(x)}{d^2}$

$$= \frac{(1.96)^2 (10)}{(0.2)^2}$$

$$= 960.4$$

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Nayeef (20-42048-1)

Ans. to the Q. No. 1

The transition probability matrix: $P = \begin{bmatrix} p & 1-p \\ 1-p & p \end{bmatrix} = \begin{bmatrix} 0.2 & 0.8 \\ 0.8 & 0.2 \end{bmatrix}$

it will reach the destination at $(4-1) = 3$ steps.

Thus, we need P^3_{00} in P^3

$$P^2 = \begin{bmatrix} 0.2 & 0.8 \\ 0.8 & 0.2 \end{bmatrix} \times \begin{bmatrix} 0.2 & 0.8 \\ 0.8 & 0.2 \end{bmatrix} = \begin{bmatrix} 0.68 & 0.32 \\ 0.32 & 0.68 \end{bmatrix}$$

$$P^3 = \begin{bmatrix} 0.68 & 0.32 \\ 0.32 & 0.68 \end{bmatrix} \times \begin{bmatrix} 0.2 & 0.8 \\ 0.8 & 0.2 \end{bmatrix} = \begin{bmatrix} 0.392 & 0.608 \\ 0.608 & 0.392 \end{bmatrix}$$

The required probability is 0.392 (Ans)

Ans. to the Q. No. 2

Let, T be the elapsed time between the entrance of $(n-1)^{th}$ and n^{th} signal and S_n be the waiting time untill the n^{th} signal reaches to the destination.

a) $P(T > 1) = e^{-\lambda t} = e^{-3 \times 1} = \cancel{0.05}\ 0.0498$

b) $P(T < 1) = 1 - e^{-\lambda t} = 1 - e^{-3 \times 1} = 0.9502$

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c) $P(2<T<3) = e^{-\lambda t_1} - e^{-\lambda t_2} = e^{-3\times2} - e^{-3\times3}$

$= 0.0025 - 0.0001$

$= 0.0024$

$E(S_n) = \frac{n}{\lambda} = \frac{9}{3} = 3$ hour (Ans)

Ans. to the Q. No. 3

Transition probability matrix, $P = \begin{bmatrix} 0.6 & 0.4 \\ 0.8 & 0.2 \end{bmatrix}$

To reach upto 2 pm from 9am. We need (9-10, 10-11, 11-12, 12-1, 1-2) 5 steps.

~~It will reach the destination at (5-1) = 4 steps~~

Thus, we need P^5_{00} in P^5

$P^2 = \begin{bmatrix} 0.6 & 0.4 \\ 0.8 & 0.2 \end{bmatrix} \times \begin{bmatrix} 0.6 & 0.4 \\ 0.8 & 0.2 \end{bmatrix} = \begin{bmatrix} 0.68 & 0.32 \\ 0.64 & 0.36 \end{bmatrix}$

$P^4 = \begin{bmatrix} 0.68 & 0.32 \\ 0.64 & 0.36 \end{bmatrix} \times \begin{bmatrix} 0.68 & 0.32 \\ 0.64 & 0.36 \end{bmatrix} = \begin{bmatrix} 0.6672 & 0.3328 \\ 0.6656 & 0.3344 \end{bmatrix}$

~~The required probability is 0.6672.~~

$$P^5 = \begin{bmatrix} 0.6672 & 0.3328 \\ 0.6656 & 0.3344 \end{bmatrix} \times \begin{bmatrix} 0.6 & 0.4 \\ 0.8 & 0.2 \end{bmatrix}$$

$$= \begin{bmatrix} 0.6666 & 0.3334 \\ 0.6669 & 0.3331 \end{bmatrix}$$

The required probability is 0.6666 (Ans)

Ans. to the Q.No.4

Let T be the time between the entrance of 10^{th} and 11^{th} customers. Here, $\lambda = 5$ /hour

i) $P(T<2) = 1 - e^{-5\times2} = 0.99995$

ii) $P(T>5) = e^{-5\times5} = 1.3888\times10^{-11}$

iii) $P(3<T<5) = e^{-5\times3} - e^{-5\times5} = 3.0589\times10^{-7}$

$E(S_n) = \frac{50}{5} = 10$ hour

Ans. to the Q. No 5

Sampling: It is a technique to select a representative part of population units, where units are investigated to study the characteristics of population units.

In cooking rice, we check the status of the rice by inserting a poon until it touches the bottom of the pot, pull out the spoon, some rice will stick to it (sample) and taste the rice.

The objective of sampling are;

i) We don't need to work with the total population.

ii) Makes data collection easier.

iii) Gives us a short idea about the population.

Ans. to the Q. No. 6

Simple random sampling: It is a sampling technique where every unit in the population has an even chance and likelihood of being selected in the sample.

There are 40 students in a Math class at AIUB. The teacher wants to select a student as the CR. He makes 40 slips. If we write the ID's of the students on them distinctly and put them in a box. After shuffling the slips, he picks up one slip randomly and declare the student whose ID is there on that slip. as CR. Here, each and every single student has equal probability $\frac{1}{40}$ of being selected as CR.

Ans. to the Q. No. 7

~~Symatic~~ **Symatric sampling:** It is a type of probability sampling method in which sample members from a larger population are selected according to a random starting point (R) but with a fixed periodic intereval. This interval called the sampling interval ($k = \frac{N}{n}$) is calculated by dividing the population size by the desired sample size.

If total students are 40 and we take 10 students as sample then the interval ($= \frac{N}{n}$) = 4. If we ~~st~~ select a random number from 1-4. ~~Then eve~~ Like if we choose 2. Then starting with 2 and take every 4th unit.

Ans. to the Q. No. 8

Circular systematic sampling: In this method, we assume the listings to be in a circle such that the last unit is followed by the first. A random start is chosen from 1 to N. We then add the intervals k until exactly n elements are chosen. If we come to the end of the list, you continue from the beginning.

Ans. to the Q. No. 9

Sample size, n is given by, $n = \frac{z^2 pq}{d^2}$

$$= \frac{(1.96)^2 \times 0.6 \times 0.4}{(0.1)^2}$$

$$= 92.1984$$ (Ans)

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Ans. to the Q. No. 10

Sample size, n is given by, $n = \dfrac{z^2 \ V(x)}{d^2}$

$$= \frac{(1.96)^2 \ (10)}{(0.2)^2}$$

$$= 960.4$$

(Ans)

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ID : 20-42138-1

1. The transition probability matrix $P = \begin{vmatrix} 0.2 & 0.8 \\ 0.8 & 0.2 \end{vmatrix}$

It will reach to the destination at $(4+1) = 3$ steps

Thus we need P^3_{00} in P^3

$$P^2 = \begin{bmatrix} 0.2 & 0.8 \\ 0.8 & 0.2 \end{bmatrix} \begin{bmatrix} 0.2 & 0.8 \\ 0.8 & 0.2 \end{bmatrix} = \begin{bmatrix} 0.68 & 0.32 \\ 0.32 & 0.68 \end{bmatrix}$$

$$P^3 = \begin{bmatrix} 0.68 & 0.32 \\ 0.32 & 0.68 \end{bmatrix} \begin{bmatrix} 0.2 & 0.8 \\ 0.8 & 0.2 \end{bmatrix} = \begin{bmatrix} 0.392 & 0.608 \\ 0.608 & 0.392 \end{bmatrix}$$

The required probability is 0.392

2.

a) $P(T>1) = e^{-\lambda T} = e^{-3\times1} = 0.04978$

b) $P(T<1) = 1 - e^{-\lambda T} = 1 - e^{-3\times1} = 0.95021$

c) $P(2<T<3) = e^{-\lambda T_1} - e^{-\lambda T_2} = e^{-3\times2} - e^{-3\times3} = 0.00235$

$E(S_n) = \frac{9}{3} = 3$ hour.

3. The transition probability matrix:

$$P = \begin{bmatrix} 0.6 & 0.4 \\ 0.8 & 0.2 \end{bmatrix}$$

We need P^5_{00} in P^5

$$P^2 = \begin{bmatrix} 0.6 & 0.4 \\ 0.8 & 0.2 \end{bmatrix} \begin{bmatrix} 0.6 & 0.4 \\ 0.8 & 0.2 \end{bmatrix} = \begin{bmatrix} 0.68 & 0.32 \\ 0.64 & 0.36 \end{bmatrix}$$

$$P^5 = \begin{bmatrix} 0.68 & 0.32 \\ 0.64 & 0.36 \end{bmatrix} \begin{bmatrix} 0.68 & 0.32 \\ 0.64 & 0.36 \end{bmatrix} \begin{bmatrix} 0.6 & 0.4 \\ 0.8 & 0.2 \end{bmatrix} = \begin{bmatrix} 0.66656 & 0.33344 \\ 0.66688 & 0.33312 \end{bmatrix}$$

The required probability is 0.66656

4. Here, Paisson rate $\lambda = 5$

i) $P(T<2) = 1 - e^{-\lambda T} = 1 - e^{-5\times 2} = 0.99995$

ii) $P(T>5) = e^{-\lambda T} = e^{-5\times 5} = 1.38879\times 10^{-11}$

iii) $P(3<T<5) = e^{-\lambda T_1} - e^{-\lambda T_2} = e^{-5\times 3} - e^{-5\times 5} = 3.05888\times 10^{-7}$

$E(S_n) = \frac{n}{\lambda} = \frac{50}{5} = 10$ hour

5. Its a technique to select a representative part of population units, where units are investigate to study the characteristics of population units.

Sometimes we can not work with whole population and that is why we need to do sampling.

6. Simple random sampling technique where every unit in the population has an even chance and likelihood of being selected in the sample.

There are 40 students in a Math class at AIUB. The teacher wants to select a student as the class monitor. He makes 40 slips, write the IDs of the students on them distinctly and put them in a box. After shuffling the slips, he picks one up randomly and declare the student whose ID is there on the selected slip as the class monitor. Here, each and every single student has equal probability 1/40 of being selected as the class monitor.

7. Systematic sampling is a type of probability sampling method in which sample members from a larger population are selected according to a random starting point (R) but with a fixed, periodic interval. This interval, called the sampling interval ($K = \frac{N}{n}$), is calculated by diving the population size by the desired sample size.

8. In this method, we assume the listings to be in a circle such that the last unit is fallowed by the first. A random start is chosen from 1 to N. We then add the intervals k untill exactly n elements are chasen. If we come to the end of the list, you continue from the beginning.

9. Here, $p = 0.6 \quad q = 0.4 \quad d = 0.1$

Sample size $n = \frac{z^2 pq}{d^2}$

$$= \frac{1.96^2 \times 0.6 \times 0.4}{0.1^2}$$

$$= 92$$

10. Here, $v(x) = 10 \quad d = 0.2$

Sample size $n = \frac{z^2 v(x)}{d^2}$

$$= \frac{1.96^2 \times 10}{0.2^2}$$

$$= 960$$