Assignment 2

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Download all python codes from

https://github.com/Dhatri−nanda/mini/blob/main/Assignment2/code.py

and latex-tikz codes from

https://github.com/Dhatri−nanda/mini/blob/main/Assignment2/Assignment2.tex

1 Problem

Let X denote the number of hours you study during a randomly selected school day. The probability that X can take the values x, has the following form, where k is some unknown constant.

$$\Pr(X=x)=\begin{cases} 0.1, & \text{if} x=0 \\ kx, & \text{if } x=1 or 2 \\ k(5-x), & \text{if } x=3 or 4 \\ 0, & \text{otherwise} \end{cases}$$

A) Find the value of k.

B) What is the probability that you study at least two hours? Exactly two hours? At most two hours?

2 Solution

If we expand the probabilities given further more by substituting the value of x and only considering 0 to 4 hours as the probability of studying in the remaining hours is zero, we get

x	0	1	2	3	4
$\Pr(X=x)$	0.1	k	2k	2k	k

we also know that,

$$\sum_{x=0}^{4}\Pr(X=x)=1 \tag{2.0.1}$$

By substituting the probabilities in (2.0.1),

$$\implies 0.1+k+2k+2k+k=1 \tag{2.0.2}$$

$$\implies 6k=0.9 \tag{2.0.3}$$

Therefore, from (2.0.3)

$$k=0.15 \tag{2.0.4}$$

Now, we get the probabilities as

x	0	1	2	3	4
$\Pr(X=x)$	0.1	0.15	0.3	0.3	0.15

1) Probability of studying at least two hours

$$\implies \sum_{x=2}^{4}\Pr(X=x) \tag{2.0.5}$$

$$\implies \Pr(X=2)+\Pr(X=3)+\Pr(X=4) \tag{2.0.6}$$

By substituting probabilities in (2.0.6)

$$=0.3+0.3+0.15 \tag{2.0.7}$$

$$=0.75 \tag{2.0.8}$$

2) Probability of studying exact two hours

$$=\Pr(X=2) \tag{2.0.9}$$

$$=0.3 \tag{2.0.10}$$

3) Probability of studying at most two hours

$$\implies \sum_{x=0}^{2}\Pr(X=x) \tag{2.0.11}$$

$$\implies \Pr(X=0)+\Pr(X=1)+\Pr(X=2) \tag{2.0.12}$$

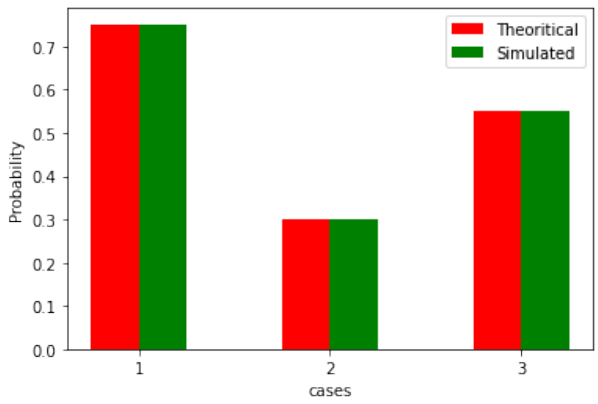
By substituting probabilities in (2.0.12)

$$=0.1+0.15+0.3 \tag{2.0.13}$$

$$=0.55 \tag{2.0.14}$$

Final solution :

$\Pr(X\geq 2)$	$\Pr(X=2)$	$\Pr(X\leq 2)$
0.75	0.3	0.55
Case1	Case2	Case3


Theoritical
Simulated
Probability
0.0
0.1
0.2
0.3
0.4
0.5
0.6
0.7
1
2
3
cases