Assignment 2

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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.

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

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,

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

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

$$
\implies \sum_{k=2}^{4} \Pr(X = k) \tag{2.0.5}
$$
$$
\implies \Pr(X = 2) + \Pr(X = 3) + \Pr(X = 4) \tag{2.0.6}
$$

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 exactly two hours

$$
= \Pr(X = 2) \tag{2.0.9}
$$
$$
= 0.3 \tag{2.0.10}
$$

3) Probability of studying at most two hours

$$
\implies \sum_{k=0}^{2} \Pr(X = k) \tag{2.0.11}
$$
$$
\implies \Pr(X = 0) + \Pr(X = 1) + \Pr(X = 2) \tag{2.0.12}
$$

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
Case 1	Case 2	Case 3