

# PROBABILITY

DIVYA SAI - FWC22094

16.4.10 <sup>1</sup>The random variable  $X$  has a probability distribution  $P(X)$  of the following form, where  $k$  is some number:

$$P(X) = \begin{cases} k, & \text{if } x=0 \\ 2k, & \text{if } x=1 \\ 3k, & \text{if } x=2 \\ 0, & \text{otherwise} \end{cases} \quad (16.4.10.1)$$

- a) Determine the value of  $k$   
b) Find  $P(X < 2), P(X \leq 2), P(X \geq 2)$

**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
$\Pr\{X = x\}$	$k$	$2k$	$3k$

we also know that,

$$\sum_{k=0}^2 \Pr\{X = k\} = 1 \quad (16.4.10.2)$$

By substituting the probabilities in (16.4.10.2)

$$\Rightarrow k + 2k + 3k = 1 \quad (16.4.10.3)$$

$$\Rightarrow 6k = 1 \quad (16.4.10.4)$$

$$k = 0.167 \quad (16.4.10.5)$$

$x$	0	1	2
$\Pr\{X = x\}$	0.167	0.334	0.501

x	0	1	2
$F(X)$	0.167	0.501	1.00

We know that, Cumulative Distributive Function (CDF)

$$F(x) = \Pr \{X \leq x\} \quad (16.4.10.6)$$

And also,

$$\Pr \{x < X \leq y\} = F \{y\} - F \{x\} \quad (16.4.10.7)$$

(a)  $P(X < 2)$

$$\begin{aligned} \Rightarrow \sum_{k=0}^1 \Pr \{X = k\} &= \Pr \{X \geq 2\} \\ \Rightarrow \Pr \{0 < X \leq 1\} \\ &= F(1) \\ &= 0.501 \end{aligned}$$

(b)  $P(X \leq 2)$

$$\begin{aligned} \Rightarrow \sum_{k=0}^2 \Pr \{X = k\} &= \Pr \{X \leq 2\} \\ &= F(2) \\ &= 1 \end{aligned}$$

(c)  $P(X \geq 2)$

$$\begin{aligned} \Rightarrow \Pr \{1 < X \leq 2\} \\ &= F(2) - F(1) \\ &= 1.002 - 0.501 \\ &= 0.501 \end{aligned}$$

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<sup>1</sup>Read question numbers as (CHAPTER NUMBER).(EXERCISE NUMBER).(QUESTION NUMBER)