

# PROBABILITY

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

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

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

**Solution:** If we expand the probabilities given further more by substituting the value of  $x$ , we get  
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)

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

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

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

We know that, Cumulative Distributive Function (CDF)

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

And also,

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

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

$$\text{(a)} \quad \Pr(X < 2)$$

$$\sum_{k=0}^1 \Pr(X = k) = \Pr(X \geq 2) \quad (16.4.1.8)$$

$$\implies \Pr(0 < X \leq 1) \quad (16.4.1.9)$$

$$= F(1) \quad (16.4.1.10)$$

$$= 0.501 \quad (16.4.1.11)$$

$$\text{(b)} \quad \Pr(X \leq 2)$$

$$\sum_{k=0}^2 \Pr(X = k) = \Pr(X \leq 2) \quad (16.4.2.12)$$

$$= F(2) \quad (16.4.2.13)$$

$$= 1 \quad (16.4.2.14)$$

$$\text{(c)} \quad \Pr(X \geq 2)$$

$$\Pr(1 < X \leq 2) \quad (16.4.3.15)$$

$$= F(2) - F(1) \quad (16.4.3.16)$$

$$= 1.002 - 0.501 \quad (16.4.3.17)$$

$$= 0.501 \quad (16.4.3.18)$$