**Question 1**

**Suppose the p.m.f. of the discrete random variable X is**

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| **x** | **0** | **1** | **2** | **3** |
| **f(x)** | **0.2** | **0.1** | **0.4** | **0.3** |

**Find E(2), E(X), E(2X) and V(X)?**

E(2) = 2 × 0.4

= 0.8

E(X) = 

= 

= 0 + 0.1 + 0.8 + 0.9

= 1.8

E(2X) = 2 ∙ E(X)

= 3.6

V(X) = E(X2)­­­ – [E(X)]2

= 

= 

= 0 + 0.1 + 1.6 + 2.7 – 3.24

= 1.16

**Question 2**

**The maximum patient life for a new drug is 17 years. Subtracting the length of time required by the Food and Drug Administration for testing and approval of the drug provides the actual patient life for the drug - that is, the length of time that the company has to recover research and development costs and to make a profit. The distribution of the lengths of actual patient lives for new drugs is as follows**

|  |  |  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| **x** | **3** | **4** | **5** | **6** | **7** | **8** | **9** | **10** | **11** | **12** | **13** |
| **f(x)** | **0.03** | **0.05** | **0.07** | **0.10** | **0.14** | **0.20** | **0.18** | **0.12** | **0.07** | **0.03** | **0.01** |

**What is the mean and variance patient life for a new drug?**

Mean = E(X) = 

= (3×0.03) + (4×0.05) + (5×0.07) + (6×0.10) + (7×0.14) + (8×0.20)

(9×0.18) + (10×0.12) + (11×0.07) + (12×0.03) + (13×0.01)

= 0.09 + 0.2 + 0.35 + 0.6 + 0.98 + 1.6 + 1.62 + 1.2 + 0.77 + 0.36 + 0.13 = 7.9

≈ 8

The mean patient life is 8 years.

Variance V(X) = E(X2) – [E(X)]2

= – [E(X)]2

= [(32×0.03) + (42×0.05) + (52×0.07) + (62×0.10) + (72×0.14) + (82×0.20)

(92×0.18) + (102×0.12) + (112×0.07) + (122×0.03) + (132×0.01) ] – (7.9)2

= (0.27 + 0.8 + 1.75 + 3.6 + 6.86 + 12.8 + 14.58 + 12 + 8.47 + 4.32 + 1.69) – 62.41

= 67.14 – 62.41

= 4.73

≈ 5

Variance of the patient life is 5 years

**Question 3**

**From the following probability distribution find**

**a) k,**

**b) E(X),**

**c) Var(X),**

**d)S.D.(X) and**

**e) E(2X+5).**

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
| **X** | **-4** | **-2** | **0** | **2** | **4** |
| **P(X)** | **0.1** | **0.3** | **k** | **0.3** | **0.1** |

(a) The given table represents the probability distribution.

Therefore the sum of all P(X) = 1

P(X) = 0.1 + 0.3 + k + 0.3 + 0.1

1 = 0.8 + k

k = 1 – 0.8

**k = 0.2**

(b) E(X) = 

= (-4×0.1) + (-2×0.3) + (0×0.2) + (2×0.3) + (4×0.1)

= – 0.4 – 0.6 + 0 + 0.6 + 0.4

= 0

(c) V(X) = E(X2) – [E(X)]2

= [(16×0.1) + (4×0.3) + (0×0.2) + (4×0.3) + (16×0.1)] – 0

= 1.6 + 1.2 + 0 + 1.2 + 1.6

= 5.6

(d) SD(X) =

= 

= 2.3664

(e) E(2X + 5) = 2E(X) + 5

= 2(0) + 5

= 5