Ex: 3.7):-

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Given

$$\mu = 12 \text{ hours} = 720 \text{ minutes}$$

$$\sigma = 6 \text{ minutes}$$

$$P\left(\frac{X-\mu}{\sigma} > 725\right) = 1 - P\left(\frac{X-\mu}{\sigma} < 725\right)$$

$$= 1 - \left(\frac{725-720}{6}\right)$$

$$= 0.833$$

$$= \phi(0.833)$$

Probability that bus is not departed $= 1 - \phi(0.83)$

$$= 1 - 0.7967$$

$$= 0.2033$$

Ex: 4.1:-

Given there 1200 students

$$P(\text{Month}) = 1/12$$

$$\text{mean } E(x) = \frac{1}{12} \times 1200$$

$$= 100$$

$$\text{Variance } (\sigma^2(X)) = 1200 \times \frac{11}{12} \times 1/12$$

$$= 91.6667$$

$$P(X > 130) = P\left(\frac{X-100}{\sqrt{91.6667}}\right)$$

$$= P\left(\frac{130-100}{\sqrt{91.6667}}\right)$$

4.1

$= P(X > 3.13)$

$P(\cancel{X > 130})$

Probability that not more than 130 students were born in january $= 1 - \phi(3.13)$

$= 1 - 0.991$

$= 0.0009$

(b)

$$E(x) = \frac{31}{365} \times 1200$$

$$= 101.9178$$

$$\sigma^2(x) = \frac{31}{365} \times \left(1 - \frac{31}{365}\right) \times 1200$$

$$= 93.26178$$

$$P(X > 130) = \left(P > \frac{130 - 101.9178}{\sqrt{93.26178}}\right)$$

$$= P(X > 2.90789)$$

$$= 1 - \phi(2.91)$$

$$= 1 - 0.9982$$

$$= 0.0018$$

4.2

Given

$$P(\text{simple pair}) = 0.42$$

$$\mu = E(X) = 0.42 \times 1000$$
$$= 420$$

$$\sigma^2(x) = (0.42) \times (1-0.42) \times 1000$$
$$= 243.6$$

$$P\left(X \geq \frac{x-\mu}{\sigma}\right) = P\left(X \geq \frac{450-420}{\sqrt{243.6}}\right)$$
$$= P(X \geq 1.922)$$
$$= 1 - \phi(\cancel{0.97}\ 1.922)$$
$$= 1 - 0.9726$$
$$= 0.0274$$

4.3 :-

Given

$$X = \{1, 2, 3, 4, 5, 6\}$$

$$S = \text{multiplies of } 3 = \{3, 6\}$$

$$P(S) = 2/6 = 1/3$$

$$E(S) = \frac{1}{3} \times 300$$
$$= 100$$

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Ex: 4.3:- Variance (s) $= \frac{1}{3}\left(\frac{2}{3}\right) \times 300$

$= 66.66.$

$$P\left(\frac{X-\mu}{\sigma}\right) = P\left(\frac{99.5-100}{\sqrt{66.66}} < X < \frac{100.5-100}{\sqrt{66.66}}\right)$$

$$= P\left(\frac{-0.5}{8.1645} < x < \frac{0.5}{8.1645}\right)$$

$$= P\left(-0.0612 < x < 0.0612\right)$$

$$= \phi(0.0612) - \phi(-0.0612)$$

$$= 0.0478$$

Ex:- 4.9

Given

$X \sim \text{Poisson}(10)$

$$P(X \geq 7) = 1 - P(X \leq 7)$$

$$= 1 - P(X=0) - P(X=1) - P(X=2) - P(X=3) - P(X=34) - P(X=5) - P(X=6) - P(X=7)$$

we know

$$P(X=r) = \frac{e^{-\lambda}\lambda^{r}}{r!}$$

$\therefore\ P(X \geq 7) = \cancel{1 - 0.1572}\ 1 - 0.1301$

$= \cancel{0.8428}\ 0.8699$

$$P\left(X \leq 13 / X \geq 7\right) = \frac{P(7 \leq X \leq 13)}{P(X \geq 7)}$$

$= 0.844$

Ex: 4.11

Given

$\lambda = 6$

$P(X \geq 4) = 1 - P(X \leq 4)$

$= 1 - [P(X=0) + P(X=1) + P(X=2) + P(X=3) + P(X=4)]$

$= 1 - 0.1512$

$= 0.8488$

4.10) From Poisson distribution

$$P(X=r) = \frac{e^{-\lambda} \lambda^r}{r!}$$

Let $X=0$ i.e he scores zero goals

$$P(X=0) = \frac{e^{-\lambda} \lambda^0}{0!}$$

$$P(X=0) = e^{-\lambda}$$

Since he scores at least one goal in half time of his games

$$P(X=0) = 1/2$$

$$e^{-\lambda} = 1/2$$

$$\lambda = \ln(2)$$

$$P(X=3) = \frac{e^{-\lambda} \lambda^3}{3!}$$

$$= \frac{e^{-\lambda} (\ln(2))^3}{3!}$$

$$= \frac{\frac{1}{2} (\ln(2))^3}{3!}$$

$$= 0.027752$$