

QUESTION

In a certain windy desert, sandstorms occur randomly at an average rate of one every two days. Calculate

- (i) the probability that, on a randomly chosen day, there will be two sandstorms,
- (ii) the probability that, in a randomly chosen week, there will be more than two sandstorms,
- (iii) the probability that, on a randomly chosen day there will not be a sandstorm,
- (iv) the probability that, in a randomly chosen week, there will be exactly two days on which there are no sandstorms.

ANSWER

Rate of sandstorms $\lambda = \frac{1}{2}$ Number of sandstorms per day is $P(\frac{1}{2})$

(i) $P(2) = e^{-\frac{1}{2}} \frac{(\frac{1}{2})^2}{2!} = 0.758$

(ii) The number of sandstorms in a week is $P(\frac{7}{2})$

$$\begin{aligned} P(\text{more than two}) &= 1 - P(0) - P(1) - P(2) \\ &= 1 - e^{-\frac{7}{2}} \left(1 + \frac{7}{2} + \frac{(\frac{7}{2})^2}{2!} \right) \\ &= 0.679 \end{aligned}$$

(iii) $P(0) = e^{-\frac{1}{2}} = 0.0607$

(iv) Number of days on which there were sandstorms $\sim B(7, 0.607)$

$$P(2) = \binom{7}{2} (.607)^2 (0.393)^5 = .0729$$