

4.4 The Poisson Distribution

■ If the random variable X is the number of occurrences of some random event in a certain period of time or space (or some volume of matter).

■ The probability distribution of X is given by:

$$f(x) = P(X=x) = \frac{e^{-\lambda} \lambda^x}{x!}, x = 0, 1, \dots$$

The symbol e is the constant equal to 2.7183. λ (Lambda) is called the parameter of the distribution and is the average number of occurrences of the random event in the interval (or volume)

Properties of the Poisson distribution

1. $f(x) \geq 0$
2. $\sum f(x) = 1$
3. $\mu = E(X) = \lambda$
4. $\sigma^2 = \text{var}(X) = \lambda$

Example 4.4.1 page 111

In a study of a drug -induced anaphylaxis among patients taking rocuronium bromide as part of their anesthesia, Laake and Rottingen found that the occurrence of anaphylaxis followed a Poisson model with $\lambda = 12$ incidents per year in Norway .Find

- 1- The probability that in the next year, among patients receiving rocuronium, exactly three will experience anaphylaxis?

- 2- The probability that less than two patients receiving rocuronium, in the next year will experience anaphylaxis?
- 3- The probability that more than two patients receiving rocuronium, in the next year will experience anaphylaxis?
- 4- The expected value of patients receiving rocuronium, in the next year who will experience anaphylaxis.
- 5- The variance of patients receiving rocuronium, in the next year who will experience anaphylaxis
- 6- The standard deviation of patients receiving rocuronium, in the next year who will experience anaphylaxis



Example 4.4.2 page 111: Refer to example 4.4.1

- 1-What is the probability that at least three patients in the next year will experience anaphylaxis if rocuronium is administered with anesthesia?
- 2-What is the probability that exactly one patient in the next year will experience anaphylaxis if rocuronium is administered with anesthesia?
- 3-What is the probability that none of the patients in the next year will experience anaphylaxis if rocuronium is administered with anesthesia?



■ 4-What is the probability that at most two patients in the next year will experience anaphylaxis if rocuronium is administered with anesthesia?

■ Exercises: examples 4.4.3, 4.4.4 and 4.4.5 pages 111-113

■ Exercises: Questions 4.3.4 ,4.3.5, 4.3.7 ,4.4.1,4.4.5