

The Poisson Probability Distribution

1 Determine if a probability experiment follows a Poisson process.

- 1) Given that a random variable x , the number of successes, follows a Poisson process, the probability of 2 or more successes in any sufficiently small subinterval is
 - A) zero.
 - B) one.
 - C) any number between zero and one.
 - D) none of these
- 2) Given that a random variable x , the number of successes, follows a Poisson process, then the probability of success for any two intervals of the same size
 - A) is the same.
 - B) are complementary.
 - C) are reciprocals.
 - D) none of these
- 3) Given that a random variable x , the number of successes, follows a Poisson process, then the number of successes in any interval is independent of the number of successes in any other interval provided the intervals
 - A) are disjoint.
 - B) overlap.
 - C) have at least one element in common.
 - D) are the same size and are independent.

2 Compute probabilities of a Poisson random variable.

- 4) A history professor finds that when he schedules an office hour at the 10:30 a.m. time slot, an average of three students arrive. Use the Poisson distribution to find the probability that in a randomly selected office hour in the 10:30 a.m. time slot exactly four students will arrive.
- 5) A help desk receives an average of four calls per hour on its toll-free number. For any given hour, find the probability that it will receive exactly three calls. Use the Poisson distribution.
- 6) The local police department receives an average of two calls per hour. Use the Poisson distribution to determine the probability that in a randomly selected hour the number of calls is six.
- 7) A dictionary contains 500 pages. If there are 200 typing errors randomly distributed throughout the book, use the Poisson distribution to determine the probability that a page contains exactly three errors.
- 8) A customer service firm receives an average of three calls per hour on its toll-free number. For any given hour, find the probability that it will receive at least three calls. Use the Poisson distribution.
- 9) An online retailer receives an average of five orders per 500 hits on its website. If it gets 100 hits on its website, find the probability of receiving at least two orders. Use the Poisson distribution.
- 10) The university police department must write, on average, five tickets per day to keep department revenues at budgeted levels. Suppose the number of tickets written per day follows a Poisson distribution with a mean of 9.3 tickets per day. Find the probability that exactly four tickets are written on a randomly selected day from this distribution.
- 11) The number of goals scored at State College hockey games follows a Poisson distribution with a mean of 3 goals per game. Find the probability that a randomly selected State College hockey game would have more than three goals scored.
- 12) The number of goals scored at State College hockey games follows a Poisson distribution with a mean of 5 goals per game. Find the probability that each of three randomly selected State College hockey games resulted in six goals being scored.
- 13) A small life insurance company has determined that on the average it receives 5 death claims per day. Find the probability that the company receives at least seven death claims on a randomly selected day.
- 14) The number of traffic accidents that occurs on a particular stretch of road during a month follows a Poisson distribution with a mean of 8.9. Find the probability that less than two accidents will occur on this stretch of road during a randomly selected month.
- 15) Suppose the number of babies born during an eight-hour shift at a hospital's maternity wing follows a Poisson distribution with a mean of 3 an hour. Find the probability that exactly seven babies are born during a randomly selected hour.

3 Find the mean and standard deviation of a Poisson random variable.

- 16) The university police department must write, on average, five tickets per day to keep department revenues at budgeted levels. Suppose the number of tickets written per day follows a Poisson distribution with a mean of 4.5 tickets per day. Interpret the value of the mean.
- A) If we sampled all days, the arithmetic average number of tickets written would be 4.5 tickets per day.
 - B) The number of tickets that is written most often is 4.5 tickets per day.
 - C) Half of the days have less than 4.5 tickets written and half of the days have more than 4.5 tickets written.
 - D) The mean has no interpretation since 0.5 ticket can never be written.
- 17) Suppose x is a random variable for which a Poisson probability distribution with $\lambda = 6.9$ provides a good characterization. Find μ for x .
- 18) Suppose x is a random variable for which a Poisson probability distribution with $\lambda = 10$ provides a good characterization. Find σ for x .
- 19) The number of goals scored at State College soccer games follows a Poisson process with a goal scored approximately every 18 minutes (a soccer game consists of 2 45-minute halves). What is the mean number of goals scored during a game
- 20) The university police department keeps track of the number of tickets it write in a year. Last year the campus police wrote 1460 tickets. Ticket writing on campus follows a Poisson process. What is the mean number of tickets written per day by the campus police?