

IT2120 - Probability and Statistics

Department of Information Technology, Faculty of Computing

Year 2 semester 1 (2025)

Tutorial 05

1. An officer is always late to the office and arrives within the grace period of ten minutes after the start. Let X be the time that elapses between the start and the time the officer signs in with a probability density function

$$f(x) = \begin{cases} kx^2 & 0 \leq x \leq 10 \\ 0 & \text{otherwise} \end{cases}$$

where $k > 0$ is a constant.

- (a) Compute the value of k .
 - (b) Find the cumulative distribution function of X .
 - (c) Find the probability that he arrives less than 3 minutes after the start of the office.
 - (d) Calculate the mean and variance of X .
2. It is given that the smiling time of a 1-year-old baby follows a uniform distribution between 0 and 25 seconds, inclusively.
- (a) What is the probability that a 1-year-old baby smiles between 4 and 10 seconds?
 - (b) What is the expected time that a 1-year-old baby smiles?
 - (c) What is the standard deviation?
3. Waiting time for a bus is uniformly distributed between 0 and 15 minutes, inclusive. What is the probability that a person waits for at least 10 minutes for the bus?
4. The time taken to assemble a car in a certain plant is a random variable having a normal distribution of 20 hours and a standard deviation of 2 hours. What is the probability that a car can be assembled at this plant in a period of time,
- (a) Less than 19.5 hours?
 - (b) Between 20 and 22 hours?
5. A large group of students took a test in Physics and the final grades have a mean of 70 and a standard deviation of 10. If we can approximate the distribution of these grades by a normal distribution, what percent of the students,

- (a) Scored higher than 80?
 - (b) Should pass the test (grades ≥ 60)?
 - (c) Should fail the test (grades < 60)?
6. A radar unit is used to measure speeds of cars on a motorway. The speeds are normally distributed with a mean of 90 km/hr and a standard deviation of 10 km/hr. What is the probability that a car picked at random is travelling at more than 100 km/hr?
 7. Suppose we know that the birth weights of babies are normally distributed with mean 3500g and standard deviation 500g. What is the probability that a baby is born that weighs less than 3100g?
 8. Suppose that we are told that the heights of adult males in a particular region of the world are normally distributed with a mean of 70 inches and standard deviation of 2 inches.
 - (a) Approximately what proportion of adult males are taller than 73 inches?
 - (b) What proportion of adult males are between 72 and 73 inches?
 - (c) What height corresponds to the point where 20% of all adult males are greater than this height?
 - (d) What height corresponds to the point where 20% of all adult males are less than this height?
 9. Assume the speed of vehicles along a stretch of a highway has an approximately normal distribution with a mean of 71 mph and a standard deviation of 8 mph.
 - (a) The current speed limit is 65 mph. What is the proportion of vehicles less than or equal to this speed limit?
 - (b) What proportion of the vehicles would be going less than 50 mph?
 - (c) A new speed limit will be initiated such that approximately 10% of vehicles will be over the speed limit. What is the new speed limit based on this criterion?
 10. The bottom 30% of students failed an end semester examination. The mean for the test was 120 and the standard deviation was 17. What was the passing score?
 11. Suppose that customers arrive at Banks ATM at the rate 20 per hour. If customer has just arrived, what is the probability that the next customer arrives within 6 minutes?
 12. The time required to repair a machine is an exponential random variable with rate $\lambda = 0.5$ downs/hour. What is the probability that a repair time exceeds 2 hours?
 13. The breakdowns occur on an old car with rate $\lambda = 5$ breakdowns/month. The owner of the car is planning to have a trip in his car for 4 days. What is the probability that he will return home safely on his car?
 14. Autos arrive at a tollbooth located at the entrance to a bridge at the rate of 50 per minute during 12.00 to 13.00 hrs. What is the probability that the next auto will arrive within 3 seconds?

15. Telephone calls arrive at the information desk of a large computer software company at the rate of 15 per hour.
- (a) What is the probability that the next call will arrive within 3 mts (0.05 hrs)?
 - (b) What is the probability that the next call will arrive within 15 mts?
 - (c) Supposed that the company has just introduced an updated version of one of its software programs and telephone calls are now arriving at the rate of 25 per hour. Given this information, what would be your answers to part (a) and (b) above?