

Department of Mathematical Sciences
Rajiv Gandhi Institute of Petroleum Technology, Jais

Tutorial Set - 4

Subject: Statistical Methods & Data Analysis (MA 231)

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1. A bus arrives every 10 minutes at a bus stop. It is assumed that the waiting time for a particular individual is a random variable with a continuous uniform distribution.
 - (a) What is the probability that the individual waits more than 7 minutes?
 - (b) What is the probability that the individual waits between 2 and 7 minutes?
 - (c) What is the probability that the individual waits at most 5 minutes?

2. Based on extensive testing it is determined that the time X in years before a major repair is required for a certain washing machine is characterized by the density function given by

$$f(x) = \begin{cases} \frac{1}{4}e^{-x/4}, & x \geq 0, \\ 0, & \text{elsewhere} \end{cases}$$

The machine is considered a bargain if it is unlikely to require a major repair before the sixth year. Thus, what is the probability $P(X > 6)$? Also, what is the probability that a major repair occurs in the first year?

3. In an industrial process, the diameter of a ball bearing is an important component part. The buyer sets specifications on the diameter to be 3.0 ± 0.01 cm. The implication is that no part falling outside these specifications will be accepted. It is known that in the process the diameter of a ball bearing has a normal distribution with mean $\mu = 3.0$ and standard deviation $\sigma = 0.005$. On the average, how many manufactured ball bearings will be scrapped?
4. A soft-drink machine is regulated so that it discharges an average of 200 millimeters per cup. If the amount of drink is normally distributed with a standard deviation equal to 15 millimeters, then,
 - (a) What percentage of the cups will contain more than 224 millimeters?
 - (b) What is the probability that a cup contains between 191 and 209 millimeters?
 - (c) How many cups will probably overflow if 230 millimeter cups are used for the next 1000 drinks?
5. Compute the MGF of standard normal distribution.
6. A company produces component parts for an engine. Parts specifications suggest that 95% of items meet specifications. The parts are shipped to customers in lots of 100.
 - (a) What is the probability that more than 2 items will be defective in a given lot?
 - (b) What is the probability that more than 10 items will be defective in a lot?
7. Concentration of pollutants produced by chemical plants historically are known to exhibit behavior that resembles a lognormal distribution. Suppose it is assumed that the concentration of a certain pollutant, in parts per million, has a lognormal distribution with parameters $\mu = 3.2$ and $\sigma = 1$. What is the probability that the concentration exceeds 8 parts per million?