

# Tutorial 7: Probability and Statistics (MAL403/IC105)

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1. The daily consumption of oil in a city, in excess of 30,000 gallons, is approximately distributed as a gamma distributed with parameters  $\alpha = 2$  (two consumptions in a day) and  $\beta = 1/10000$  (time taken in days per consumption of one gallon of oil). The city has a daily stock of 40,000 gallons. What is the probability that the stock is insufficient on a particular day?
2. TV- manufacturer offers a one year warranty. If a TV fails during this warranty period, it is replaced free of cost. The time to failure (in years)  $X$  has a shifted exponential distribution with location parameter 0 and scale parameter 8. What percentage of TVs will fail within the warranty period? The manufacturing cost of a TV is Rs 25,000 and the net profit per unit scale is Rs 10,000. If in the first week of January 2010, thousand TVs are sold, what is the expected profit after a year?
3. The lead time for orders of diodes from a certain manufacturer is known to have a gamma distribution with a mean of 20 days and a standard deviation of 10 days. Determine the probability of receiving an order within 15 days of placement date.
4. A large microprocessor chip contains multiple copies of circuits. If a circuit fails, the chip knows it and knows how to select the proper logic to repair itself. The average number of defects per chip is 300. What is the probability that no more than 4 defects will be found in a randomly selected area that comprises 2% of the total surface area?
5. A small industrial unit has 10 bulbs whose lifetimes are independent exponentially distributed with mean 50 hours. If all the bulbs are used at a time, find the probability that even after 100 hours there are at least two bulbs working.
6. Suppose  $X$  denotes the time (in hours) needed to locate and rectify a problem in the software that governs the timing of lights in a large city. Let  $X$  follow  $N(10, 9)$ . Find the probability that the next problem will require at most 15 hours to locate and rectify.
7. In a town adult population have equally divided opinion on the implementation of a municipality project. A random sample of 100 adults is asked to give their opinion. Using binomial approximation to normal determine the probability that at least 60% of adults in the sample are in favour of the project.
8. In an industrial process the diameter of a ball bearing is an important component. The buyer sets specifications on the diameter to be  $3.0 \pm 0.01$  cm. The diameter has a normal distribution with mean 3 cm. and s.d. 0.005 cm. On the average what percentage manufactured balls will be scrapped?
9. The height a university high jumper will clear, each time he jumps, is a normal r.v. with mean 2 meters and s.d. 10 cm. What is the greatest height that he will jump with probability 0.95? What is the height that he will clear only 10% of the time?

10. If a set of marks on a Statistics exam is approximately  $N(74, 62.41)$ , find
- (a) the lowest passing grade if the lowest 10% of the students are given F's;
  - (b) the highest B if the top 5% of the students are given A's
11. Let  $X \sim N(2, 4)$ . Find  $P(X \leq 0)$ ,  $P(|X| \geq 2)$ ,  $P(1 < X \leq 3)$  and  $P(X \leq 3|X > 1)$  (Solved in the class)