## TUTORIAL 4

1. Calls arrive at a switchboard according to a Poisson process with parameter $\lambda = 5$ per hour. If we are at the switchboard, what is the probability that

   (a) at least 15 minutes will elapse until the next call?

   (b) no more than 10 minutes will elapse to the next call?

   (c) exactly 5 minutes will elapse to the next call?

2. A soft drinks machine is regulated so that it discharges an average of 7 ounces per cup. The amount of drink is normally distributed with standard deviation equal to 0.5 ounce.

   (a) What fraction of cups will contain more than 7.8 ounces?

   (b) What is the probability that a cup contains between 6.7 and 7.3 ounces?

   (c) How many cups are likely to overflow if 8 ounce cups are used for the next 1000 drinks?

   (d) Below what value do we get the smallest 25% of the drinks?

3. (a) If $X$ is a random variable with mean $\mu$ and variance $\sigma^2$, prove that for any $k > 0$

$$P(|x - \mu| \geq k\sigma) \leq \frac{1}{k^2}$$

   (b) A model of an on-line computer system gives a mean time to retrieve a record from a direct access storage system device of 200 milliseconds with a standard deviation of 58 milliseconds. The design criterion requires that at least 90% of all retrieval times must not differ from the mean by more that 75 milliseconds.

      i. Use (a) to establish whether the design criterion is satisfied.

      ii. Would the design criterion be satisfied if it were known that the retrieval time is normally distributed with a mean of 200 milliseconds and a standard deviation of 58 milliseconds?