Questions involving normal, binomial and Poisson distributions

1. Ten percent of computer parts produced by a certain supplier are defective. What is the probability that a sample of 10 parts has no defective parts? Contains exactly one defective part? Contains at least one defective part? Contains more than 3 defective ones?

2. In a survey of 100 people, 55% prefer candidate A over candidate B.

   (a) Simulate this situation with matlab.

   (b) Use binomial distribution to estimate the probability that candidate A will get more votes than candidate B. You will need to program this in Matlab.

   (b) Use the normal approximation to binomial distribution to answer question (a).

   (c) Repeat question (b) but for a survey of 1000 people, where 55% prefer A.

3. A newspaper took a survey of 1000 people. Of those, 40% voted for A and 60% for B. The newspaper said: "The results are accurate within X points 19 times out 20." What is X?

4. The average male height is 175 cm and about 20% of males are more than 182 cm tall. Assume that the heights follow a normal distribution.

   (a) Find the standard deviation.

   (b) What are the chances of being at least 190cm tall?

   (c) What are the chances that among 20 male students, there is a student who is at least 190cm tall?

5. The finish times for marathon runners during a race are normally distributed with a mean of 200 minutes and a standard deviation of 30 minutes.

   (a) What is the probability that a runner will complete the marathon within 3 hours?

   (b) Calculate the time by which the first 10% of runners have completed the marathon.

   (c) What proportion of the runners will complete the marathon between 3 hours and 4 hours?

6. A radioactive source emits particles with rate of 2 particles per minute.

   (a) (a) What is the probability that the random time at which the first particle appears is some time after three minutes?

   (b) What is the probability that the first particle appears sometime after three minutes but before five minutes?

   (c) What is the probability that exactly one particle is emitted in the interval from three to five minutes?

7. On the average, two tornadoes hit major U.S. metropolitan areas every year. What is the probability that more than four tornadoes occur in major U.S. metropolitan areas next year?

8. From past experience, airlines know that 3% of passangers don't show up for their flight.

   (a) Suppose that the airplane has 200 seats. If the airline sells exactly 200 seats, what are the chances that the airplane will be full when it takes off?

   (b) The airline sells 203 seats for the same airplane. What are the chances that the airplane will be overbooked (i.e. more than 200 passengers will arrive at the gate)?

9. A book has 600 pags and 250 typos.

   (a) (a) What is the probability that the first five pages have no typos?

   (b) What is the probability that the first five pages have at most two typos?