Questions

1. Whooping cough is highly contagious. About 80% of unvaccinated children who are exposed to whooping cough will develop the infection. Only 5% of vaccinated children who are exposed to whooping cough will develop the infection.
   a) If 50 unvaccinated children are exposed to whopping cough, what is the probability that 5 will develop the infection?
   b) If 50 vaccinated children are exposed to whopping cough, what is the probability that 5 will develop the infection?
   c) If 50 unvaccinated children are exposed to whopping cough, what is the probability that at most 5 children will develop the infection?
   d) If 50 unvaccinated children are exposed to whopping cough, what is the probability that at least 25 children will develop the infection?
   e) If 50 vaccinated children are exposed to whopping cough, what is the probability that at most 5 children will develop the infection?
2. You are conducting an experiment in which you need to examine 40 full grown potato plants. You plant 60 of the plants, knowing that 65% of the plants will reach the fully grown state.

   1. What is the probability that exactly 40 of the 60 plants will be fully grown?

   2. What is the probability that at least 40 of the 60 plants will be fully grown?

3. Plot the probability density function of a Binomial distribution with 30 identical trials and
   a) Probability of success (p) =0.15.
      (Hint: use plot(x, y) with x<- seq(0,30, 1) and y its probability values)
   b) Probability of success(p)=0.4
   c) Probability of success(p)=0.8.

   Observe the change in the shape of the plots.

4. Calculate the probability that in 60 tosses of a fair coin the head comes up
   a) 20,25 or 30 times
   b) less than 20 times
   c) between 20 and 30 times

5. Generate a series of Poisson distributions for different λ values. Keep the number of items in all the distributions as 100. Observe and explain what happens to the distribution when value of λ changes.

6. The emission of alpha particles by polonium fits a Poisson distribution. Generate 2608 numbers as per this distribution with Poisson rate parameter λ = 10097/2608. Plot a histogram of the same.

7. A random variable X has Poisson distribution with mean 7. Find the probability that
    a. X is less than 5
    b. X is greater than 10
    c. X is between 4 and 16

8. Suppose in a quiz there are 30 participants. A question is given to all 30 participants and the time allowed to answer it is 25 seconds. Find the probability of participants responds within 6 seconds?
    (hint: calculate P(x<6) of uniform distribution. The probability of responding in all seconds are equal (1/25))