# Assignment 1

1. A loaded coin with probabilities p(Head) = ¾ and q(Tail) = ¼ is thrown five times. Find the probability for the outcome of 4 heads and 1 tail.

2. Consider a system of 5 molecules. The probability of any one molecule being in an excited state is 0.1.
   a) What is the probability of none being in an excited state?
   b) What is the probability that only one molecule is in an excited state?

3. Calculate the probability of getting exactly 500 heads and 500 tails when flipping 1000 coins using Stirling's formula.
$$\ln n! = n \ln n - n + \frac{1}{2} \ln(2\pi n)$$

4. Show that $\sigma^2 = N\,p\,q$ for the binomial distribution.

5. Suppose the mean grade of 500 students is 75% and the standard deviation is 8%. Assuming grades are normally distributed, find
   a) the number of grades above 85%
   b) the grade limits of the middle 400 students