Discrete Random Variables

1) The probability that a defective semiconductor chip fails a test is 0.8 Three defective chips are tested. Assume the failure of each defective chip is independent of the other tests. Let the random variable X denote the number of defective chips that fail the test.
    i) Find the probability distribution of X.
    ii) Find the mean of X and the standard deviation of X.

2) A manufacturing process has 100 customer orders to fill. Each order requires one component part that is purchased from a supplier. However, typically 2% of the components are defective, and the components can be assumed to be independent.
    i) If the manufacturer stocks 100 components, what is the probability that the 100 orders can be filled without reordering components?
    ii) If the manufacturer stocks 102 components, what is the probability that the 100 orders can be filled without reordering components?
    iii) If the manufacturer stocks 105 components, what is the probability that the 100 orders can be filled without reordering components?

3) The probability of a successful assembly of a product in a manufacturing process is 0.8.
    i) What is the probability that the first successful assembly requires exactly four trials?
    ii) What is the probability that the first successful assembly requires at least four trials?
    iii) What is the probability that the first successful assembly requires at most four trials?
    iv) What assumptions did you make, if any, to solve this problem?

4) A lot of 75 washers contains five in which the variability in thickness around the circumference of the washer is unacceptable. A sample of 10 washers is selected at random, without replacement.
    i) What is the probability that at least one unacceptable washer is in the sample?
    ii) What is the probability that at most one unacceptable washer is in the sample?

5) The number of failures of a testing instrument from contamination particles on the product is a Poisson random variable with mean of 0.02 failures per hour.
    i) What is the probability that the instrument does not fail in an 8-hour shift?
    ii) What is the probability of at least one failure in a 24-hour day?