

**TMA1201 Tutorial 13 -
T9.3&4 Binomial, Poisson, and Normal distributions**

1. A company that produces fine crystals knows from experience that 10% of its product have flaws and must be classified as 'defective'.
 - a) Among six randomly selected products, how likely it is that only one is a defective item?
 - b) Among six randomly selected products, what is the probability that at least two are defective?
2. Thirty per cent of all telephones are submitted for service. Among these, 30 % must be replaced while the remaining can be repaired. If a company purchases 20 of these telephones, what is the probability that exactly 4 will end up being replaced under warranty?
3. A research report that 1 in 200 people carry the defective gene that causes inherited colon cancer. In a sample of 1000 individuals, what is the probability that
 - a) Between 5 and 8 (inclusive) carry the gene.
 - b) At most 3 carry the gene.
4. Suppose the arrival of aircraft at a certain airport according to a Poisson process with a rate of 8 per hour, so that the number of arrivals during a period of t hours is a Poisson random variable with parameter $\mu = 8t$.
 - a) What is the probability that exactly 6 aircraft arrive during a 1-hour period?
 - b) What are the expected value and the standard deviation of the number of aircraft that arrive during a 90 min period?
5. A research report found that the concentration of a certain contaminant (in mg/cm^3) is normally distributed with $\mu = 0.3$ and $\sigma = 0.06$.
 - a) What is the probability that the concentration exceeds 0.25?
 - b) What is the probability that the concentration is at most 0.10?
6. A company pays its employees an average wage of \$15.90 an hour with a standard deviation of \$1.50. If the wages are approximately normally distributed and paid to the nearest cent,
 - a) What percentage of the workers received wages between \$13.75 and \$16.22 an hour inclusive?
 - b) The highest 5% of the employee hourly wages is greater than what amount?
7. The average life of a certain type of small motor is 10 years with a standard deviation of 2 years. The manufacturer replaces free all motors that fail while under guarantee. If he is willing to replace only 3% of the motors that fail, how long a guarantee should he offer? Assume that the lifetime of a motor follows a normal distribution.
8. Find the probability that 200 tosses of a balance coin will result in
 - a) Between 80 and 120 heads inclusive.
 - b) Less than 90 heads.