

TUTORIAL SHEET 7

Binomial and Poisson Distributions

1. The number of cracks, X , per concrete specimen for a particular type of cement mix has approximately a Poisson distribution with an average number of 2.5 cracks per specimen.
 - (i) Find the probability that a randomly selected concrete specimen has exactly 5 cracks.
 - (ii) Find the probability that a randomly selected concrete specimen has 2 or more cracks.

2. An electronic system that operates continuously develops faults at random times with an average of 14 faults per seven-day week. What is the distribution of the number of faults *per day*? On what proportion of days would the system be expected to develop:
 - (i) no faults?
 - (ii) exactly 3 faults?
 - (iii) at most 2 faults?
 - (iv) more than 1 fault?
 - (v) at least 3 faults?
 - (vi) less than 4 faults?
 - (vii) between 2 and 4 faults inclusive?

3. A multiple choice test contains 25 questions, each with four answers. If a student just guesses on each question, what is the probability that the student answers less than 5 questions correctly?

4. A manufactured article has a 0.20 probability that it will not conform to a special severe specification. Use Minitab to calculate the appropriate cumulative binomial probability to find the chance that a sample of 50 articles contains 15 or more non-conforming articles.

5. An engineer has designed a modified welding robot. The robot will be considered good enough to manufacture if it misses only 1% of its assigned welds. And it will be judged a poor performer if it misses 5% of its welds. A test is performed involving 100 welds. The new design will be accepted if the number of missed welds X is 2 or less and rejected otherwise.
 - (i) What is the probability that a good design will be rejected?
 - (ii) What is the probability that a poor design will be accepted?

6. The number of surface flaws in plastic panels used in the interior of automobiles has a Poisson distribution with a mean of 0.05 per square foot of plastic panel. Assume an automobile interior contains 10 square feet of plastic panel.
 - (i) What is the probability that there are no surface flaws in an auto's interior?
 - (ii) If 10 cars are sold to a rental company, what is the probability that none of the 10 cars has any surface flaws?