Lecture 7 Exercises

7.1 A recursion formula for the Binomial distribution. Show that,

$$P(X = x) = \frac{n - x + 1}{x} \times \frac{\pi}{1 - \pi} \times P(X = x - 1)$$

7.2 Ropes are tested at a certain breaking strain. According to past experience a quarter of all ropes break at this strain. If 4 identical ropes are tested, write down the probability distribution of the number of ropes breaking.

7.3 It is estimated that 20% of all individuals carry antibodies to a particular virus. What is the probability that in a group of 20 randomly selected individuals,

a) More than 8 have antibodies.

b) Exactly 6 have antibodies.

c) Fewer than 4 have antibodies

d) Between 3 and 6 inclusive have antibodies.

7.4 A car salesperson knows from past experience that she will make a sale to 30% of her customers. Find the probability that in 20 randomly selected sales pitches she makes a sale to

a) more than 4 customers

b) fewer than 7 customers

c) exactly 6 customers

d) between 4 and 10 exclusive

7.5 When David Beckham takes a free kick he scores a goal on 10% of occasions. Find the probability that in a match in which he takes 10 free kicks

a) he scores at least two goals

b) he scores exactly two goals

c) he scores 3 goals or less

(these are goals from free-kicks of course!). What assumption do you need to make?

7.6 A statistics lecturer sets a test involving 20 multiple choice questions. He wants to choose the pass mark so that the chance of passing a student who guesses every question is less than 0.05. What should the pass mark be?

7.7 The game of advanced *Chuck-a-luck* (see Exercise 5.8) is an extension of the simple game. The banker now rolls n dice ($n \leq 6$) and the player wins £x if his number comes up on x of the n dice. As before, he loses his £1 stake if his number does not come up at all.

a) Write down the probability mass function of X

b) Show that $\mathrm{E}[X] = \frac{n}{6} - \left(\frac{5}{6}\right)^n$

7.8 In each of the previous questions, use the Binomial formula to evaluate any probabilities involving equalities.