STAT100
Assignment 3: Lectures 10-16
30 marks

External students: If you have not already done so, please complete the form at the front of the Unit Information and lecture notes booklet, indicating if you are going to attend the residential school. Return the form with this assignment.

Question 1 (9 marks)  
Refer to Example 10.3, & Exercise 10.1
The probability distribution of litter size ($Y$) for a particular species of animal is given by:

\[
\begin{array}{c|cccc}
Y & 1 & 2 & 3 & 4 \\
P(Y) & 0.2 & 0.3 & 0.3 & 0.2 \\
\end{array}
\]

(a) Plot the probability and distribution functions (by hand).

(b) Use R to calculate the mean number of animals per litter.

(c) Use R to calculate the variance of the distribution.

(d) Find the probability that a particular litter will have 2 or more animals.


Question 2 (9 marks)  
Refer to Example 11.1 & 11.2
It is claimed that a new drug for hypertension (high blood pressure) is effective in 70% of treated patients. In a given experiment, seven patients were treated.

(a) What conditions must be satisfied for this to be considered a binomial experiment?

(b) Assuming that these conditions are met, find the expected number of successful treatments and the standard deviation.

(c) Use R to find the probability that

- (i) at least four patients will be successfully treated?
- (ii) exactly four patients will be successfully treated.
- (iii) no fewer than 3 and no more than 5 patients will be successfully treated.

Question 3 (5 marks)  
Refer to Example 12.1  
It was claimed that in 1990 Washington D.C. had become the murder capital of the US with a murder rate of 70 murders per hundred thousand people per year.

(a) Assuming that the murders follow a Poisson distribution:

(i) What is the distribution of the number of murders in a district of 100,000 people in a month?

(ii) What is the probability of more than 3 murders occurring in a month? (Use R.)

(b) What practical problems can you foresee in applying a rate which is an average over a whole year, to some particular month?


Question 4 (7 marks)  
Refer to Exercise 15.2

In an agricultural experiment, a large uniform field was divided into many plots and the yield (kg) was measured for each plot. The yield for these plots follows a normal distribution with mean 40kg and standard deviation of 3.2 kg. Use R to answer the following:

(a) What proportion of plots have a yield of 36kg or more?

(b) What proportion of the plots had a yield of between 34kg and 41 kg?

(c) What is the minimum yield that would place a plot in the upper 10% of the distribution?  
Hint: In (c) use the R command `qnorm()`.