Tutorial 6: Special random variables using R

For all the problems below, write an R script to solve the problem. Any descriptive answer, comments, assumptions and approximations should be given as comments in the script itself. Use the help command in R for using the commands indicated in the hints.

[1] The colour of one's eyes is determined by a single pair of genes, with the gene for brown eyes being dominant over the one for blue eyes. This means that an individual having two blue-eyed genes will have blue eyes, while one having either two brown-eyed genes or one brown-eyes and one blue-eyed genes will have brown eyes. A baby inherits one randomly chosen gene fron each of its parents' gene pair. If the eldest child of a pair of brown-eyed parents has blue eyes, what is the probability that exactly two of the other four children (none of whom is a twin) of this couple also have blue eyes.

Hint: Use the command **dbinom**.

[2] Consider the following script:

```
n <- 10
k = seq(0,n,1)
p = 0.5
plot(k,dbinom(k,n,p),type="l")
abline(v=5)
```

How does the plot look? What happens if you use p value of 0.3 or 0.6? Can you generate the same data and plot it as a histogram?

[3] If X is a binomial random variable with parameters n=100 and p=0.75 find P{X=70} and P{X <= 70}. Compare your results with the results given in Ross: Example 5.1f.

Hint: Use **pbinom** to get cumulative probability.

[4] Plot the Poisson probability mass function with λ=4 (in the range 0 to 12).

Hint: Use **dpois** to get Poisson distribution.

[5] Suppose the probability that an item produced by a certain machine will be defective is 0.1. Find the probability that a sample of 10 items will contain at most one defective item. Assume that the quality of successive items is independent. Use Poisson approximation and compare the result with that obtained using binomial.

[6] If the average number of claims handled daily by an insurance company is 5, what proportion of days have less than 3 claims? What is the probability that there will be 4 claims in exactly 3 of the next 5 days? Assume that the number of claims on different days independent.

[7] Generate ten random numbers between 1 and 4.

Hint: Use **runif** to generate random numbers.

[8] Suppose that a number of miles that a car can run before its battery wears out is exponentially distributed with an average value of 10000 miles. Is a persona desires to take a 5000 mile trip, what is the probability that she will be able to complete her trip without having to replace her car battery?

Hint: Use *pexp* for exponential function.

9. Plot gamma(alpha,1) for alpha values of 0.5,2,3,4,5, and 50. Compare your plots with those in Ross: Figure 5.11.

Hint: Check *dgamma* for the gamma distribution.

10. Plot chi-square distribution function with 8 degrees of freedom. Compare your plot with Ross: Figure 5.12.

Hint: Check *dchisq* for the chi-square distribution function.