**Practical 2-Expectation and Variance of a discrete random variable**

In this practical you will simulate discrete random variables and examine their expectation and variance.

**Exercise 1**

The probability distribution of X, the number of cars owned by a randomly selected family in Lewes is given by:

x 0 1 2 3 4

p(x) 0.08 0.15 0.45 0.27 0.05

In the lecture you calculated the mean and variance of X. You are now going to simulate the number of cars owned by 100 randomly selected families in Lewes

First, enter the values of x into C1and their respective probabilities into C2. Select:

**Calc> Random Data> Discrete**

Complete the dialogue box to:

Generate **100** rows of data

Store in column(s): **C3**

Values in: **C1**

Probabilities in: **C2**

and click on O.K.

Calculate the mean and variance of observed number cars per family and compare them to the theoretical values you calculated in the lecture.

**Exercise 2**

In a study into industrial injuries a factory employing 220 people is used. The number of accidents each employee has in a one year period is recorded and can be found in:

**public on ‘cssstudent’( P: ) >Coursewk>MM161>Accidents**

If accidents occur randomly and are not the result of poor health and safety practice, these numbers will be consistent with a Poisson distribution.

To check that it does,

(i) Calculate the mean and variance of the number accidents each employee has per year. Write your results below.

Mean =

Variance =

Explain why the values you have calculated suggest that the Poisson distribution is appropriate.

(ii) Obtain a frequency table of the number of accidents per person.

These are the observed frequencies Write them in the table overleaf.

Open a new worksheet.

Enter the number of accidents/person (i.e. numbers 0 to 6) into C1. Now calculate the **probabilities** of having 0,1,2,…..6 accidents assuming a Poisson distribution with mean found in part (i) and put these in C2.

(ii)cont.The values in C2 are the theoretical *probabilities* of a person having 0, 1, 2, 3, 4, 5 or 6 accidents. Calculate the theoretical *frequencies* in C3 by multiplying C2 by 220 using

**Calc > Calculator**

Complete the dialogue box to:

New variable: **C3**

Expression: **C2\*220**

**O.K.**

Write the theoretical frequencies in the table below. How close are they to the observed frequencies? Does a Poisson distribution seem appropriate?

|  |  |  |
| --- | --- | --- |
| No. of accidents | Observed frequency | Theoretical frequency |
| 0 |  |  |
| 1 |  |  |
| 2 |  |  |
| 3 |  |  |
| 4 |  |  |
| 5 |  |  |
| 6 |  |  |

**Ans.**

2(i) 0.63, 0.70 The mean and variance are close, suggesting a Poisson distribution.

(ii) 117, 74, 23, 5, 1, 0, 0. The observed frequencies are close to the theoretical frequencies calculated assuming a Poisson distribution.