**Record**

**Experiment II**

**Poisson distribution**

**Problem 1:** If the probability that an individual suffers a bad reaction from a certain injection is 0.001. Determine the probability that out of 2000 individuals (i) exactrly3 (ii) more than 2 individuals (iii) none (iv) more than one individual suffer a bad reaction.

**Aim:-** To determine the probability that out of 2000 individuals (i) exactrly3 (ii) more than 2 individuals (iii) none (iv) more than one individual suffer a bad reaction.

**Formula:-**

The probability mass function of poison distribution is ,

x = 0,1,2,3,……∞,

Given n=2000 and p=0.0001 so

1. ,

**Calculation & R-commands:-**

n<- 2000

p<- 0.001

lambda <- 2000\*0.001 =2

1. To determine the probability that out of 2000 individuals **exactly 3** i.e., P(X=3)

**R-commands** :

ans<-dpois(x=3, lambda=2, lower.tail=T)

ans

0.180447

1. To determine the probability that out of 2000 individuals more **than 2 individuals i.e,** **P(X>2) =1-P(X<=2)**

**R-commands** :

**ans<-** ppois(q=2, lambda = 2, lower.tail = F)

**ans**

0.3233236

1. To determine the probability that out of 2000 individuals **none**

**i.e., P(X=0)**

**R-commands** :

**ans<**- dpois(x=0, lambda=2, lower.tail = T)

**ans**

0.1353353

1. To determine the probability that out of 2000 individuals **more than one** individual i.e., **P(X>1) = 1- P(X<=1)**

**R-commands** :

Ans<- ppois(q=1, lambda = 2, lower.tail = F)

ans

0.5939942

**Problem 2:** Fit the Poison distribution of the following data

x: 0 1 2 3 4 5 6 7 8

f: 56 156 132 92 37 22 4 0 1

**Aim:-** To fit the Poison distribution of the above data

**Formula:-**

The probability mass function of poison distribution is , x = 0,1,2,3,……∞,

The expected frequencies are obtained by using the formula E(X) = N\*P(X=x), mean =

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| x | Observed frequency  f | Probability  P(x) | Expected or Theoretical frequency  f(x) =N.P(x) | Round the Expected or Theoretical frequency |
| 0 | 2 | P(0) =  = 0.1391782212 | f(0) = 500.P(0) =**69.5891106** | **70** |
| 1 | 156 | P(1) = = 0.2744594523 | f(1) = 500.P(1) =**137.2297261** | **137** |
| 2 | 132 | P(2) = = 0.2706170199 | f(2) = 500.P(2) =**135.3085100** | **135** |
| 3 | 92 | P(3) = = 0.1778855878 | f(3) = 500.P(3) =**88.9427939** | **89** |
| 4 | 37 | P(4) = = 0.0876975948 | f(4) = 500.P(4) =**43.8487974** | **44** |
| 5 | 22 | P(5) = = 0.0345879314 | f(5) = 500.P(5) =**17.2939657** | **17** |
| 6 | 4 | P(6) = = 0.0113679001 | f(6) = 500.P(6)= **5.6839501** | **6** |
| 7 | 0 | P(7) = = 0.0032024999 | f(7) = 500.P(7)= **1.6012499** | **2** |
| 8 | 1 | P(5) = = 0.0007894162 | f(8) = 500.P(8)= **0.3947081** | **0** |

Manual Answer is : **70 137 135 89 44 17 6 2 0**

**R - commands:-**

|  |
| --- |
| > x<-c(0,1,2,3,4,5,6,7,8)  > x  [1] 0 1 2 3 4 5 6 7 8  > f<-c(56,156,132,92,37,22,4,0,1)  > f  [1] 56 156 132 92 37 22 4 0 1  > mu<-sum(x\*f)/sum(f)  > mu  [1] 1.972  > F <- dpois(x,mu)  > F  [1] 0.1391782212 0.2744594523 0.2706170199 0.1778855878 0.0876975948  [6] 0.0345879314 0.0113679001 0.0032024999 0.0007894162  > ans=F\*sum(f)  > ans  [1] 69.5891106 137.2297261 135.3085100 88.9427939 43.8487974 17.2939657  [7] 5.6839501 1.6012499 0.3947081  > round(ans)  [1] 70 137 135 89 44 17 6 2 0 |
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