Hessa Ahmad

Alaa Al-Kharashi

Shahad Al-Ahmad

STAT215

Poisson Distribution

*Poisson distribution $X \sim Poisson(\lambda)$then its pmf is given by

$$f(x) = f(x;\lambda) = \begin{cases} \frac{e^{-\lambda}\lambda^{x}}{x!} & ;x=0,1,2,\ldots \\ 0 & otherwise \end{cases}$$

Parameter of the Distribution: $\lambda > 0$ (The average)

Mean and Variance

If X is a discrete random variable has Poisson distribution with parameter λ then,

$$E(X) = V(x) = \lambda.$$

Example 3.11"from slides"

Suppose that the number of typing errors per page has a Poisson distribution with average 6 typing errors. What is the probability that

I. the number of typing errors in a page will be 7.
II. the number of typing errors in a page will be at least 2.
III. in 2 pages there will be 10 typing errors.
IV. in a half page there will be no typing errors.

outstanding Job! :)

very clear and easy to understand!

Solution

Let X represents the no. of typing errors per page. Therefore, $\lambda_x = 6 \Rightarrow X \sim Poisson(6)$.

I. $P(X = 7) = 0.1377$.

II. $P(X \geq 2) = f(2) + f(3) + \cdots = 1 - P(X < 2) = 1 - f(0) - f(1) = 0.9826$.

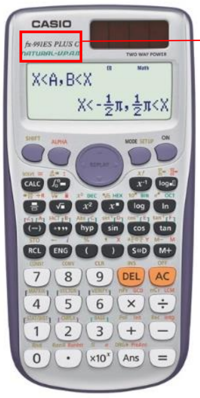
III. Let Y represents the no. of typing errors in 2 pages. Therefore, $\lambda_y = \lambda_x t = 6 \cdot 2 = 12 \Rightarrow Y \sim Poisson(12)$.

$P(Y = 10) = 0.1048$.

IV. Let Z represents the no. of typing errors in a half pages. Therefore, $\lambda_z = \lambda_x t = 6 \cdot 1/2 = 3 \Rightarrow Z \sim Poisson(3)$.

$P(Z = 0) = 0.0498$.

#Now a way to solve the Poisson distribution question with the calculator type(fx-991ES)



(fx-991ES)

#steps:

- **Solve** $P(X = 7) = 0.1377.$

  first click then , , ,write (-6), click right ,write (6)then click write (7) then click double right and write(7)then click then finally click **"="** to have a solution 0.1377 .

- **Solve** $P(X \geq 2) = f(2) + f(3) + \cdots = 1 - P(X < 2) = 0.9826.$

  First write (1-) "Subtract " , now click then so now write the function for Poisson distribution between "()" so click then , , , write (-6), click right then click **X** "Multiply" ,write (6)then click , then then click double right and click again , then then so now we done from function go to summation ∑ by click double right and write (0) then click right and write (1) , so now click **"="** to have a solution 0.9826 .

***So complete in this way with any question just change λ value and chick if it needs to write x or use summation , about the mean and variance don't needs for calculator because both of them have same λ value.**

Excellent!

"Poisson Approximation to binomial distribution"

Example:

A factory produces a particular electrical component and on average 1 in 50 is faulty. in a batch of 300 components taken at random. what is the probability of haveing at least eight faulty components?

$$p(x \geq 8) = 1 - p(X \leq 7)$$

$$= 1 - [p(X=0) + p(X=1) + \cdots + p(X=7)]$$

$$= 1 - [300C_0 \left(\tfrac{1}{50}\right)^0 \left(\tfrac{49}{50}\right)^{300} + 300C_1 \left(\tfrac{1}{50}\right)^1 \left(\tfrac{49}{50}\right)^{299}$$

$$+ \cdots 300C_7 \left(\tfrac{1}{50}\right)^7 \left(\tfrac{49}{50}\right)^{293}]$$

$$= 1 - 0.74538 = 0.25461$$

*

mean $\rightarrow$ $\mu = E(X) = \lambda = np$

Variance $\rightarrow$ $\sigma^2 = E(X)$

$$f(x) = \frac{e^{-(np)} (np)}{x!}$$

توضيح لآلة: Fx-991ES

Step :

First clik $\frac{\square}{\square}$ then Shift ln , write the sample and probability of success then cklik (and write sample and probabitity of success then ↓ then cklik Shift then ENG and write X!.