Question 1

a.

|  |  |
| --- | --- |
| **Table 1** | Number of O-ring seal failure |
| Number of failed O-rings | 0 | 1 | 2 | 3 | 4 | 5 | 6 |
| Number of flights | 16 | 5 | 2 | 0 | 0 | 0 | 0 |

i.

The distribution follows a binomial distribution. The random variable is the number of O-rings that fails and the probability is associated with a particular number of O-rings failing.

ii.

iii.

For a binomial distribution to be used, there should be a fixed number of trials which are independent of each other, there should be only two outcomes “Success” and “Failure”. Binomial model is appropriate because there are two outcomes, either an O-ring fails or do not fail and there are 6 fixed number of outcomes.

iv)

p.m.f

Binomial with n = 6 and p = 0.065

x P( X = x )

0 0.668143

1 0.278691

2 0.048436

3 0.004490

4 0.000234

5 0.000007

6 0.000000

Binomial with n = 6 and p = 0.065

c.d.f

x P( X ≤ x )

0 0.66814

1 0.94683

2 0.99527

3 0.99976

4 0.99999

5 1.00000

6 1.00000

v.

|  |  |  |
| --- | --- | --- |
| Number of failed O-rings | Observed Proportion | Probability |
| 0 | 0.696 | 0.668 |
| 1 | 0.217 | 0.279 |
| 2 | 0.087 | 0.048 |
| 3 | 0 | 0.004 |
| 4 | 0 | 0 |
| 5 | 0 | 0 |
| 6 | 0 | 0 |

The observed proportions are close to the probabilities predicted using the binomial distribution. This suggest the binomial model can fit the distribution of the occurrences well.

b.

i.

Binomial distribution with parameters, n=20 and p = 0.06

Using *B(20,0.06)*

P( X ≥ 3) = 1 - P(X < 3)

1. P(X = 0,1,2)

$$\left(\genfrac{}{}{0pt}{}{n}{x}\right)p^{x}\left(1-p\right)^{n-x}$$

$$\left(\genfrac{}{}{0pt}{}{20}{0}\right)0.06^{0}\left(1-0.06\right)^{20-0}+\left(\genfrac{}{}{0pt}{}{20}{1}\right)0.06^{1}\left(1-0.06\right)^{20-1}+\left(\genfrac{}{}{0pt}{}{20}{2}\right)0.06^{2}\left(1-0.06\right)^{20-2}+\left(\genfrac{}{}{0pt}{}{20}{3}\right)0.06^{3}\left(1-0.06\right)^{20-3} $$

0.2901062 + 0.3703484 + 0.224573 = 0.8850276

P( X ≥ ) = 1 – 0.885028 = 0.1150

ANS: 0.1150

ii.

Geometric distribution with parameters K=9, and p= 0.06

P(X = k) = (1-p)k-1  \* p

(1-0.06)8 \* 0.06 =0.0366

C

*λ* = 1.25

Poisson

 $P\left(X;µ\right)= \frac{e^{-µ}\*µ^{x}}{x! }$ =

P(X≤ 2), = P(X=0,1,2)

$$\frac{e^{-1.25}\*1.25^{0}}{0! }+ \frac{e^{-1.25}\*1.25^{1}}{1! }+\frac{e^{-1.25}\*1.25^{2}}{2! }=0.869$$