The University of Melbourne
CVEN30008 Engineering Risk Analysis

Tutorial 6 (Discrete Distribution)

1. **Of all the new vehicles of a certain model that are sold, 20% require repairs to be done under warranty during the first year of service. A particular dealership sells 12 such vehicles.**
   a) **What is the probability that exactly four of them require warranty repairs?**
   b) **What is the probability that fewer than three of them require warranty repairs?**
   c) **Verify your results by using Matlab**

Solution:

a) P = 20%, n = 12

$$P(X = 4, 12|0.2) = \frac{12!}{4!\,(12-4)!}0.2^4(1-0.2)^{12-4} = 0.1329$$

b) $P(X < 3, 12|0.2) = P(X = 0, 12|0.2) + P(X = 1, 12|0.2) + P(X = 2, 12|0.2)$

$$\begin{aligned} P(X < 3, 12|0.2) &= \frac{12!}{0!\,(12-0)!}0.2^0(1-0.2)^{12-0} \\ &+ \frac{12!}{1!\,(12-1)!}0.2^1(1-0.2)^{12-1} \\ &+ \frac{12!}{2!\,(12-2)!}0.2^2(1-0.2)^{12-2} \\ &= 0.5583 \end{aligned}$$

c) MATLAB

```
>> Tute4Q1A

P =

    0.1329

>> Tute4Q1B

P =

    0.5583
```

2. **The past 10 years of data indicate that there were 20 severe Australian bushfires. Assume that damage event for different bushfires are statistically independent**
   a) **What is the probability that there will be no bushfires in Australia in next two years?**
   b) **What is the probability that there will be four bushfires in Australia in next three years?**
   c) **Verify your results by using Matlab**

Solution:

a) $X = 0$, $t = 2$, $v = 20/10 = 2$

$$vt = 2 \times 2 = 4$$

$$P(X = 0) = \frac{4^0}{0!} e^{-4} = 0.018$$

b) $X = 4$, $t = 3$, $v = 20/10 = 2$

$$vt = 2 \times 3 = 6$$

$$P(X = 4) = \frac{6^4}{4!} e^{-6} = 0.134$$

c) MATLAB

```
>> Tute4Q2A

P =

    0.0183

>> Tute4Q2B

P =

    0.1339
```

3. **In a large shipment of automobile tires, 5% have a certain flaw. Four tires are chosen at random to be installed on a car.**
   (a) What is the probability that none of the tires have a flow?
   (b) What is the probability that two or more of the tires has a flaw?
   (c) Verify your results by using Matlab

Solution

(a) p = 5%, n =4

$$P(X = 0, 4|0.05) = \frac{4!}{0!\,(4-0)!}0.05^0(1-0.05)^{4-0} = 81.5\%$$

(b) $P(X \geq 2, 4|0.05) = P(X = 2, 4|0.05) + P(X = 3, 4|0.05) + P(X = 4, 4|0.05) = 1.4\%$

(c) MATLAB

```
>> Tute4Q3A

P =

    0.8145

>> Tute4Q3B

P =

    0.0140
```

4. **The past 50 years of data indicate that there were two strong earthquakes in the area. Assume that damage event for different earthquakes are statistically independent. Assume it follows Poisson distribution.**
   (a) What is the probability that there will be no strong earthquakes in the area in 20 years, during the service life of the building?
   (b) What is the probability that there will be only one strong earthquake in 20 years?
   (c) Verify your results by using Matlab

Solution

(a) $X = 0$, $t = 20$, $v = 2/50$

$$vt = 20 \times 2/50 = 0.8$$

$$P(X = 0) = \frac{0.8^0}{0!} e^{-0.8} = 44.9\%$$

(b) $X = 1$, $t = 20$, $v = 2/50$

$$vt = 20 \times 2/50 = 0.8$$

$$P(X = 1) = \frac{0.8^1}{1!} e^{-0.8} = 35.9\%$$

(c) MATLAB

```
>> Tute4Q4A

P =

    0.4493

>> Tute4Q4B

P =

    0.3595
```