**Stevens Institute of Technology**

**SYS-601 Homework Cover Sheet**

**Date:** 2/18/2018 **HW #:** HW #4

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**Collaborators:** -

**4.1)**

1. Z = (ZL/2) – (ZR/2)

1. P{X = x} = P(x) ;

* P{X = -2.5} = P(-2.5) → P(ZL=1) and P(ZR=6) → P(-2.5) = 1/6x1/6 = 1/36

**→ P(-2.5) = 1/36**

* P{X = -2.0} = P(-2.0) → P(ZL=1) and P(ZR=5)

or; P(ZL=2) and P(ZR=6)

→ P(-2.0) = (1/6x1/6) + (1/6x1/6) = 2/36

**→ P(-2.0) = 1/18**

* P{X = -1.5} = P(-1.5) → P(ZL=3) and P(ZR=6)

or; P(ZL=2) and P(ZR=5)

or; P(ZL=1) and P(ZR=4)

→ P(-1.5) = (1/6x1/6) + (1/6x1/6) + (1/6x1/6) = 3/36

**→ P(-1.5) = 1/12**

* P{X = -1.0} = P(-1.0) → P(ZL=4) and P(ZR=6)

or; P(ZL=3) and P(ZR=5)

or; P(ZL=2) and P(ZR=4)

or; P(ZL=1) and P(ZR=3)

→ P(-1.0) = (1/6x1/6)+(1/6x1/6)+(1/6x1/6)+(1/6x1/6)=4/36

**→ P(-1.0) = 1/9**

* P{X = -0.5} = P(-0.5) → P(ZL=5) and P(ZR=6)

or; P(ZL=4) and P(ZR=5)

or; P(ZL=3) and P(ZR=4)

or; P(ZL=2) and P(ZR=3)

or; P(ZL=1) and P(ZR=2)

→ P(-0.5) = (1/6x1/6)+(1/6x1/6)+(1/6x1/6)+(1/6x1/6) )+(1/6x1/6)=5/36

**→ P(-0.5) = 5/36**

* P{X = 0} = P(0) → P(ZL=6) and P(ZR=6)

or; P(ZL=5) and P(ZR=5)

or; P(ZL=4) and P(ZR=4)

or; P(ZL=3) and P(ZR=3)

or; P(ZL=2) and P(ZR=2)

or; P(ZL=1) and P(ZR=1)

→ P(0) = (1/6x1/6)+(1/6x1/6)+(1/6x1/6)+(1/6x1/6) )+(1/6x1/6) +(1/6x1/6)=6/36

**→ P(0) = 1/6**

* P{X = 0.5} = P(0.5) → P(ZL=6) and P(ZR=5)

or; P(ZL=5) and P(ZR=4)

or; P(ZL=4) and P(ZR=3)

or; P(ZL=3) and P(ZR=2)

or; P(ZL=2) and P(ZR=1)

→ P(0.5) = (1/6x1/6)+(1/6x1/6)+(1/6x1/6)+(1/6x1/6) )+(1/6x1/6)=5/36

**→ P(0.5) = 5/36**

* P{X = 1} = P(1) → P(ZL=6) and P(ZR=4)

or; P(ZL=5) and P(ZR=3)

or; P(ZL=4) and P(ZR=2)

or; P(ZL=3) and P(ZR=1)

→ P(1) = (1/6x1/6)+(1/6x1/6)+(1/6x1/6)+(1/6x1/6)=4/36

**→ P(1) = 1/9**

* P{X = 1.5} = P(1.5) → P(ZL=6) and P(ZR=3)

or; P(ZL=5) and P(ZR=2)

or; P(ZL=4) and P(ZR=1)

→ P(1) = (1/6x1/6)+(1/6x1/6)+(1/6x1/6)=3/36

**→ P(1) = 1/12**

* P{X = 2} = P(2) → P(ZL=6) and P(ZR=2)

or; P(ZL=5) and P(ZR=1)

→ P(1) = (1/6x1/6)+(1/6x1/6)=2/36

**→ P(1) = 1/18**

* P{X = 2.5} = P(2.5) → P(ZL=6) and P(ZR=1)

→ P(1) = (1/6x1/6)=1/36

**→ P(1) = 1/36**

**P(Z) table:**



1. P{X ≤ x} = F(x) ;

* F{X ≤ -2.5} = F(-2.5)

→ F(-2.5) = P(-2.5)

**→ F(-2.5) = 1/36**

* F{X ≤ -2.0} = F(-2.0)

→ F(-2.0) = P(-2.5) + P(-2.0) = 1/36+2/36=3/36

**→ F(-2.0) = 1/12**

* F{X ≤ -1.5} = F(-1.5)

→ F(-1.5) = P(-2.5) + P(-2.0) + P(-1.5)

= 1/36+2/36+3/36=6/36

**→ F(-1.5) = 1/6**

* F{X ≤ -1.0} = F(-1.0)

→ F(-1.0) = P(-2.5) + P(-2.0) + P(-1.5) + P(-1.0)

= 1/36+2/36+3/36+4/36=10/36

**→ F(-1.0) = 5/18**

* F{X ≤ -0.5} = F(-0.5)

→ F(-0.5) = P(-2.5) + P(-2.0) + P(-1.5) + P(-1.0) + P(-0.5)

= 1/36+2/36+3/36+4/36+5/36=15/36

**→ F(-0.5) = 15/36**

* F{X ≤ 0} = F(0)

→ F(0) = P(-2.5) + P(-2.0) + P(-1.5) + P(-1.0) + P(-0.5) + P(0)

= 1/36+2/36+3/36+4/36+5/36+6/36=21/36

**→ F(0) = 7/12**

* F{X ≤ 0.5} = F(0.5)

→ F(0.5) =P(-2.5)+P(-2.0)+P(-1.5)+P(-1.0)+P(-0.5)+P(0)+P(0.5)

= 1/36+2/36+3/36+4/36+5/36+6/36+5/36=26/36

**→ F(0.5) = 13/18**

* F{X ≤ 1.0} = F(1.0)

→ F(1.0) =P(-2.5)+P(-2.0)+P(-1.5)+P(-1.0)+P(-0.5)+P(0)+P(0.5)+P(1.0)

= 1/36+2/36+3/36+4/36+5/36+6/36+5/36+4/36=30/36

**→ F(1.0) = 5/6**

* F{X ≤ 1.5} = F(1.5)

→ F(1.5) =P(-2.5)+P(-2.0)+P(-1.5)+P(-1.0)+P(-0.5)+P(0)+P(0.5)+P(1.0)+P(1.5)

= 1/36+2/36+3/36+4/36+5/36+6/36+5/36+4/36+3/36=33/36

**→ F(1.5) = 11/12**

* F{X ≤ 2.0} = F(2.0)

→ F(2.0) =P(-2.5)+P(-2.0)+P(-1.5)+P(-1.0)+P(-0.5)+P(0)+P(0.5)+P(1.0)+P(1.5)+P(2.0)

= 1/36+2/36+3/36+4/36+5/36+6/36+5/36+4/36+3/36+2/36=35/36

**→ F(2.0) = 35/36**

* F{X ≤ 2.5} = F(2.5)

→ F(2.5) =P(-2.5)+P(-2.0)+P(-1.5)+P(-1.0)+P(-0.5)+P(0)+P(0.5)+P(1.0)+P(1.5)+P(2.0)+P(2.5)

= 1/36+2/36+3/36+4/36+5/36+6/36+5/36+4/36+3/36+2/36+1/36=36/36

**→ F(2.5) = 1**



|  |  |  |
| --- | --- | --- |
| **Z/P(Z)/F(Z) TABLE** | | |
| **Z** | **P(Z)** | **F(Z)** |
| -2.5 | 1/36 | 1/36 |
| -2.0 | 2/36 = 1/18 | 3/36 = 1/12 |
| -1.5 | 3/36 = 1/12 | 6/36 =1/6 |
| -1.0 | 4/36 = 1/9 | 10/36 = 5/18 |
| -0.5 | 5/36 | 15/36 =5/12 |
| 0 | 6/36 = 1/6 | 21/36 = 7/12 |
| 0.5 | 5/36 | 26/36 = 13/18 |
| 1.0 | 4/36 = 1/9 | 30/36 = 5/6 |
| 1.5 | 3/36 = 1/12 | 33/36 = 11/12 |
| 2.0 | 2/36 = 1/18 | 35/36 |
| 2.5 | 1/36 | 36/36 = 1 |

**4.2)**

1. P(y) = ?

**𝜆 →** 1% chance for each year; 3.7 per year

**𝜆 =** 3.7

P(y) = (**𝜆**y x e-)/ y!

**P(y) = (3.7y x 2.71-3.7)/y!**

1. P(y ≥1) =?

[1-P(0)] = P(y ≥1) **→** P(0) = ?

P(0) = 0.25 (calculated in excel)

Accordingly; 1 – P(0) = 1 – 0.25 = 0.75

**P(y ≥1) = 0.75**

1. The average rate, , value is assumed for being able to derive the equation of P(y) in (a). The **𝜆** value assumed according to the given probability and the time span. The probability was given as 1% chance of having flood each year. We were supposed to do our calculations in the time span of years, so one year is 365 days. And if the chance is 1 in 100, it is assumed as it should be 3.7 in 365 with a simple direct proportion. However, in reality of course this is not a appropriate assumption since flood is a natural disaster and depends on various conditions. For instance, if that year was drought the possibility is lower where as if the rain ratio was high the probability should be higher and there is more variables effecting this situation directly. Also, with the direct proportion we have the result of 3.7 flood chance per year however, it is not logical to say a decimal number when talking about flood etc. It should be a whole number as 2 or 3 etc.

**4.3)**

**a)** P(x) =?

* n = 52
* p = ½ (since either having heads or tails in a coin flip has the probability of ½)

P(x) = px (1-p)n-x

**P(x) = (0.5)x (1-0.5)52-x**

**b)**

**c)** NFC won the coin flip 35 times out of 52 trials. The P(x) value of this point in the binomial distribution chart is in between 0.01 and 0. More surprisingly, it is much closer to zero than 0.01. What I mean is that, the probability of winning 35 time out of 52 trials is approximately equal to 0 according to the binomial distribution. If we also calculate the exact value of having 35 winnings out of 52 trials; P(35) = 0.004873 (calculated in excel). Which means that this is a unusual outcome…

**d**) P(x ≥ 35) =?

P(x ≥ 35) = P(35)+P(36)+P(37)+P(38)+P(39)+P(40)+…..+P(52)

**P(x ≥ 35) = 0.008767** (calculated in excel)