Problem Statement 1

Let X be the random variable number of faulty LED bulbs.

Therefore $\mathrm{X} \sim \mathrm{Bin}(6{,}0.3)$

(i) Probability of having 2 faulty LED's $= P(X = 2)$

$$= \binom{6}{2} * 0.3^2 * 0.7^{6-2}$$

= 0.324135

(ii) Average = 6*0.3

= 1.8

(iii) Standard deviation = 6*0.3*0.7

= 1.26

Used the R code below

```
> #Stats II Assignment I
> #
> #Problem 1
>
> #Probability of having two faults
> pbinom(q = 2,size = 6,prob = 0.3) - pbinom(q = 1,size = 6,prob = 0.3)
[1] 0.324135
>
> #Average
> average = 6*0.3
> average
[1] 1.8
>
> #Standard deviation
> std = 6*0.3*0.7
> std
[1] 1.26
```

Problem Statement 2

Let G and B be the random variable number of correct question attempted by Gaurava and Barakha respectively per day

Therefore $G \sim Bin(8{,}0.75)\ and\ B \sim Bin(12{,}0.45)$

(i) Probability Gaurava solve 5 questions $= \ P(G = 5)$

$$= \left[\binom{8}{5} * 0.75^5 * 0.25^3\right]$$

$$= \ 0.2076416$$

Probability Barakha solve 5 questions $= \ P(B = 5)$

$$\left[\binom{12}{5} * 0.45^5 * 0.55^7\right]$$

$$= 0.2224982$$

Therefore Probability both will solve 5 question correctly =

$$= P(G = 5) * P(B = 5)$$

$$= 0.04619989$$

Used the following R code

```
> #Problem 2
> #(i)
> #     Probablity Gaurava solve 5 questions
> g_five = pbinom(q = 5,size = 8,prob = 0.75) - pbinom(q = 4,size = 8,prob = 0.75)
> g_five
[1] 0.2076416
>
> #Probablity Barakha solve 5 questions
> b_five = pbinom(q = 5,size = 12,prob = 0.45) - pbinom(q = 4,size = 12,prob = 0.45)
> b_five
[1] 0.2224982
> #Therefore Probablity both will solve 5 question correctly
> g_five*b_five
[1] 0.04619989
```

(ii) Probability Gaurava solve 4 questions $= P(G = 4)$

$$= \left[\binom{8}{4} * 0.75^4 * 0.25^4\right]$$

$$= 0.08651733$$

Probability Barakha solve 6 questions $= P(B = 6)$

$$\left[\binom{12}{6} * 0.45^6 * 0.55^6\right]$$

$$= 0.2123847$$

Therefore Probability of 4 and 6 correct solution $= P(G = 4) * P(B = 6)$

$$= 0.01837496$$

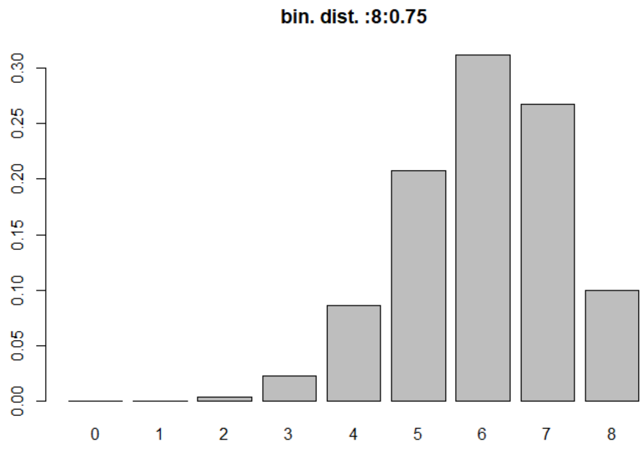
Used the following R code

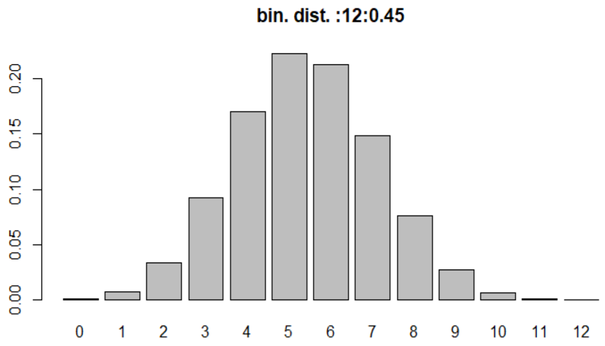
```
> #Problem 2
> #(ii)
> #     Probablity Gaurava solve 4 questions
> g_four = pbinom(q = 4,size = 8,prob = 0.75) - pbinom(q = 3,size = 8,prob
= 0.75)
> g_four
[1] 0.08651733
> #Probablity Barakha solve 6 questions
> b_six = pbinom(q = 6,size = 12,prob = 0.45) - pbinom(q = 5,size = 12,pro
b = 0.45)
> b_six
[1] 0.2123847
> #Therefore Probablity both will solve 5 question correctly
> g_four*b_six
[1] 0.01837496
```

(iii) This shows that because of the high correction rate of Gaurava as compared to Barakha he is less like to get only half of his attempted question (8) correct.

(iv) The number of question attempted and the correction rate.

(v) Plot of Gaurava and Barakha Probability mass function respectively





Used the following R code

```
> bin_graph <- function(n,p){
+   x <- dbinom(0:n,size=n,prob=p)
+   barplot(x,names.arg=0:n,
+           main=sprintf(paste('bin. dist. ',n,p,sep=':')))
+ }
> bin_graph(8,0.75)
> bin_graph(12,0.45)
```

Problem Statement 3

Let Y be random variable number of customers arriving at a shop in 4 minutes. Since 72 on average customers arrive hourly therefore in 4 minutes on average $\frac{72}{60} = 1.2\ arrive.$

Therefore $Y \sim Poisson(1.2)$

a) Probability of 5 customers arriving = $P(Y = 5)$

$$= \frac{1.2^5}{5!}e^{-1.2}$$
$$= 0.006245563$$

b) Probability not more than 3 customers = $P(Y \ \leq 3)$

$$= \frac{1.2^0}{0!}e^{-1.2} + \frac{1.2^1}{1!}e^{-1.2} + \frac{1.2^2}{2!}e^{-1.2} + \frac{1.2^3}{3!}e^{-1.2}$$
$$= 0.966231$$

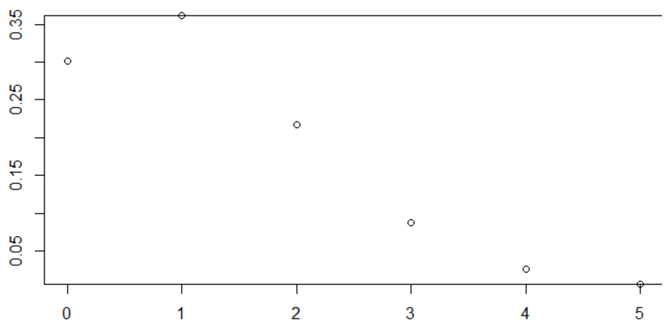
c) Probability more than 3 customers = $1 - P(Y \ \leq 3)$

$$= 0.03376897$$

Used the following R code

```
> #Problem 3
>
> #a)   Probability of 5 customers arriving
> ppois(q = 5,lambda = 1.2)-ppois(q = 4,lambda = 1.2)
[1] 0.006245563
>
> #b)   Probablity not more than 3 customers
> ppois(q = 3,lambda = 1.2)
[1] 0.966231
>
> #c)
> 1-ppois(q = 3,lambda = 1.2)
[1] 0.03376897
>
> #d)
> plot(0:5, dpois( x=0:5, lambda=1.2 ))
```

d) Plot below is the plot of PMF of a poison distribution with lambda = 1.2



Problem Statement 4

Let Z be the random variable number of errors per hour. Therefore$Z \sim Poisson(6)$.

(i) Therefore Probability of 2 errors in 455 report = $\mathrm{P}(\mathrm{Z}_1 = 2)$

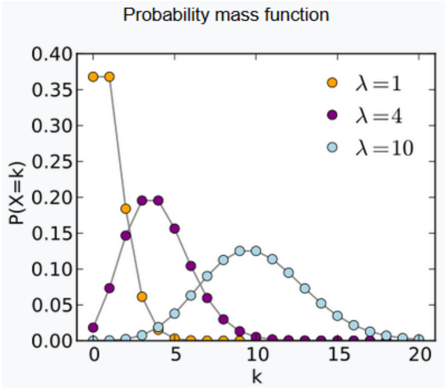
$$\text{where } \mathrm{Z}_1 \sim \mathrm{Poisson}(6 * \frac{455}{77}).$$

$$= 2.515361\mathrm{e} - 13$$

(ii) When the number increase the probability decrease and the number of word decrease the probability increase.

(iii) By increasing the number of words is increasing the hours taken hence the average number of errors hence probability decrease with increase in words.

(iv) The PMF Weight shift away from zero as we increase the number of words(λ)



Problem Statement 5

Let W be the random variable current in a copper wire.

Therefore $W \sim Unif(0,20)$

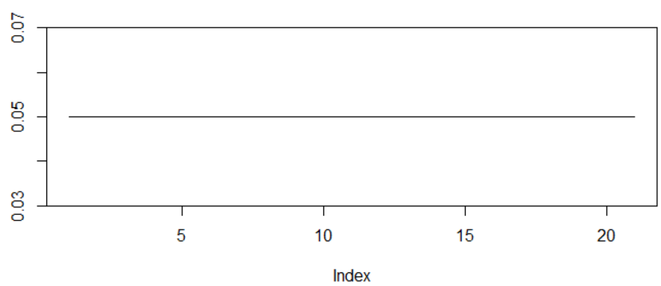
Probability that a current measurement is less than 10 milliamperes = P(W <10)

$$= \frac{10-0}{20-0}$$

=0.5

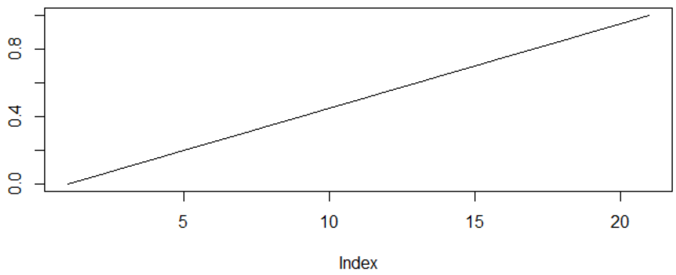
Plot of the PDF

```
#Problem 5
> plot(dunif(x = 0:20,min = 0,max = 20),type = 'l' )
```



Plot of the CDF

```
#plot of the CDF
> plot(punif(q = 0:20,min = 0,max = 20),type = 'l' )
```


0.0
0.4
0.8
5
10
15
20
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