

**Write R code to solve the following problems:**

**Q1) In a large consignment of electric bulbs 10 % are defective. A random sample of 20 is taken for inspection. Find the probability that:**

- (i) All are good bulbs,**
- (ii) At most there are 3 defective bulbs,**
- (iii) Exactly there are three defective bulbs.**

A1) Code is as follows:

```
#Q3.1)
X=20
P=10/100
#None is defective
D1 = dbinom(0,X,P)
print(D1)
#At most 3 bulbs are defective i.e.  $X \leq 3$ 
D2 = pbinom(3,X,P)
print(D2)
#  $P(X=3)$ 
D3 = dbinom(3,X,P)
print(D3)
```

**Output (via Command Window):**

```
> #Q2.1)
> X=20
> P=10/100
> #None is defective
```

```

> D1 = dbinom(0,X,P)

> print(D1)

[1] 0.1215767

> #At most 3 bulbs are defective i.e.  $X \leq 3$ 

> D2 = pbinom(3,X,P)

> print(D2)

[1] 0.8670467

> #  $P(X=3)$ 

> D3 = dbinom(3,X,P)

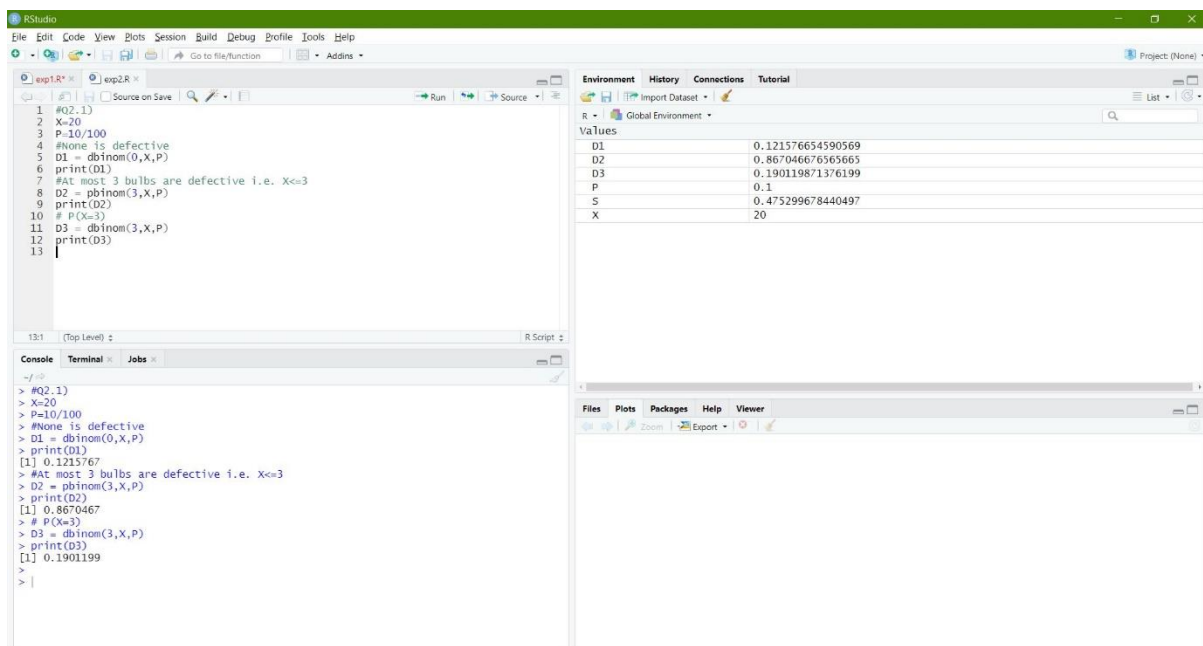
> print(D3)

[1] 0.1901199

>

```

### Implementation on R Studio Code (via Command Window):



**Q2) Out of 1000 balls 50 are red and the rest white. If 60 balls are picked at random, what is the probability of picking up (i) 3 red balls (ii) not more than 3 red balls in the sample. Assume Poisson distribution for the number of red balls picked up in the sample.**

A1) Code is as follows:

```
#Q3.2
```

```
Pr = 50/1000
```

```
Pw = 950/1000
```

```
n = 60
```

```
m = n * Pr
```

```
Lambda = m
```

```
# P(X=3)
```

```
dpois(3, Lambda)
```

```
# Not more than 3 Red balls i.e. P(0)+P(1)+P(2)+P(3)
```

```
dpois(0, Lambda)+dpois(1, Lambda)+dpois(2, Lambda)+dpois(3, Lambda)
```

**Output (via Command Window):**

```
> #Q3.2
```

```
> Pr = 50/1000
```

```
> Pw = 950/1000
```

```
> n = 60
```

```
> m = n * Pr
```

```
> Lambda = m
```

```
> # P(X=3)
```

```
> dpois(3, Lambda)
```

```
[1] 0.2240418
```

```
> # Not more than 3 Red balls i.e. P(0)+P(1)+P(2)+P(3)
```

```
> dpois(0, Lambda)+dpois(1, Lambda)+dpois(2, Lambda)+dpois(3, Lambda)
```

```
[1] 0.6472319
```

## Implementation on R Studio Code (via Command Window):

The screenshot displays the RStudio Code interface. The main editor window shows an R script with the following code:

```
1 #Q3.2
2 Pr = 50/1000
3 Pw = 950/1000
4 n = 60
5 m = n * Pr
6 Lambda = m
7 # P(X=3)
8 dpois(3, Lambda)
9 # Not more than 3 Red balls i.e. P(0)+P(1)+P(2)+P(3)
10 dpois(0, Lambda)+dpois(1, Lambda)+dpois(2, Lambda)+dpois(3, Lambda)
```

The console window at the bottom shows the execution of the script:

```
> #Q3.2
> Pr = 50/1000
> Pw = 950/1000
> n = 60
> m = n * Pr
> Lambda = m
> # P(X=3)
> dpois(3, Lambda)
[1] 0.2240418
> # Not more than 3 Red balls i.e. P(0)+P(1)+P(2)+P(3)
> dpois(0, Lambda)+dpois(1, Lambda)+dpois(2, Lambda)+dpois(3, Lambda)
[1] 0.6472319
>
```

The Environment pane on the right shows the following variables and their values:

Variable	Value
Lambda	3
m	3
n	60
Pr	0.05
Pw	0.95

**Q3) In a test on 2000 electric bulbs, it was found that the life of a particular make, was normally distributed with an average life of 2040 hours and S.D. of 60 hours. Estimate the number of bulbs likely to burn for:**

**(i) more than 2150 hours,**

**(ii) less than 1950 hours and**

**(iii) more than 1920 hours but less than 2160 hours.**

A1) Code is as follows:

```
#Q3.3
```

```
mean = 2040
```

```
SD = 60
```

```
bulbs = 2000
```

```
# Number of bulbs > 2150 hours
```

```
b1 = pnorm(2150, mean, SD)
```

```
b1 = (b1)*bulbs
```

```
bulbs-b1
```

```
# Number of bulbs < 1950 hours
```

```
b2 = pnorm(1950, mean, SD)
```

```
b2 = (b2)*bulbs
```

```
b2
```

```
# Number of bulbs > 1920 and < 2160
```

```
b3 = pnorm(2160, mean, SD) - pnorm(1920, mean, SD)
```

```
b3 = (b3)*bulbs
```

```
b3
```

**Output (via Command Window):**

```
> #Q3.3
```

```
> mean = 2040
```

```
> SD = 60
```

```
> bulbs = 2000
```

```
> # Number of bulbs > 2150 hours
```

```
> b1 = pnorm(2150, mean, SD)
```

```
> b1 = (b1)*bulbs
```

```

> bulbs-b1

[1] 66.75302

> # Number of bulbs < 1950 hours

> b2 = pnorm(1950, mean, SD)

> b2 = (b2)*bulbs

> b2

[1] 133.6144

> # Number of bulbs > 1920 and < 2160

> b3 = pnorm(2160, mean, SD) - pnorm(1920, mean, SD)

> b3 = (b3)*bulbs

> b3

[1] 1908.999

```

### Implementation on R Studio Code (via Command Window):

The screenshot shows the RStudio interface with the following components:

- Source Editor:** Contains R code for calculating bulb counts and probabilities.
- Console:** Shows the output of the R code execution, including intermediate results and final values.
- Environment Pane:** Displays the current environment with variables and their values.

**R Code (Source Editor):**

```

1 #Q3.3
2 mean = 2040
3 SD = 60
4 bulbs = 2000
5 # Number of bulbs > 2150 hours
6 b1 = pnorm(2150, mean, SD)
7 b1 = (b1)*bulbs
8 bulbs-b1
9 # Number of bulbs < 1950 hours
10 b2 = pnorm(1950, mean, SD)
11 b2 = (b2)*bulbs
12 b2
13 # Number of bulbs > 1920 and < 2160
14 b3 = pnorm(2160, mean, SD) - pnorm(1920, mean, SD)
15 b3 = (b3)*bulbs
16 b3

```

**Console Output:**

```

> #Q3.3
> mean = 2040
> SD = 60
> bulbs = 2000
> # Number of bulbs > 2150 hours
> b1 = pnorm(2150, mean, SD)
> b1 = (b1)*bulbs
> bulbs-b1
[1] 66.75302
> # Number of bulbs < 1950 hours
> b2 = pnorm(1950, mean, SD)
> b2 = (b2)*bulbs
> b2
[1] 133.6144
> # Number of bulbs > 1920 and < 2160
> b3 = pnorm(2160, mean, SD) - pnorm(1920, mean, SD)
> b3 = (b3)*bulbs
> b3
[1] 1908.999
>

```

**Environment Pane:**

Variable	Value
b1	1933.24698483037
b2	133.614402537716
b3	1908.99947220728
bulbs	2000
mean	2040
SD	60