

## PROBABILITY & STATISTICS

### LAB - 5

Heli Vijay Naliapara

K068

#1

```
pbinom(0,10,0.5)
```

```
pbinom(1,10,0.5) - pbinom(0,10,0.5)
```

```
pbinom(1,10,0.5,lower.tail = FALSE) + pbinom(1,10,0.5) - pbinom(0,10,0.5)
```

OUTPUT:

```
> #1  
> pbinom(0,10,0.5)  
[1] 0.0009765625  
> pbinom(1,10,0.5) - pbinom(0,10,0.5)  
[1] 0.009765625  
> pbinom(1,10,0.5,lower.tail = FALSE) + pbinom(1,10,0.5) - pbinom(0,10,0.5)  
[1] 0.9990234
```

1.  $n=10$   $p=0.5$   $q=0.5$   
 $P(X=x) = {}^nC_x p^x q^{n-x}$   
i]  $P(X=0) = {}^{10}C_0 p^0 q^{10-0}$   
 $= 1 (0.5)^0 (0.5)^{10}$   
 $= 0.0009765625$   
ii]  $P(X=1) = {}^{10}C_1 (0.5)^1 (0.5)^9$   
 $= 0.009765625$   
iii]  $P(X>0) = 1 - P(X=0)$   
 $= 1 - 0.0009765625$   
 $= 0.9990234$

#2

$q = (10/3)/5$

$p = 1 - q$

$n = 5/p$

$x = \text{seq}(0, 15, \text{by} = 1)$

```

y = dbinom(x, 15, 1/3)
print(y)
barplot(y, names.arg = x)
a = pbinom(x, 15, 1/3)
barplot(a, names.arg = x)

```

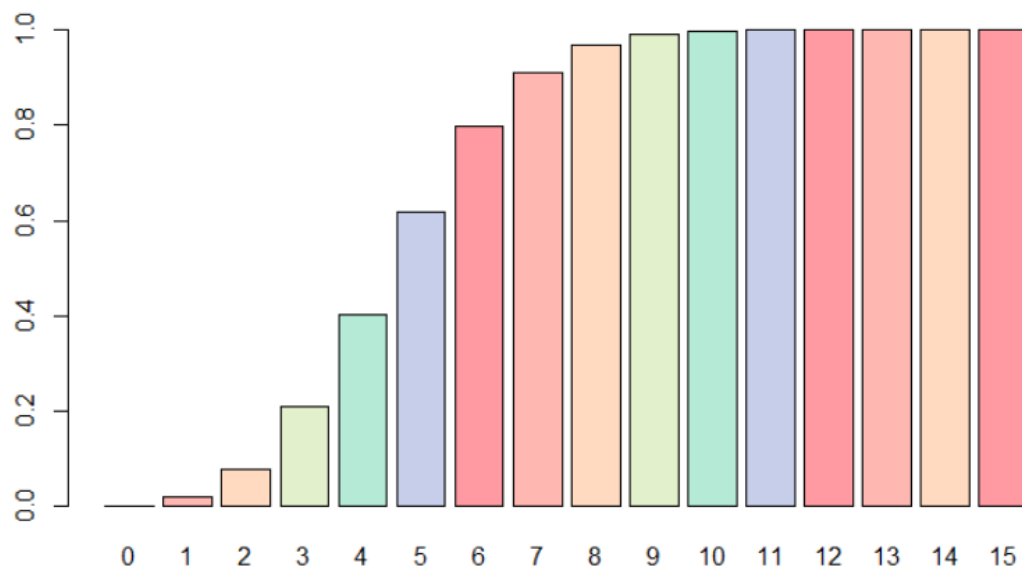
## OUTPUT:

```

> #2
> q = (10/3)/5
> p = 1 - q
> n = 5/p
> x = seq(0, 15, by = 1)
> y = dbinom(x, 15, 1/3)
> print(y)
[1] 2.283658e-03 1.712744e-02 5.994603e-02 1.298831e-01 1.948246e-01 2.143071e-01 1.785892e-01 1.148074e-01
[9] 5.740368e-02 2.232365e-02 6.697095e-03 1.522067e-03 2.536779e-04 2.927052e-05 2.090752e-06 6.969172e-08
> barplot(y, names.arg = x, col = c("#FF9AA2", "#FFB7B2", "#FFDAC1", "#E2F0CB", "#B5EAD7",
+                                     "#C7CEEA", "#FF9AA2", "#FFB7B2", "#FFDAC1", "#E2F0CB",
+                                     "#B5EAD7", "#C7CEEA", "#FF9AA2", "#FFB7B2", "#FFDAC1"))
> a = pbinom(x, 15, 1/3)
> barplot(a, names.arg = x, col = c("#FF9AA2", "#FFB7B2", "#FFDAC1", "#E2F0CB", "#B5EAD7",
+                                     "#C7CEEA", "#FF9AA2", "#FFB7B2", "#FFDAC1", "#E2F0CB",
+                                     "#B5EAD7", "#C7CEEA", "#FF9AA2", "#FFB7B2", "#FFDAC1"))
+

```

## BARPLOT:



02. mean  $n = 5$  variance  $= 10/3$   $P(X \leq 13) =$   
 mean  $= np$  variance  $= npq$   $0.999978396$   
 $\therefore$  variance  $=$  mean  $q$   $P(X \leq 14) =$   
 $q = 10/15 = 2/3$   $0.9999999$   
 $p = 1 - q$  mean  $= np$   $P(X \leq 15) = 1$   
 $p = 1 - 2/3$   $s = nC1/3$   $n = 15$   
 $p = 1/3$   
 $P(X = x) = nC_x p^x q^{n-x}$

$P(X=0) = 15C_0 (1/3)^0 (2/3)^{15} = 2.28365 \times 10^{-8}$   
 $P(X=1) = 15C_1 (1/3)^1 (2/3)^{14} = 1.7129 \times 10^{-2}$   
 $P(X=2) = 15C_2 (1/3)^2 (2/3)^{13} = 5.9946 \times 10^{-2}$   
 $P(X=3) = 15C_3 (1/3)^3 (2/3)^{12} = 1.7988 \times 10^{-1}$   
 $P(X=4) = 15C_4 (1/3)^4 (2/3)^{11} = 1.9482 \times 10^{-1}$   
 $P(X=5) = 15C_5 (1/3)^5 (2/3)^{10} = 2.1430 \times 10^{-1}$   
 $P(X=6) = 15C_6 (1/3)^6 (2/3)^9 = 1.7858 \times 10^{-1}$   
 $P(X=7) = 15C_7 (1/3)^7 (2/3)^8 = 1.1480 \times 10^{-1}$   
 $P(X=8) = 15C_8 (1/3)^8 (2/3)^7 = 5.7403 \times 10^{-2}$   
 $P(X=9) = 15C_9 (1/3)^9 (2/3)^6 = 2.2323 \times 10^{-2}$   
 $P(X=10) = 15C_{10} (1/3)^{10} (2/3)^5 = 6.6970 \times 10^{-3}$   
 $P(X=11) = 15C_{11} (1/3)^{11} (2/3)^4 = 1.5222 \times 10^{-3}$   
 $P(X=12) = 15C_{12} (1/3)^{12} (2/3)^3 = 2.5367 \times 10^{-4}$   
 $P(X=13) = 15C_{13} (1/3)^{13} (2/3)^2 = 2.9270 \times 10^{-5}$   
 $P(X=14) = 15C_{14} (1/3)^{14} (2/3)^1 = 2.0909 \times 10^{-6}$   
 $P(X=15) = 15C_{15} (1/3)^{15} (2/3)^0 = 6.9691 \times 10^{-8}$

Cumulative Probability:  $P(X \leq 0) = 15C_0 (1/3)^0 (2/3)^{15} = 2.28365 \times 10^{-8}$   
 $P(X \leq 1) = 0.019411$   $P(X \leq 5) = 0.61837$   $P(X \leq 9) = 0.9914957$   
 $P(X \leq 2) = 0.079357$   $P(X \leq 6) = 0.99696$   $P(X \leq 10) = 0.99919$   
 $P(X \leq 3) = 0.20924$   $P(X \leq 7) = 0.911768$   $P(X \leq 11) = 0.99971$   
 $P(X \leq 4) = 0.40406$   $P(X \leq 8) = 0.96917$   $P(X \leq 12) = 0.9999957$

#3

```
x = ppois(4, 7, lower.tail = FALSE)
```

```
print(x)
```

OUTPUT:

```

> #3
> x = ppois(4, 7, lower.tail = FALSE)
> print(x)
[1] 0.8270084

```

3. mean = 7 =  $\lambda$   $x \sim P(x)$   

$$P(x=x) = \frac{e^{-\lambda} \lambda^x}{x!}$$

$$P(x > 4) = 1 - [P(x=0) + P(x=1) + P(x=2) + P(x=3) + P(x=4)]$$

$$= 1 - 0.17299$$

$$= 0.8270$$

#4

```
x = ppois(2, 7.6)
y = ppois(3, 7.6) - x
print(x)
```

OUTPUT:

```
> #4
> x = ppois(2, 7.6)
> y = ppois(3, 7.6) - x
> print(x)
[1] 0.01875692
```

4. mean = 7.6 =  $\lambda$   
 $x \sim P(x)$   $P(x=x) = \frac{e^{-\lambda} \lambda^x}{x!}$   

$$P(x < 3) = P(x \leq 2) = 0.01875692$$

$$P(x = 3) = 0.0366$$