

assignment_3_solution

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```
# Q1.Roll 12 dice simultaneously, and let X denotes the number of 6's that appear.  
# Calculate the probability of getting 7, 8 or 9, 6's using R. (Try using the function pbinom;  
# If we set  $S = \{\text{get a 6 on one roll}\}$ ,  $P(S) = 1/6$  and the rolls constitute Bernoulli  
# trials; thus  $X = \text{binom}(\text{size}=12, \text{prob}=1/6)$  and we are looking for  $P(7 \leq X \leq 9)$ .  
size<-12  
prob<-1/6  
p_to9<-pbinom(9,size,prob)  
p_to7<-pbinom(6,size,prob)  
p1<-p_to9-p_to7  
p1
```

```
## [1] 0.001291758
```

```
p_9<-dbinom(9,12,1/6)  
p_8<-dbinom(8,12,1/6)  
p_7<-dbinom(7,12,1/6)  
p2<-p_9+p_8+p_7  
p2
```

```
## [1] 0.001291758
```

```
p3<-diff(pbinom(c(6,9),size,prob))  
p3
```

```
## [1] 0.001291758
```

```
# Q2.Assume that the test scores of a college entrance exam fits a normal distribution.  
# Furthermore, the mean test score is 72, and the standard deviation is 15.2. What is  
# the percentage of students scoring 84 or more in the exam?  
mean<-72  
sd<-15.2  
res<-pnorm(84,mean,sd,lower.tail=FALSE)  
res
```

```
## [1] 0.2149176
```

```
# Q3. On the average, five cars arrive at a particular car wash every hour. Let  $X$  count the
# number of cars that arrive from 10AM to 11AM, then  $X = \text{Poisson}(\text{lamda} = 5)$ . What is
# probability that no car arrives during this time. Next, suppose the car wash above
# is in operation from 8AM to 6PM, and we let  $Y$  be the number of customers that
# ppear in this period. Since this period covers a total of 10 hours, we get that  $Y =$ 
#  $\text{Poisson}(\text{lamda} = 5 \times 10 = 50)$ . What is the probability that there are between 48 and 50
# customers, inclusive?
```

```
p0<-dpois(0,5)
p0
```

```
## [1] 0.006737947
```

```
lambda<-50
p1<-ppois(50,lambda)-ppois(47,lambda)
p1
```

```
## [1] 0.1678485
```

```
a<-diff(ppois(c(47,50),lambda))
a
```

```
## [1] 0.1678485
```

```
# Q4. Suppose in a certain shipment of 250 Pentium processors there are 17 defective processors. A
# quality control consultant randomly collects 5 processors for inspection to determine whether
# or not they are defective. Let  $X$  denote the number of defectives in the sample. Find the probability
# of exactly 3 defectives in the sample, that is, find  $P(X = 3)$ .
```

```
n=250
m=233
k=5
n=17
h_1<-dhyper(3,17,233,5)
h_1
```

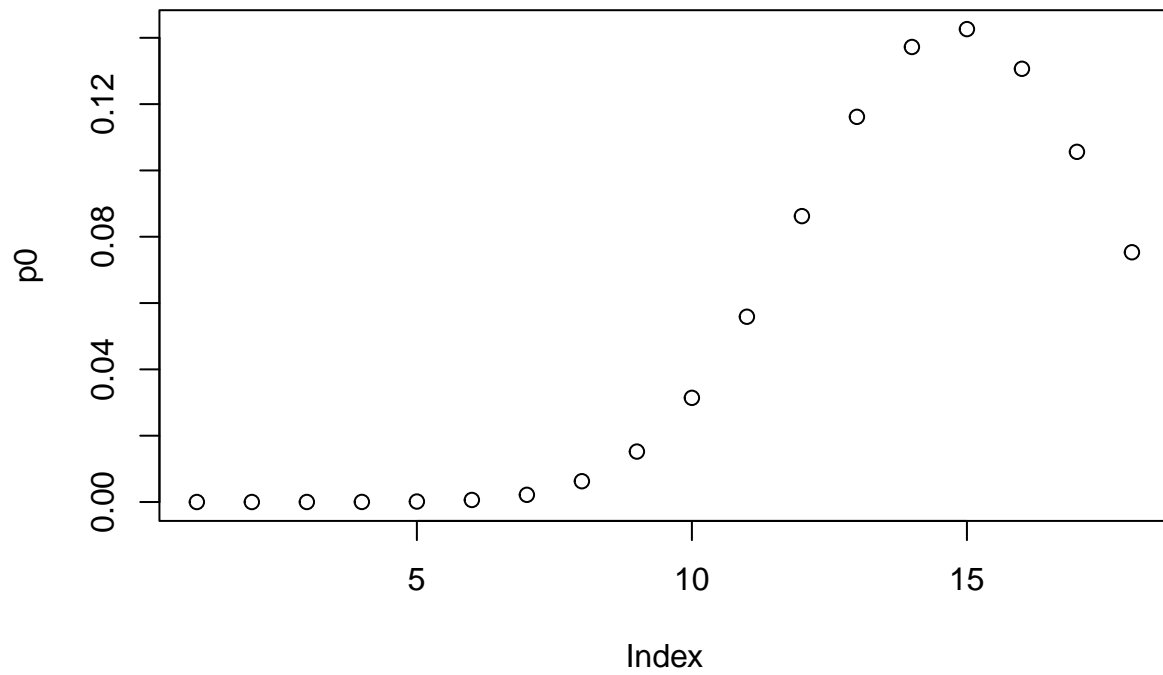
```
## [1] 0.002351153
```

```
# Q5. A recent national study showed that approximately 44.7% of college students have
# used Wikipedia as a source in at least one of their term papers. Let  $X$  equal the
# number of students in a random sample of size  $n = 31$  who have used Wikipedia as a source.
# a) How is  $X$  distributed? (b) Sketch the probability mass function. (c) Sketch the cumulative
# distribution function. (d) Find mean, variance and standard deviation of  $X$ .
```

```
x<-0:n
prob<-0.447
n<-31
p0<-dbinom(x,n,prob)
p0
```

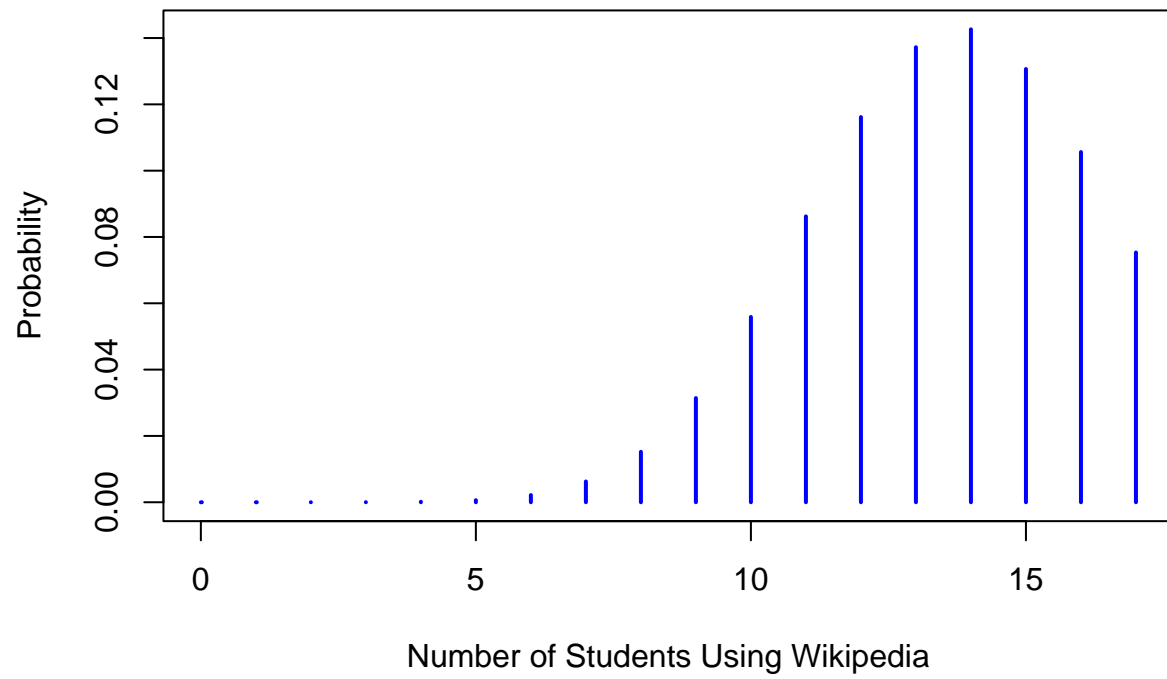
```
## [1] 1.057984e-08 2.651082e-07 3.214377e-06 2.511632e-05 1.421138e-04
## [6] 6.203153e-04 2.172786e-03 6.272510e-03 1.521055e-02 3.142047e-02
## [11] 5.587504e-02 8.622373e-02 1.161604e-01 1.372305e-01 1.426190e-01
## [16] 1.306524e-01 1.056088e-01 7.532248e-02
```

```
plot(p0)
```

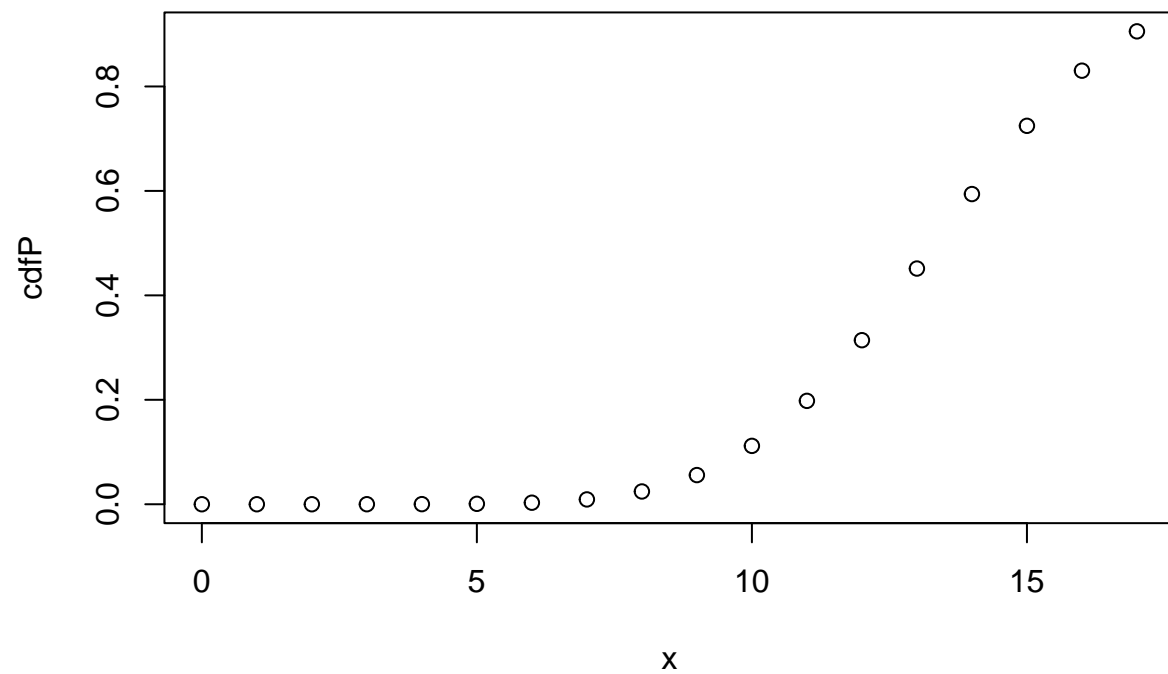


```
plot(x, p0, type = "h", lwd = 2, col = "blue",  
     xlab = "Number of Students Using Wikipedia",  
     ylab = "Probability",  
     main = "Probability Mass Function of X")
```

Probability Mass Function of X



```
cdfP<-pbinom(x,n,prob)  
plot(x,cdfP)
```



```
mean_x=n*prob  
variance_x=n*prob*(1-prob)  
sd_x=sqrt(variance_x)  
mean_x
```

```
## [1] 13.857
```

```
variance_x
```

```
## [1] 7.662921
```

```
sd_x
```

```
## [1] 2.768198
```