Engineering Statistics
IES 302

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8 Discrete Random Variable

Flip an unfair coin 10 times. (The probability of getting head for each time is 0.3.)
Count the number of heads.

Random variable X ~ binomial(10,0.3)

```
>> X = binornd(10,0.3)

X =

     3
```

Again, flip an unfair coin 10 times.

```
>> X = binornd(10,0.3)

X =

     2
```

Again, flip an unfair coin 10 times.

```
>> X = binornd(10,0.3)

X =

     2
```

Again, flip an unfair coin 10 times.

```
>> X = binornd(10,0.3)

X =

     5
```

Again, flip an unfair coin 10 times.

```
>> X = binornd(10,0.3)

X =

     1
```

Again, flip an unfair coin 10 times.

```
>> X = binornd(10,0.3)

X =

     4
```

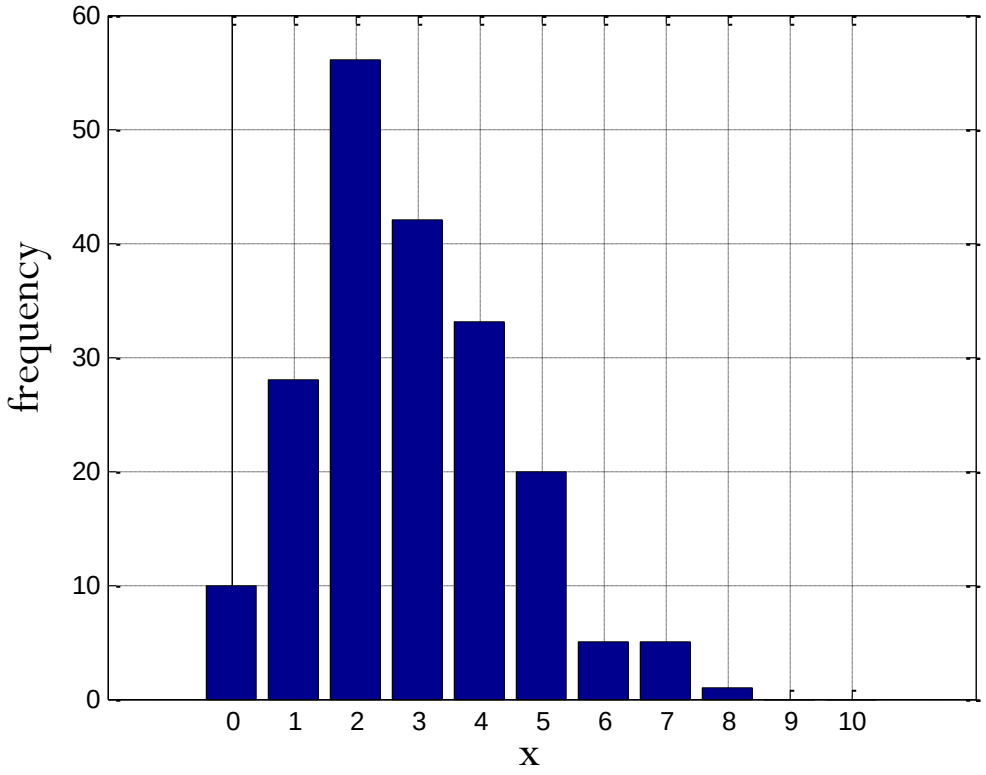
```
>> X = binornd(10,0.3,20,10)

X =

     3     4     4     5     7     2     2     2     2     1
     3     5     3     1     0     4     2     1     2     3
     5     2     2     6     4     2     2     4     3     1
     1     2     2     4     2     4     3     3     3     5
     4     1     4     3     3     4     2     2     2     2
     2     1     3     1     5     2     5     2     1     2
     4     0     3     3     2     1     2     1     3     1
     4     4     0     2     3     6     2     3     1     1
     5     0     3     3     7     1     3     1     3     8
     1     2     4     4     1     5     2     4     5     1
     5     2     4     6     3     2     3     3     5     0
     2     4     0     0     2     2     3     2     0     2
     4     3     3     2     2     2     1     2     7     4
     2     4     2     1     3     3     4     3     5     2
     5     3     2     3     4     2     3     3     1     2
     2     6     2     3     4     4     4     5     6     7
     5     1     2     4     3     3     0     5     0     2
     1     4     1     3     1     4     2     4     2     4
     5     2     2     3     3     5     3     5     2     1
     4     2     4     3     2     5     7     2     3     1
```

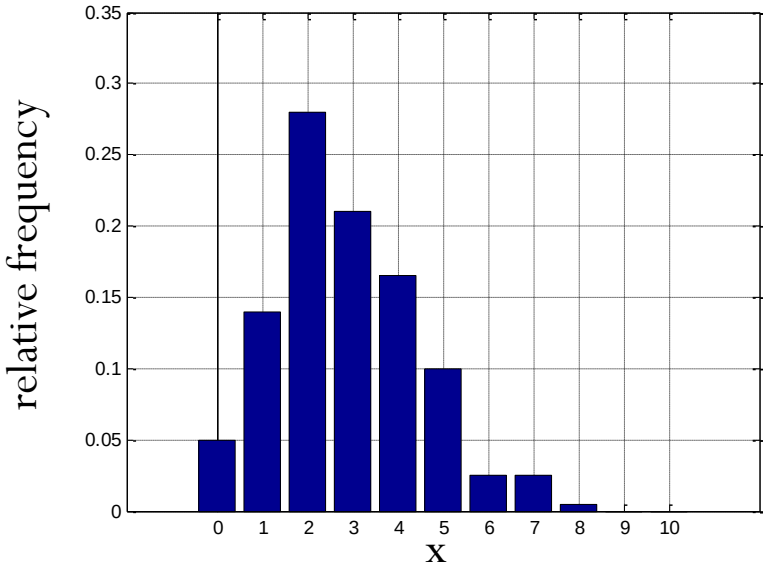
Generate X 200 times. Put the results in a table of size 20×10

Histogram

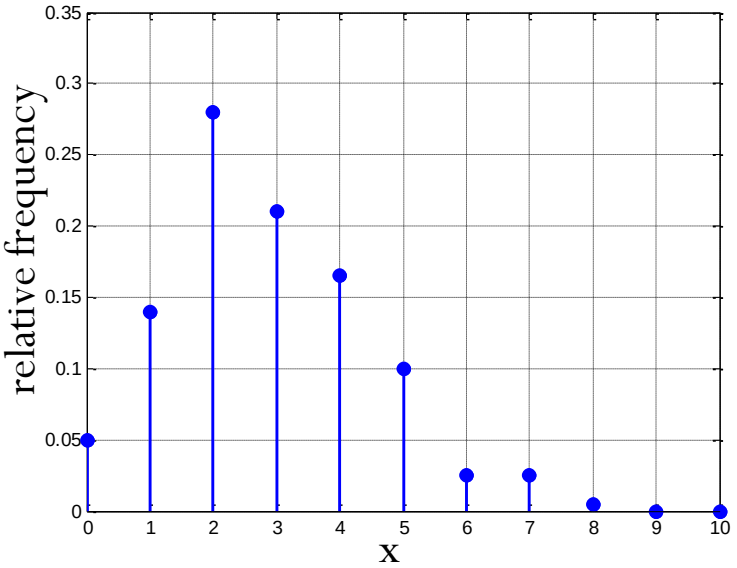



```
[N, x] = hist(reshape(X,1,prod(size(X))),0:10)
bar(x,N)
Grid on
```

Relative Frequency



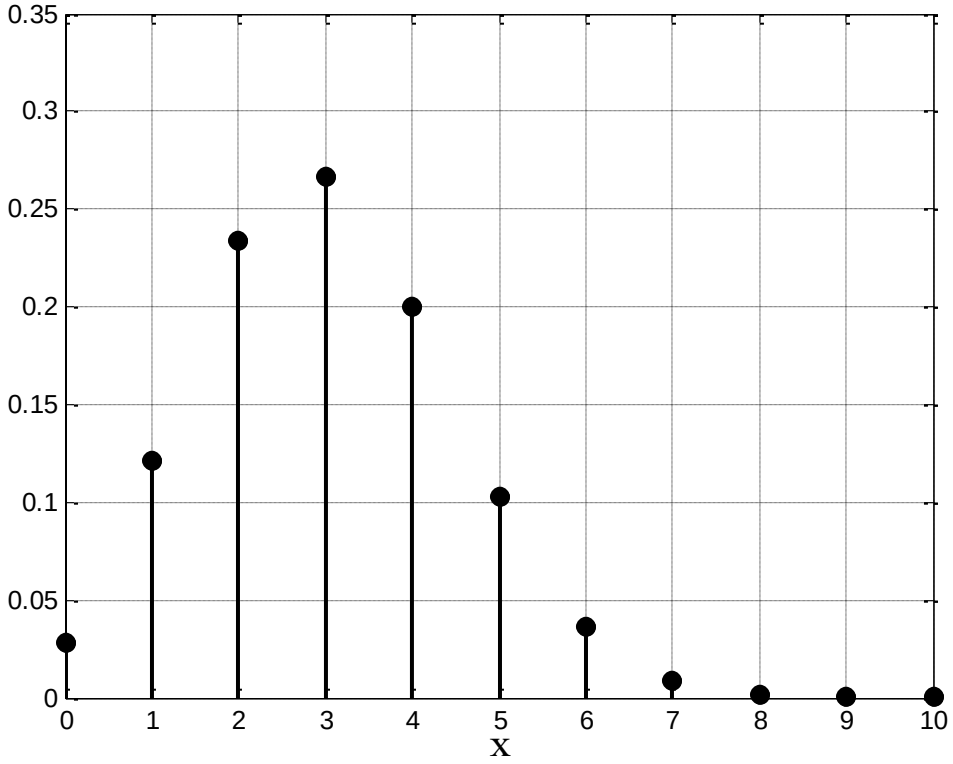

```
rf = N/prod(size(X))
bar(x,rf)
grid on
```




```
stem(x,rf,'filled','LineWidth',1.5)
grid on
```

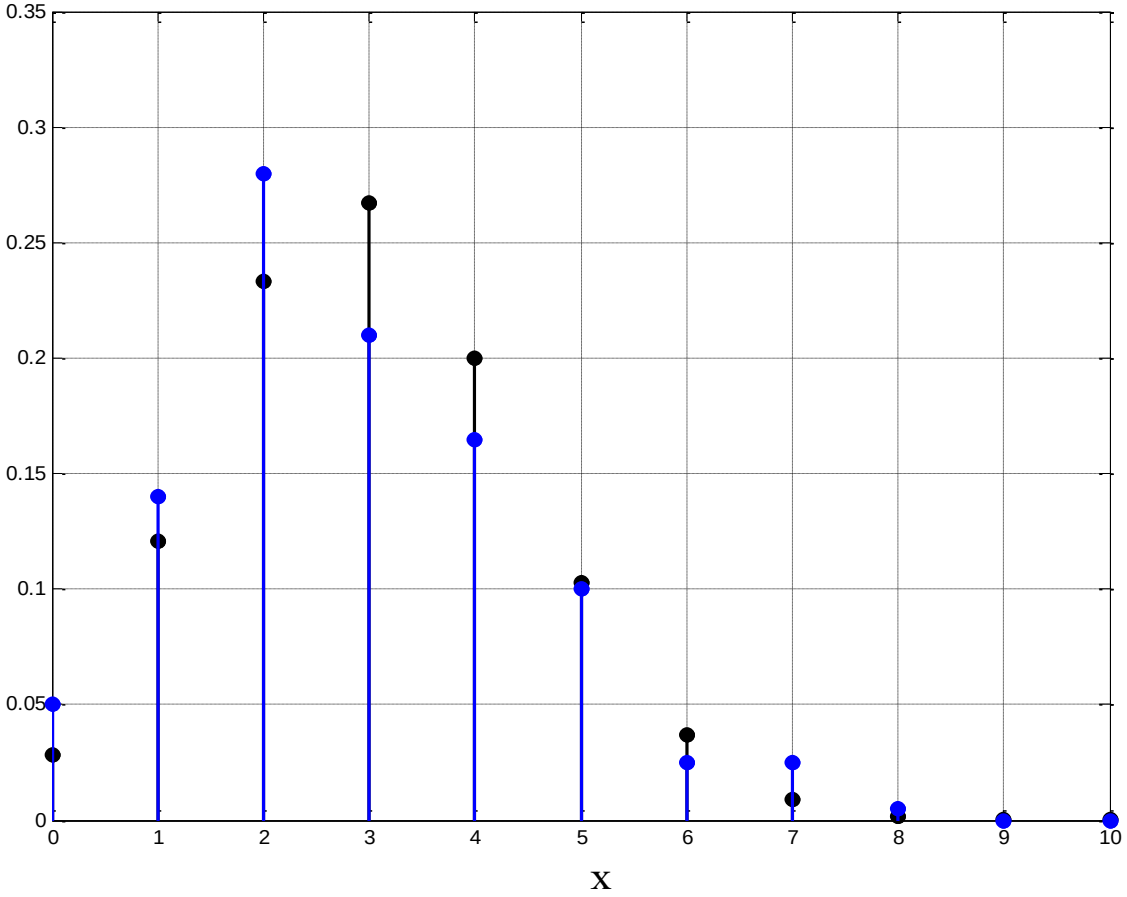
pmf for X

$$p_X(x) = \binom{10}{x} 0.3^x (1-0.3)^{10-x}$$



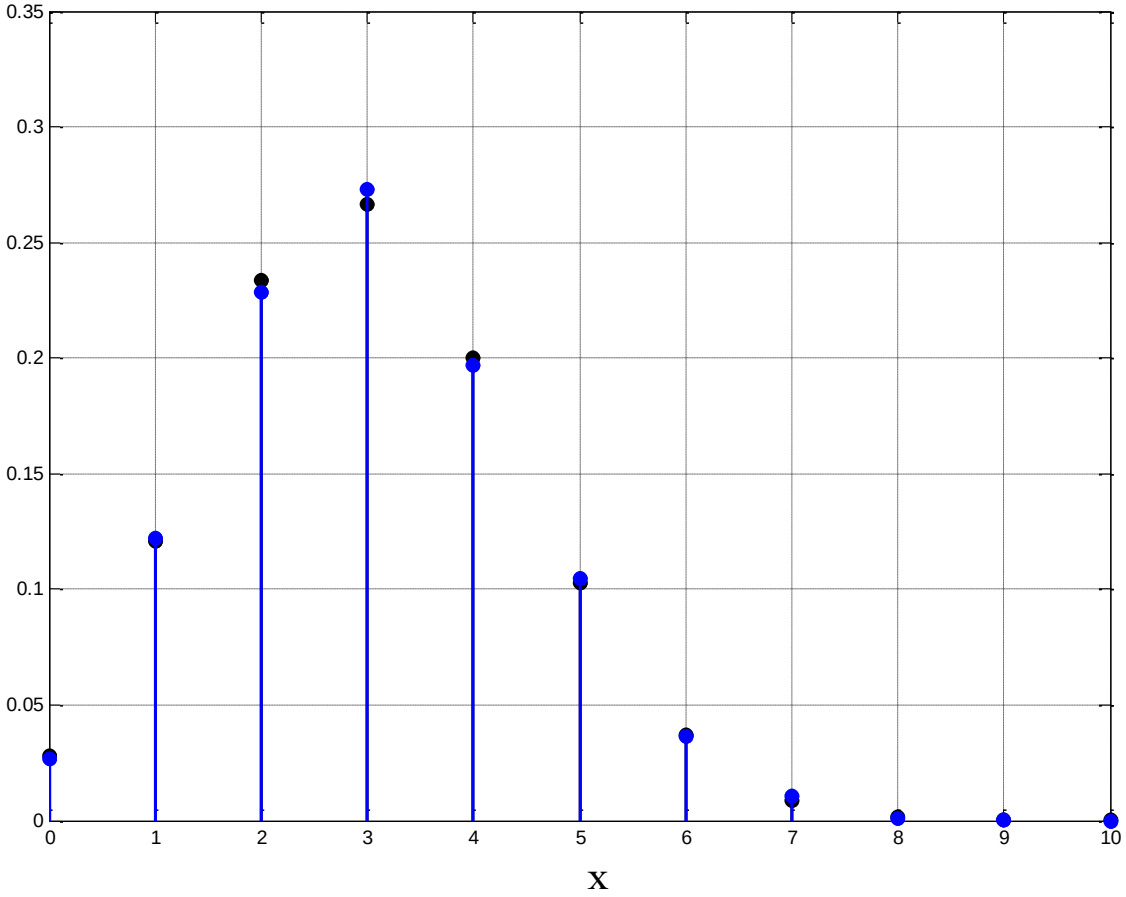

```
p = binopdf(x,10,0.3)
stem(x,p,'k','filled','LineWidth',1.5); grid on
```

Comparison

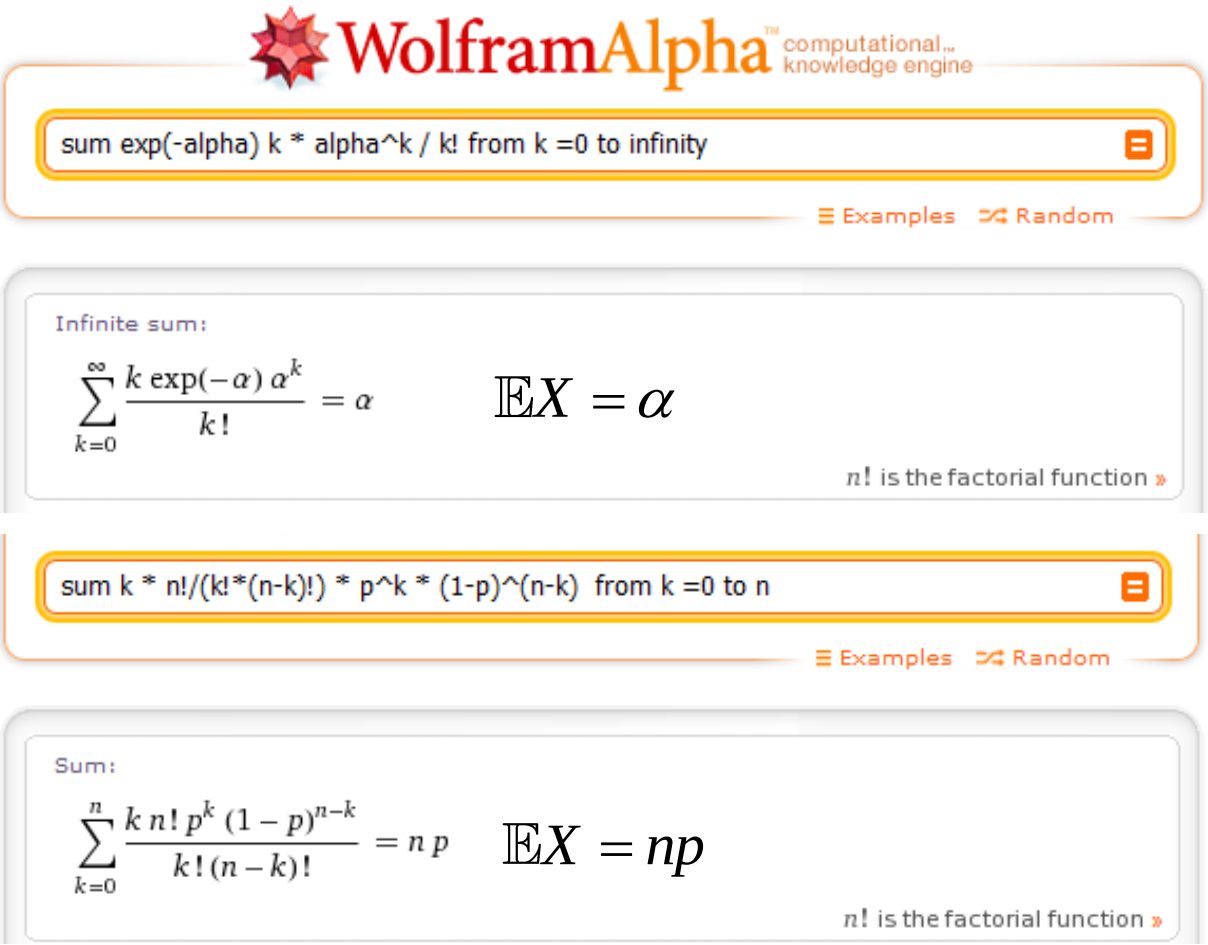


With larger number of samples

X = binornd(10,0.3,100,100);



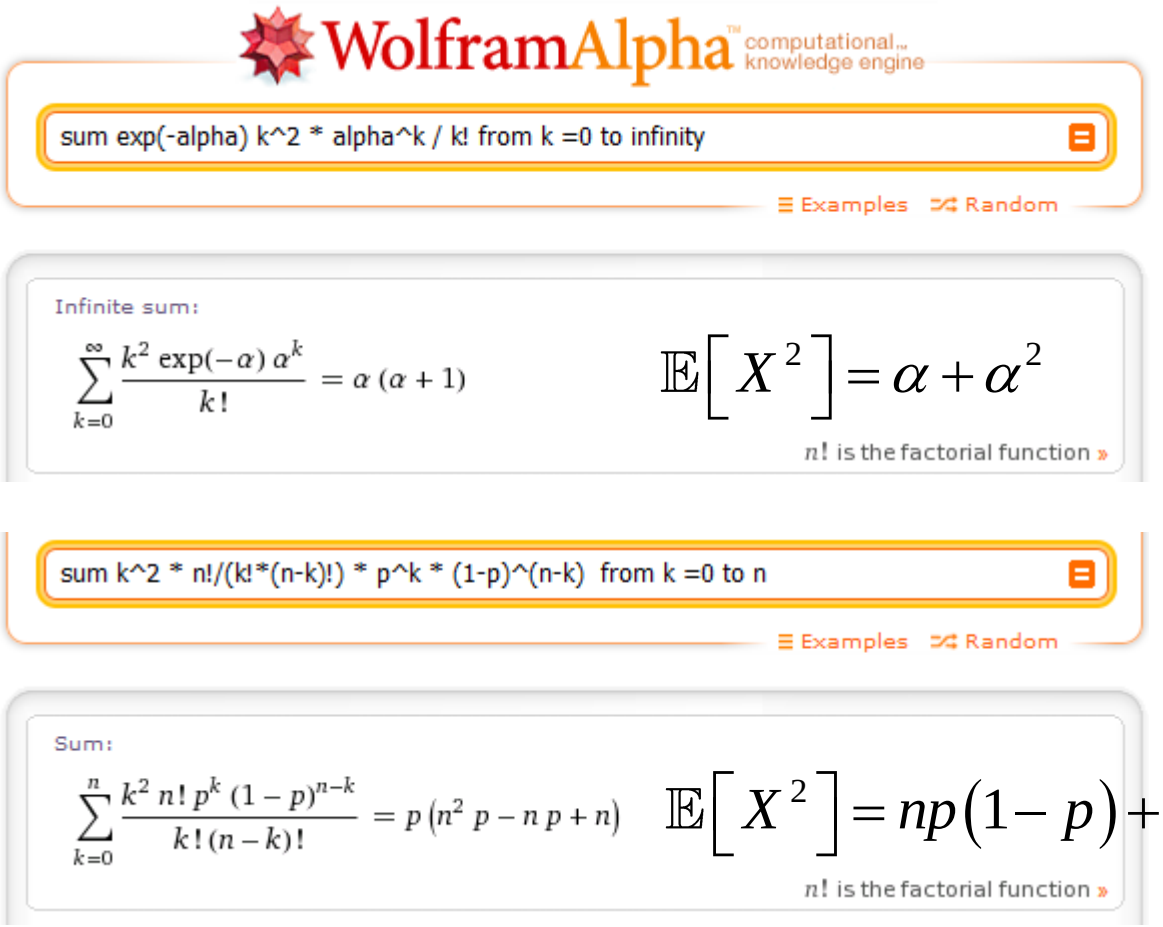
Calculations of Expected Values



Poisson(α)

Binomial(n,p)

Computation of $\mathbb{E}[X^2]$



Poisson(α)

Binomial(n,p)

One number to represent a data set

$$\text{data} = [X_1, X_2, X_3, X_4, X_5, X_6, X_7]$$
$$= [-10, -9, 1, 2, 3, 4, 5]$$

Find one number (a) to represent this data set.