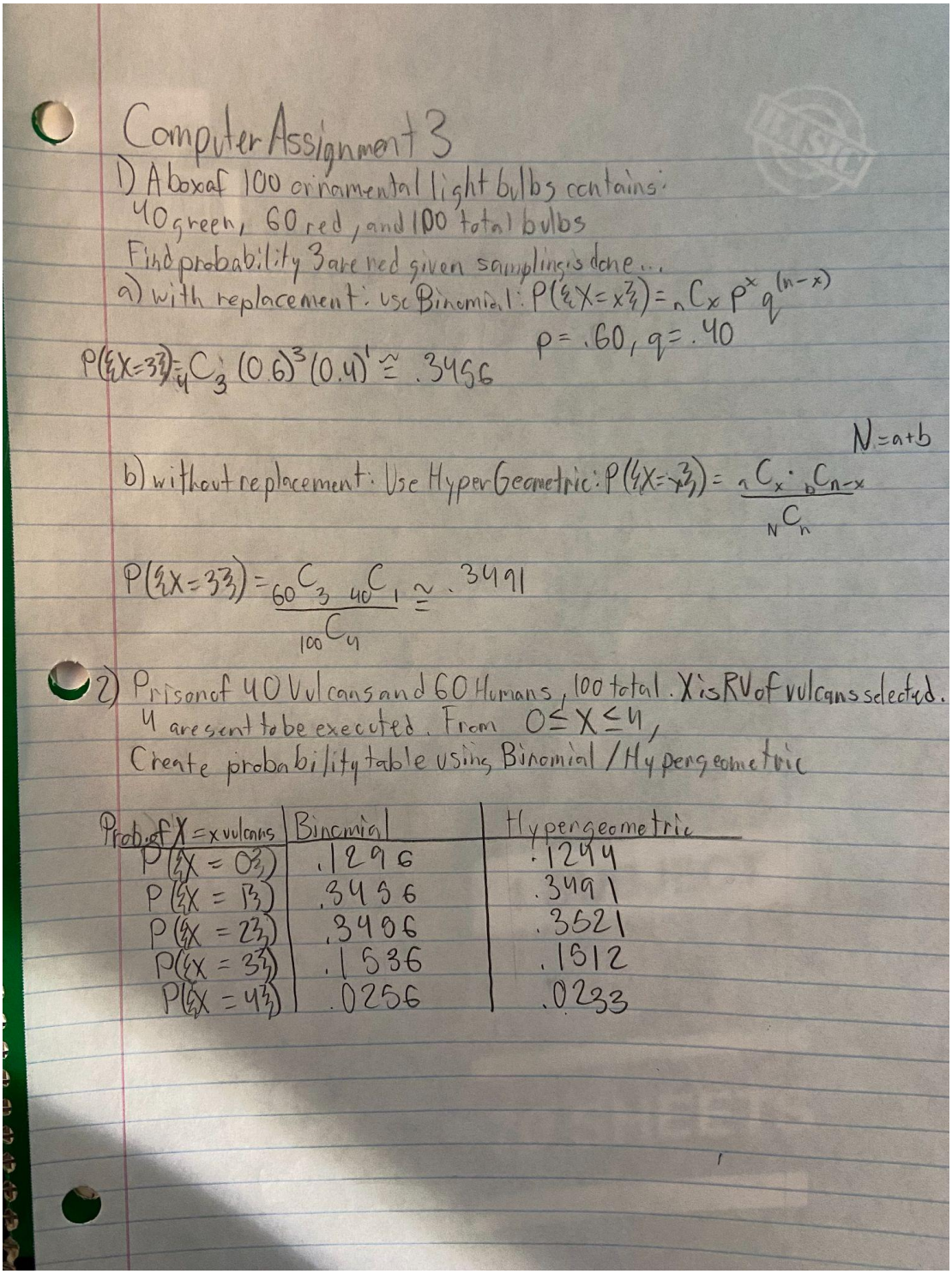
Name/ID #: Aaron Garcia/030556771
Name of Assignment: Computer Assignment 3
Due Date: Nov 27th, 2022
Submission Date: Nov 26th, 2022
Hand Written Exercises 1 and 2



Computer Assignment 3

1) A box of 100 ornamental light bulbs contains:
40 green, 60 red, and 100 total bulbs
Find probability 3 are red given sampling is done...
a) with replacement: use Binomial: $P(\text{4 } X = x \text{ 3's}) = {}_nC_x\, p^x q^{(n-x)}$
$p = .60, q = .40$

$P(\text{4 } X = 3\text{'s}) = {}_4C_3\,(0.6)^3(0.4)^1 \cong .3456$

$N = a + b$

b) without replacement: Use HyperGeometric: $P(\text{4 } X = x\text{'s}) = \dfrac{{}_aC_x \cdot {}_bC_{n-x}}{{}_NC_n}$

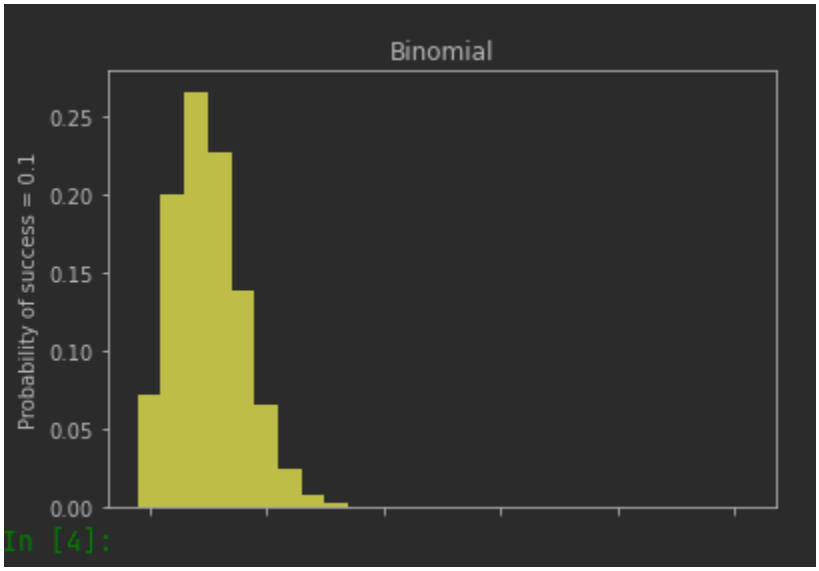
$P(\text{4 } X = 3\text{'s}) = \dfrac{{}_{60}C_3\ {}_{40}C_1}{{}_{100}C_4} \cong .3491$

2) Prison of 40 Vulcans and 60 Humans, 100 total. X is RV of vulcans selected.
4 are sent to be executed. From $0 \le X \le 4$,
Create probability table using Binomial / Hypergeometric

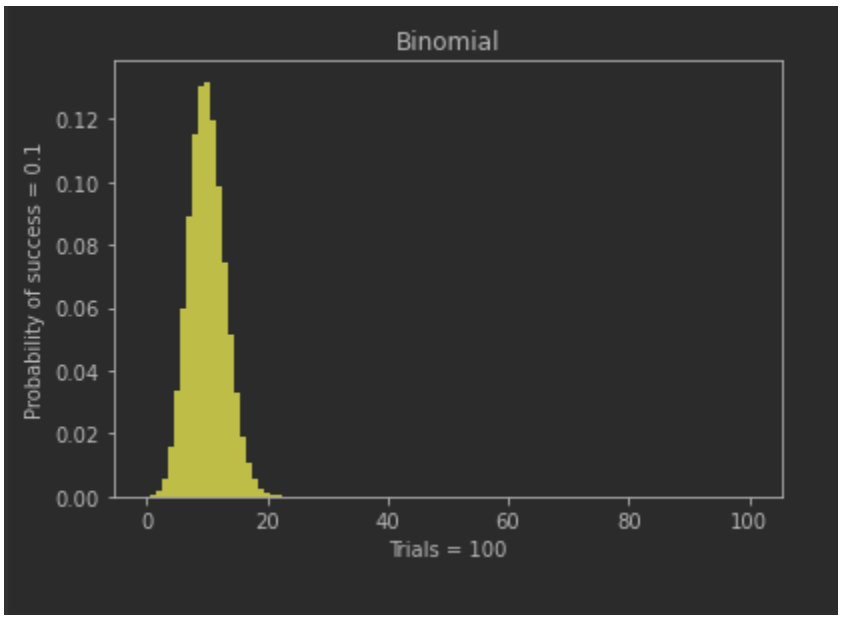
Prob. of X = x vulcans	Binomial	Hypergeometric
P(4 X = 0's)	.1296	.1244
P(4 X = 1's)	.3456	.3491
P(4 X = 2's)	.3456	.3521
P(4 X = 3's)	.1536	.1512
P(4 X = 4's)	.0256	.0233

Binomial

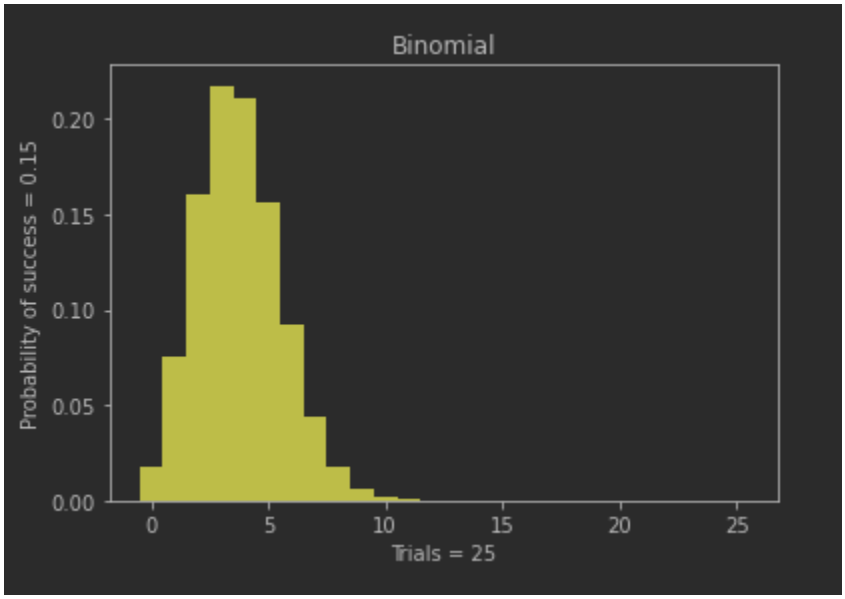
Trials: 25 Prob of Success: 0.1



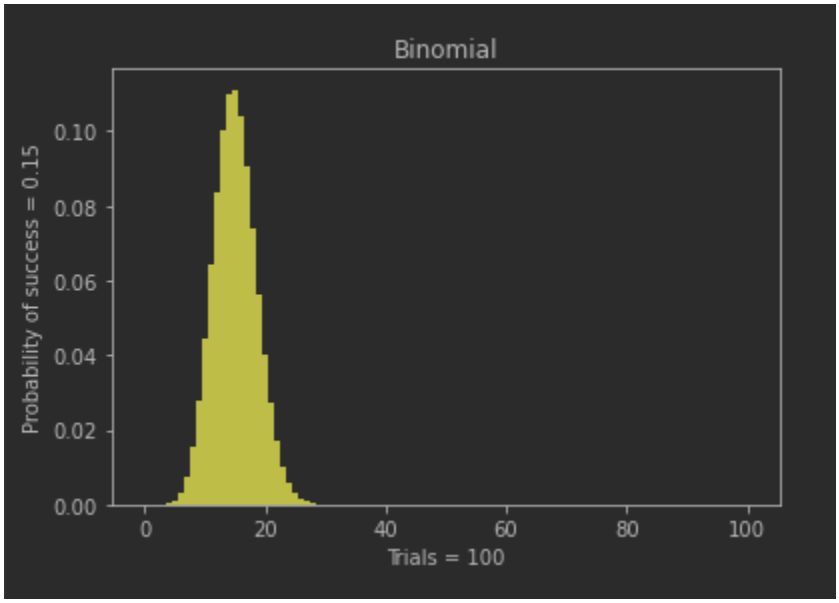
Trials: 100 Prob of Success: 0.1



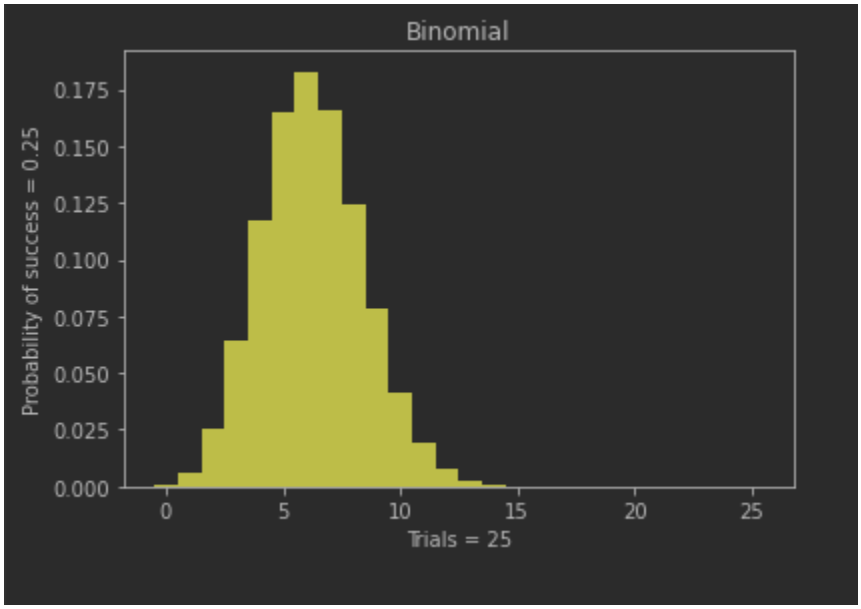
Trials: 25 Prob of Success: 0.15



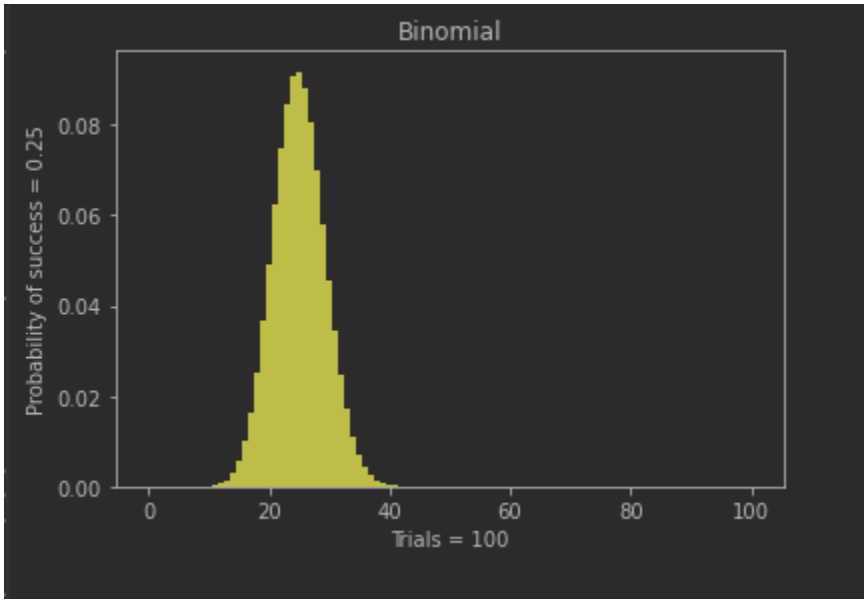
Trials: 100 Prob of Success: 0.15



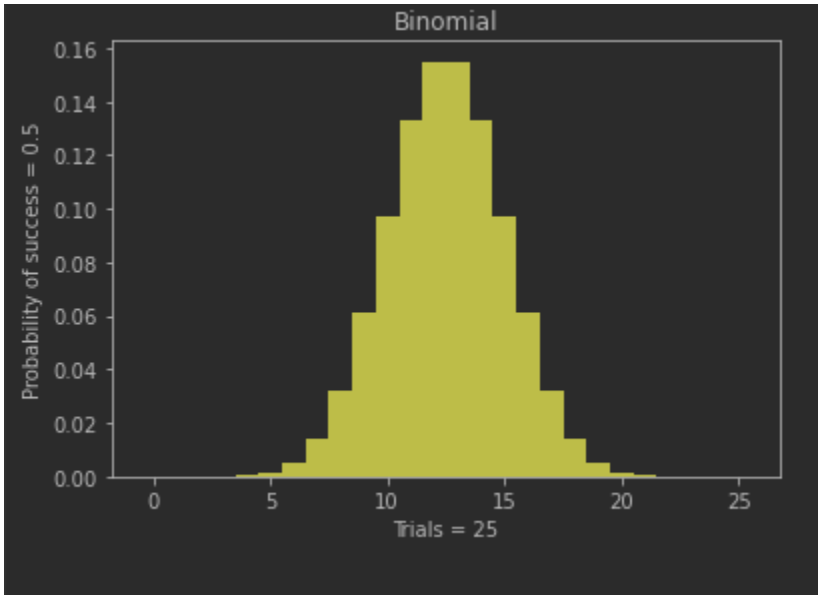
Trials: 25 Prob of Success: 0.25



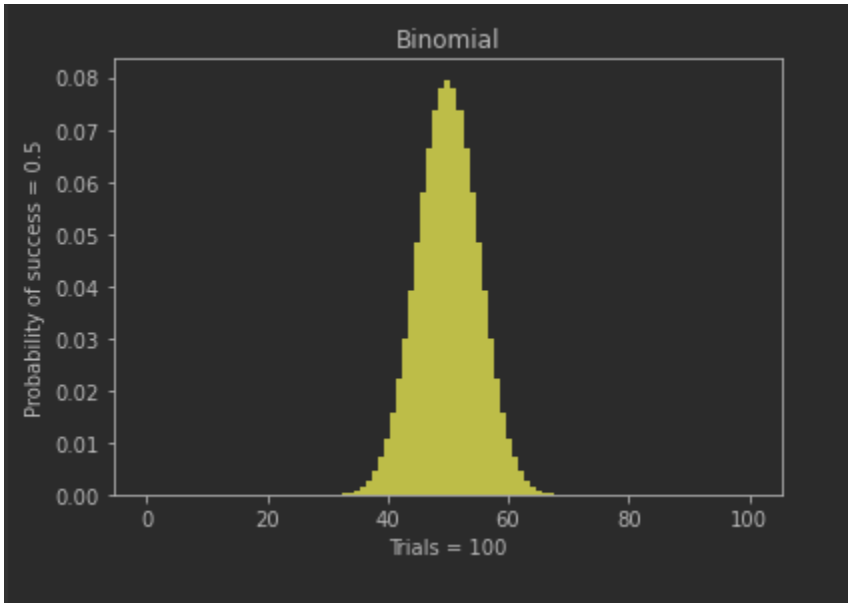
Trials: 100 Prob of Success: 0.25



Trials: 25 Prob of Success: 0.5



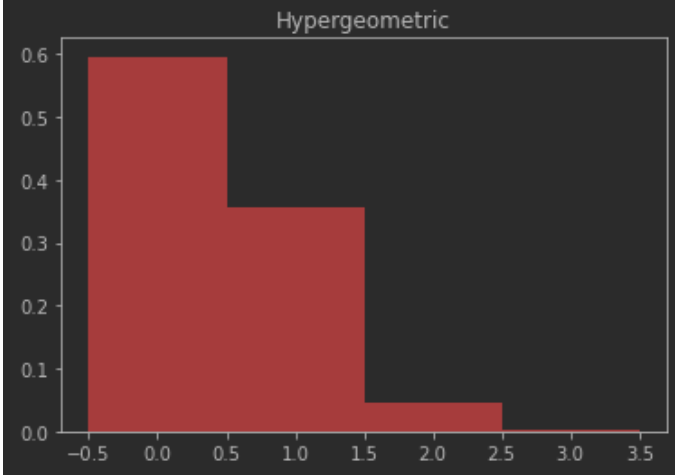
Trials: 100 Prob of Success: 0.5



Hyper-Geometric:

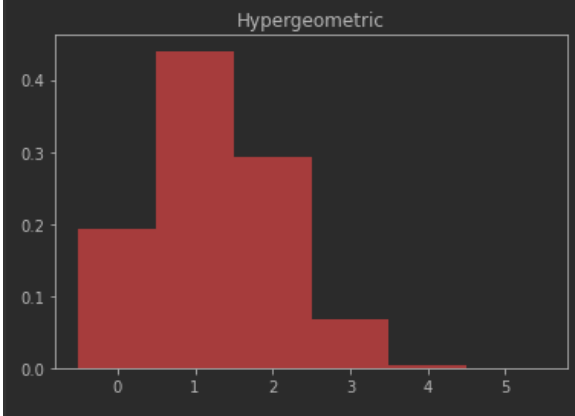
Green: 3 Red: 17

```
Input size of subpopulation of interest. >? 3
Input size of subpopulation not of interest. >? 17
Input size of sample. >? 3
[0, 1, 2, 3]
[0.5964912280701754, 0.35789473684210527, 0.04473684210526316, 0.0008771929824561404]
```



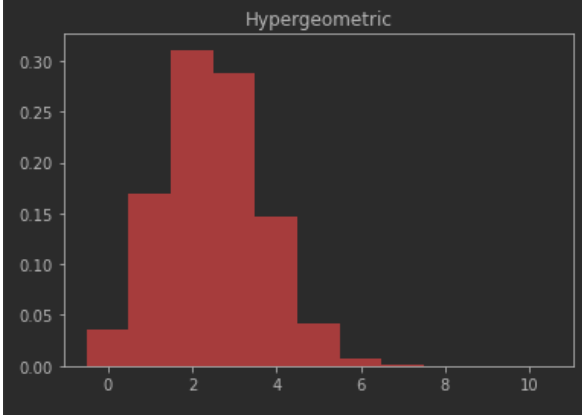
Green: 5 Red: 15

```
Input size of subpopulation of interest. >? 5
Input size of subpopulation not of interest. >? 15
Input size of sample. >? 5
[0, 1, 2, 3, 4, 5]
[0.19369195046439627, 0.44020897832817335, 0.29347265221878227, 0.06772445820433437, 0.004837461300309
```



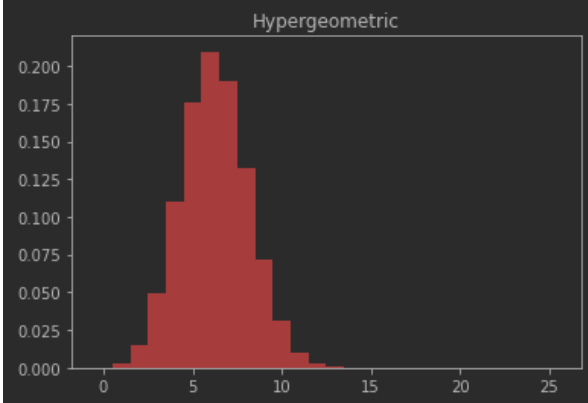
Green: 10 Red: 30

```
Input size of subpopulation of interest. >? 10
Input size of subpopulation not of interest. >? 30
Input size of sample. >? 10
[0, 1, 2, 3, 4, 5, 6, 7, 8, 9, 10]
[0.035444631438589294, 0.1687839592313776, 0.3107159249486724, 0.28820027821326133, 0.1471022253380188
```



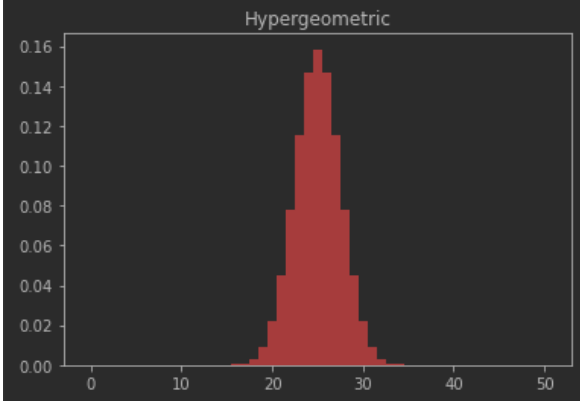
Green: 25 Red: 75

```
Input size of subpopulation of interest. >? 25
Input size of subpopulation not of interest. >? 75
Input size of sample. >? 25
[0, 1, 2, 3, 4, 5, 6, 7, 8, 9, 10, 11, 12, 13, 14, 15, 16, 17, 18, 19, 20, 21, 22, 23, 24, 25]
[0.00021684275728601593, 0.0026573867314462736, 0.014717834204933207, 0.04896688235477778, 0.109722088
```



Green: 50 Red: 50

```
Input size of subpopulation of interest. >? 50
Input size of subpopulation not of interest. >? 50
Input size of sample. >? 50
[0, 1, 2, 3, 4, 5, 6, 7, 8, 9, 10, 11, 12, 13, 14, 15, 16, 17, 18, 19, 20, 21, 22, 23, 24, 25, 26, 27,
[9.911653021418339e-30, 2.47791325535458 44e-26, 1.4873674315265894e-23, 3.807660624708069e-21, 5.25695
```



Binomial VS Error:

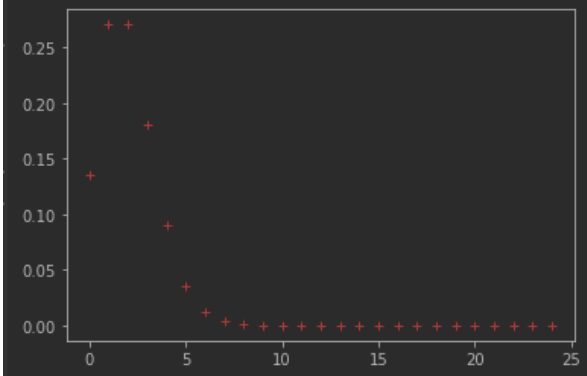
Vulcan (40) VS Humans (60):

```
Binomial
[0, 1, 2, 3, 4]
[0.1296, 0.34559999999999996, 0.3456000000000001, 0.15360000000000004, 0.025600000000000005]
Hypergeometric
[0, 1, 2, 3, 4]
[0.12435782185413997, 0.3490745876607438, 0.35208385134747433, 0.15117724690626017, 0.023306492231381776]
Error
[0, 1, 2, 3, 4]
[0.005242178145860019, -0.003474587660743822, -0.0064838513474742565, 0.0024227530937398767, 0.002293507768618228 3]
```

Poisson:

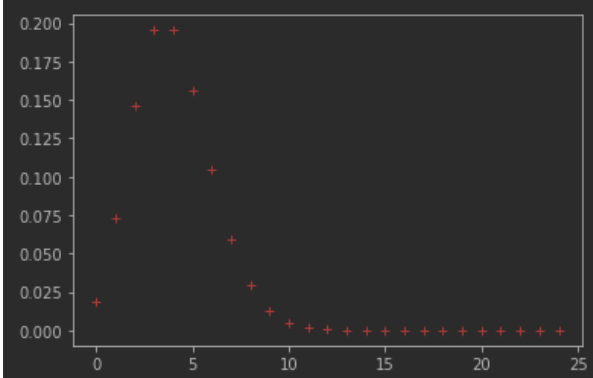
L=2

```
[0, 1, 2, 3, 4, 5, 6, 7, 8, 9, 10, 11, 12, 13, 14, 15, 16, 17, 18, 19, 20, 21, 22, 23, 24]
[0.1353352832366127, 0.2706705664732254, 0.2706705664732254, 0.18044704431548358, 0.09022352215774179,
```



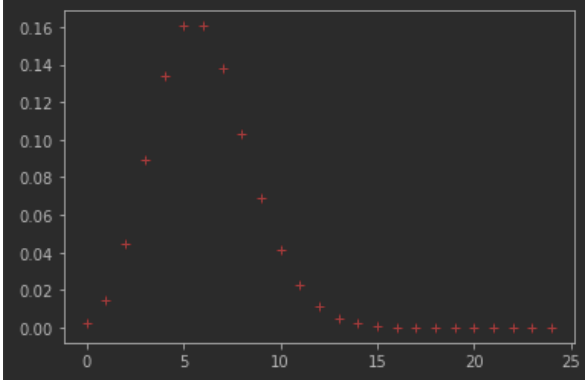
L=4

```
[0, 1, 2, 3, 4, 5, 6, 7, 8, 9, 10, 11, 12, 13, 14, 15, 16, 17, 18, 19, 20, 21, 22, 23, 24]
[0.01831563888873418, 0.07326255555493671, 0.14652511110987343, 0.19536681481316456, 0.195366814813164
```



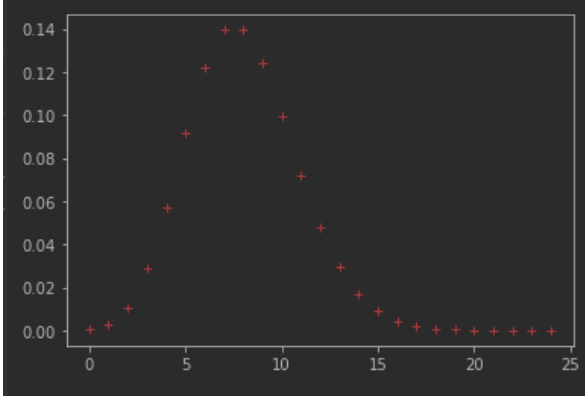
L=6

```
[0, 1, 2, 3, 4, 5, 6, 7, 8, 9, 10, 11, 12, 13, 14, 15, 16, 17, 18, 19, 20, 21, 22, 23, 24]
[0.0024787521766663585, 0.014872513059998151, 0.044617539179994455, 0.08923507835998891, 0.13385261753
```



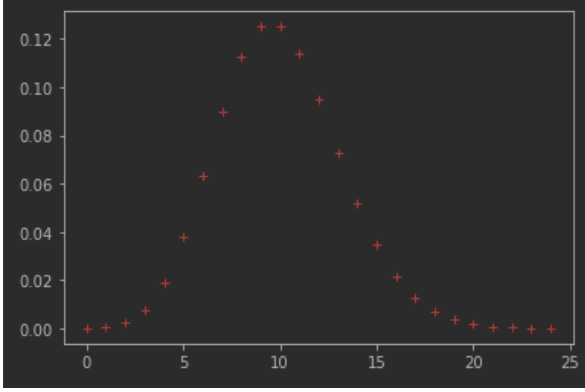
L=8

```
[0, 1, 2, 3, 4, 5, 6, 7, 8, 9, 10, 11, 12, 13, 14, 15, 16, 17, 18, 19, 20, 21, 22, 23, 24]
[0.00033546262790251185, 0.002683701023220095, 0.01073480409288038, 0.02862614424768101, 0.05725228849
```



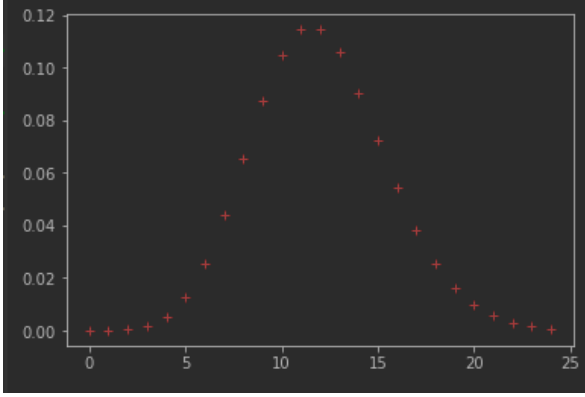
L=10

```
[0, 1, 2, 3, 4, 5, 6, 7, 8, 9, 10, 11, 12, 13, 14, 15, 16, 17, 18, 19, 20, 21, 22, 23, 24]
[4.5399929762484854e-05, 0.00045399929762484856, 0.0022699964881242427, 0.007566654960414142, 0.018916
```



L=12

```
[0, 1, 2, 3, 4, 5, 6, 7, 8, 9, 10, 11, 12, 13, 14, 15, 16, 17, 18, 19, 20, 21, 22, 23, 24]
[6.144212353328 21e-06, 7.373054823993851e-05, 0.0004423832894396311, 0.0017695331577585243, 0.00530859
```



What happens to the Poisson distribution as the value of the parameter changes?

- If you have N number of attempts trials, the closer Lambda is to N/2, the more it resembles a standard bell curve.

How might it play a role in the application of the central limit theorem?

- The closer you are to the Lth (Lambda-th) trial in the Poisson distribution, the higher the odds you have of succeeding on that trial number. (probability is higher)
- Taking such probabilities of one graph, generating binomial distributions based on those probabilities, and plotting them will result in them being normally distributed at a mean of said Lambda, as dictated by the CLT.