

Lecture A5. Simulation 2

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Exercise 1

Using `runif()` function in R, complete the following code block that generates 1,000 random numbers that follow $\exp(3)$

```
N<-1000
u<-runif(N)
x<-(-log(1-u)/3)
head(x)
```

```
## [1] 0.7073579 1.0045058 0.1062948 0.7038786 1.6837762 0.5753919
```

in python

```
import numpy as np
N=1000
u=np.random.uniform(size=N)
x=((-np.log(1-u))/3)
print(x[0:6])
```

```
## [0.06118069 0.07585188 1.1846222 0.2488375 0.05220017 0.37956704]
```

Various random numbers, Uniform random numbers p.15

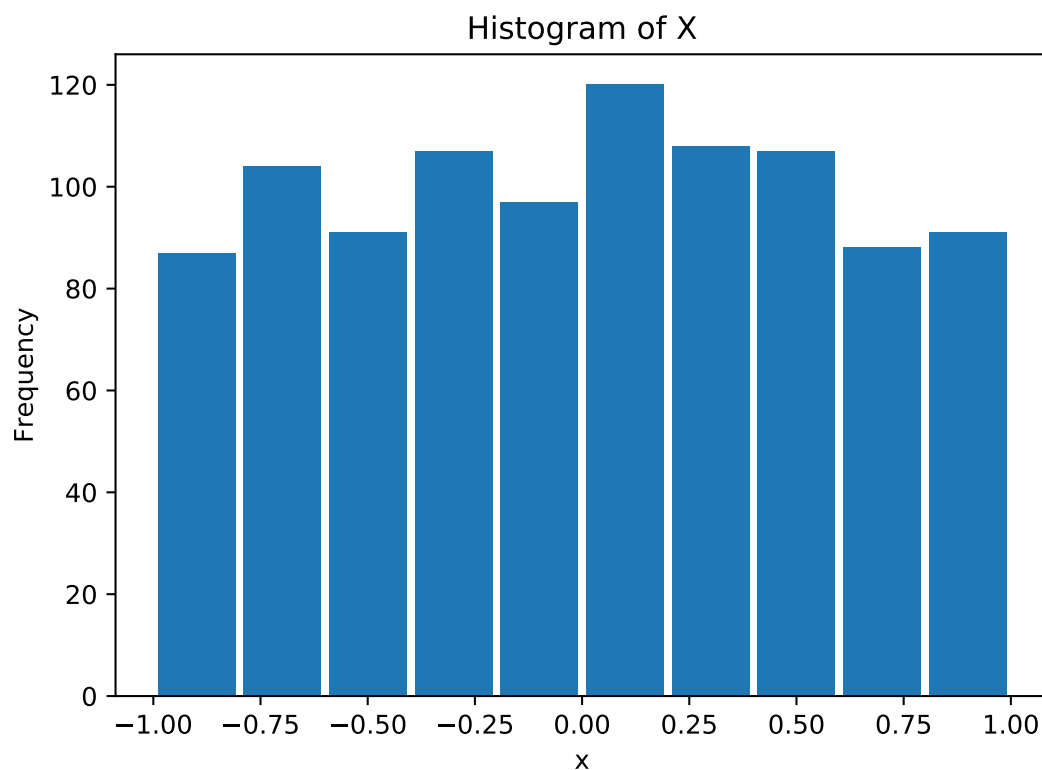
```
import matplotlib.pyplot as plt
import numpy as np

x=np.random.uniform(size=1000, low=-1,high=1)

plt.hist(x, rwidth=0.9)

## (array([ 87., 104.,  91., 107.,  97., 120., 108., 107.,  88.,  91.]), array([-9.99180777e-
01, -7.99369129e-01, -5.99557481e-01, -3.99745833e-01,
##      -1.99934185e-01, -1.22536627e-04,  1.99689111e-01,  3.99500759e-01,
##      5.99312407e-01,  7.99124056e-01,  9.98935704e-01]), <a list of 10 Patch objects>)

plt.xlabel("x")
plt.ylabel("Frequency")
plt.title("Histogram of X")
```



Various random numbers, Normal random numbers p.16

```
import matplotlib.pyplot as plt
```

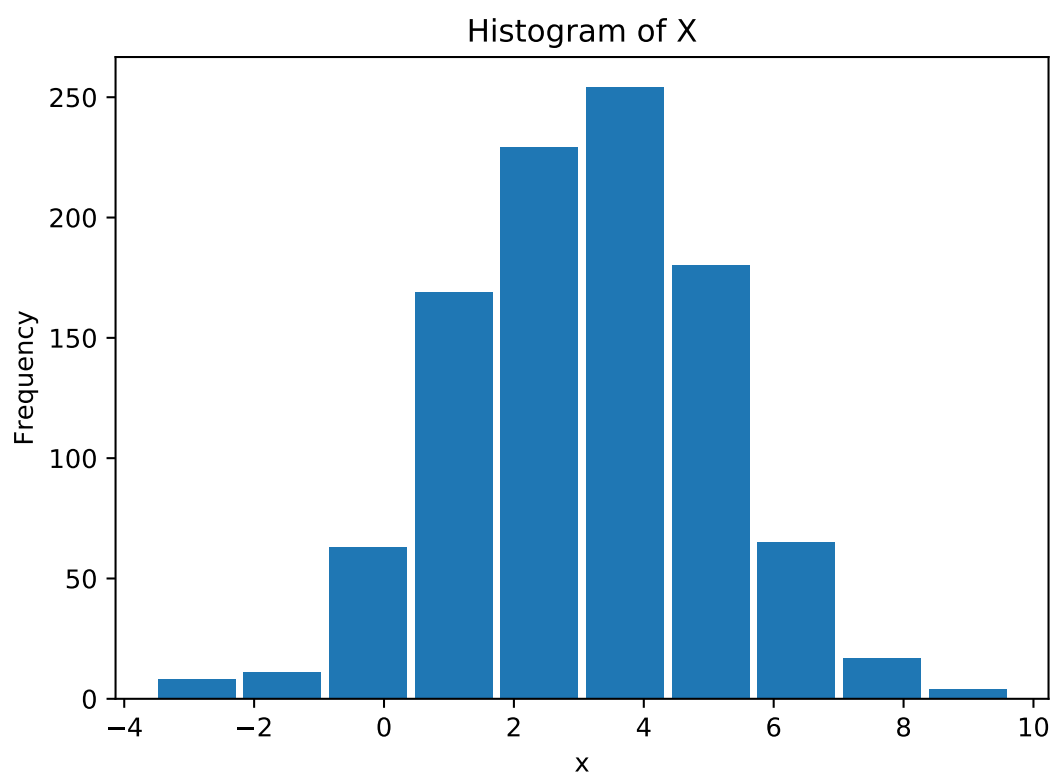
```
import numpy as np

x=np.random.normal(size=1000, loc=3, scale=2) # loc = mean , scale =sd

plt.hist(x, rwidth=0.9)

## (array([ 8., 11., 63., 169., 229., 254., 180., 65., 17., 4.]), array([-3.54671892, -
2.22755555, -0.90839217, 0.4107712 , 1.72993457,
##      3.04909794, 4.36826131, 5.68742469, 7.00658806, 8.32575143,
##      9.6449148 ]), <a list of 10 Patch objects>)

plt.xlabel("x")
plt.ylabel("Frequency")
plt.title("Histogram of X")
```



Various random numbers, Exponential random numbers p.17

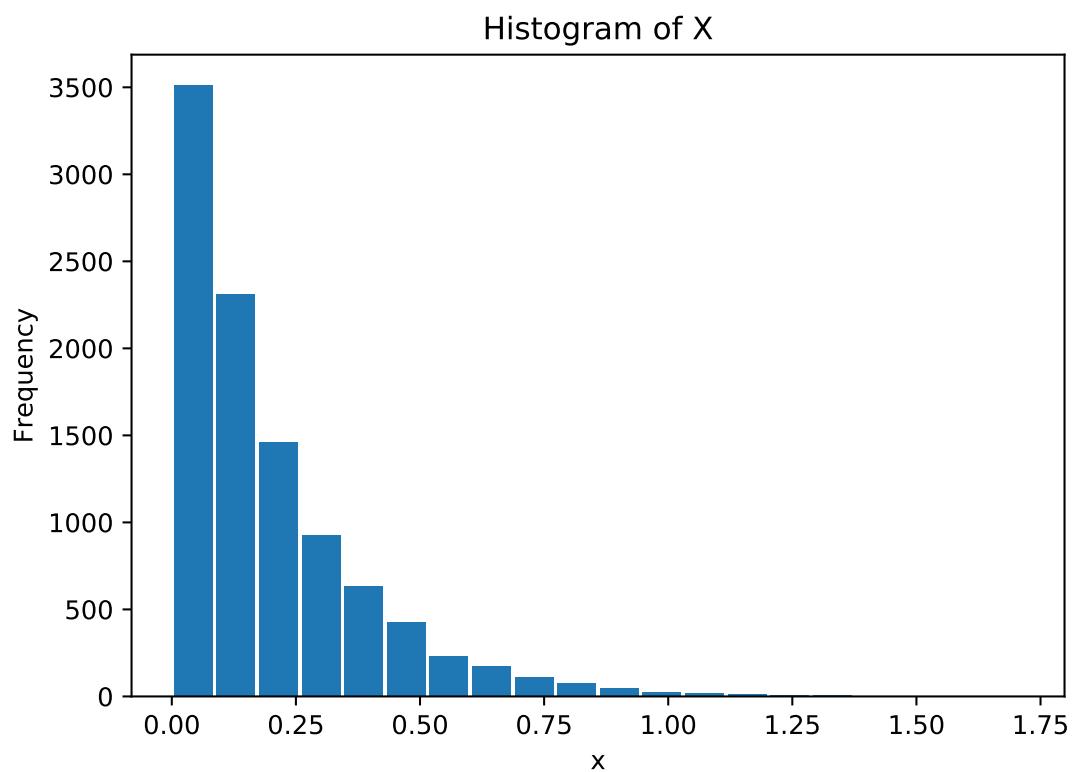
```
import matplotlib.pyplot as plt
import numpy as np

x=np.random.exponential(size=10000,scale=1/5) # meaning lambda=5
```

```
plt.hist(x,rwidth=0.9,bins=20)
```

```
## (array([3.512e+03, 2.312e+03, 1.461e+03, 9.270e+02, 6.330e+02, 4.250e+02,  
##        2.330e+02, 1.760e+02, 1.100e+02, 7.900e+01, 4.600e+01, 2.700e+01,  
##        2.100e+01, 1.600e+01, 7.000e+00, 8.000e+00, 2.000e+00, 2.000e+00,  
##        1.000e+00, 2.000e+00]), array([4.04714847e-05, 8.58986861e-02, 1.71756901e-  
01, 2.57615115e-01,  
##        3.43473330e-01, 4.29331544e-01, 5.15189759e-01, 6.01047974e-01,  
##        6.86906188e-01, 7.72764403e-01, 8.58622617e-01, 9.44480832e-01,  
##        1.03033905e+00, 1.11619726e+00, 1.20205548e+00, 1.28791369e+00,  
##        1.37377190e+00, 1.45963012e+00, 1.54548833e+00, 1.63134655e+00,  
##        1.71720476e+00]), <a list of 20 Patch objects>)
```

```
plt.xlabel("x")  
plt.ylabel("Frequency")  
plt.title("Histogram of X")
```



Various random numbers, Poisson random numbers p.18

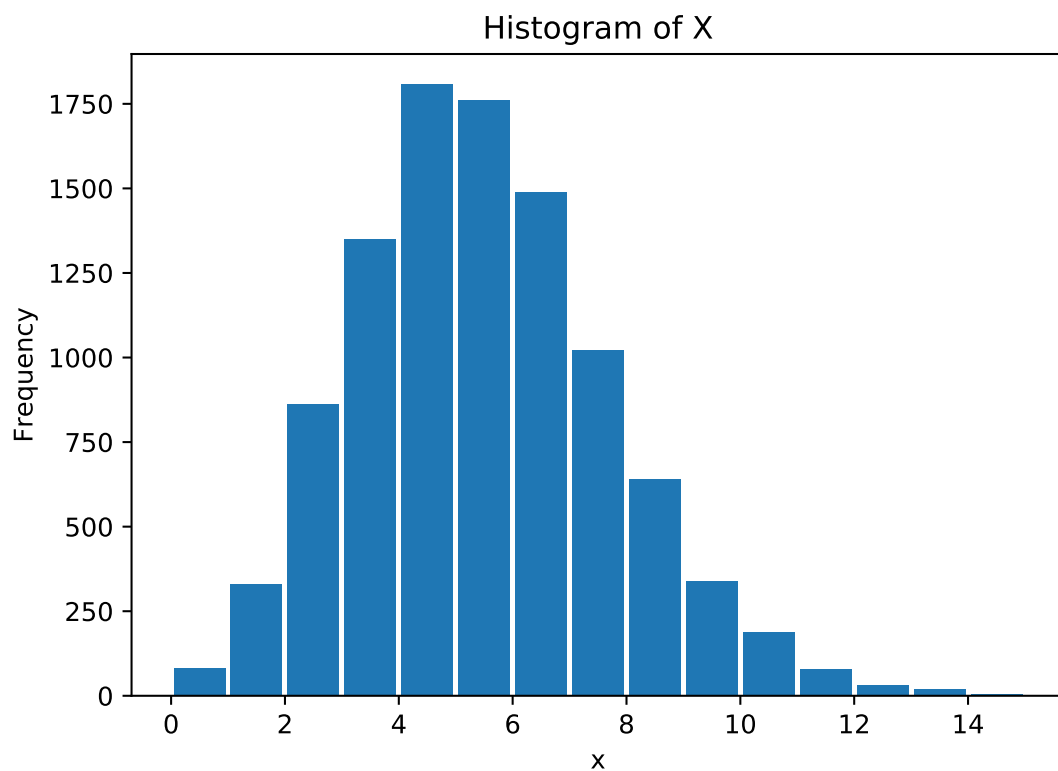
```
import matplotlib.pyplot as plt
import numpy as np
```

```
x=np.random.poisson(size=10000,lam=5) # meaning lambda=5
```

```
plt.hist(x,rwidth=0.9,bins=15)
```

```
## (array([ 81., 331., 863., 1351., 1807., 1760., 1490., 1020., 641.,
##        338., 187., 77., 32., 18., 4.]), array([ 0., 1., 2., 3., 4., 5., 6., 7., 8., 9., 10., 11., 12.,
##        13., 14., 15.]), <a list of 15 Patch objects>)
```

```
plt.xlabel("x")
plt.ylabel("Frequency")
plt.title("Histogram of X")
```



```
"Done, Lecture A5. Simulation 2 "
```

```
## [1] "Done, Lecture A5. Simulation 2 "
```