

Mathematica for Module 9.4

File: *Distributions.nb*

Introduction to Computational Science: Modeling and Simulation for the Sciences
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Statistical Distributions

- Load package containing *Histogram* and view documentation.

```
<< Histograms`;
```

```
?Histogram
```

- Generate 10000 uniformly distributed random numbers between 0.0 and 1.0 and generate histogram with 10 categories.

```
tbl = RandomReal[{0, 1}, 10 000];  
Histogram[tbl, HistogramCategories → 10]
```

Normal Distributions

- A normal or Gaussian distribution, which statistics frequently employs, has the following probability density function, where *mu* is the mean and *sigma* is the standard deviation:

```
normalPDF[mu_, sigma_, x_] :=  
  Exp[-(x - mu)^2 / 2 / sigma^2] / Sqrt[2 * Pi * sigma^2];
```

- Produce a plot of this function with mean 70 and standard deviation 5.

```
Plot[normalPDF[70, 5, x], {x, 50, 90}]
```

- View documentation of *NormalDistribution*.

```
?NormalDistribution
```

- One random number from normal distribution with mean 0 and standard deviation 1

```
r = NormalDistribution[0, 1];  
Random[r]
```

- Generate 1000 random numbers from normal distribution with mean 0 and standard deviation 1.
Employs *r* from above. Display histogram.

```
tblNormal = Table[Random[r], {1000}];  
Histogram[tblNormal]
```

- Generate 1000 random numbers from normal distribution with mean 3 and standard deviation 5.
Display histogram.

```
tblNormal = Table[Random[NormalDistribution[3, 5]], {1000}];  
Histogram[tblNormal]
```

Exponential Distributions

- View documentation of ExponentialDistribution.

```
? ExponentialDistribution
```

- One random number from exponential distribution with lambda 1. In text, the lambda value is r in the probability distribution functions $|r|e^{rt}$ with $r < 0$ and $t > 0$ and $|r|e^{rt}$ with $r > 0$ and $t < 0$.

```
r = ExponentialDistribution[1];  
Random[r]
```

- Generate 1000 random numbers from exponential distribution with lambda 1. Display histogram.

```
tblExpM = Table[Random[ExponentialDistribution[1]], {1000}];  
Histogram[tblExpM]
```

- Generate 1000 random numbers from exponential distribution with lambda 2. Display histogram.

```
tblExpM = Table[Random[ExponentialDistribution[2]], {1000}];  
Histogram[tblExpM]
```

- Adding 7 moves to right by 7

```
Histogram[tblExpM + 7]
```

- Generate 1000 random numbers from exponential distribution with lambda -2. Display histogram.

```
tblExpM = Table[Random[ExponentialDistribution[-2]], {1000}];  
Histogram[tblExpM]
```