Random Variable and Probability Distribution

Introduction:
A random variable can be described as a variable that can take on the possible values of an outcome of an experiment. There can be two types of random variables, namely, discrete and continuous random variables.

A discrete random variable can be defined as a variable that can take a countable distinct value like 0, 1, 2, 3... The probability distribution function and the probability mass function for a discrete random variable are given below:

- Probability Distribution Function: F(x) = P (X ≤ x)
- Probability Mass Function: p(x) = P(X = x)

A continuous random variable can be defined as a variable that can take on infinitely many values. The probability distribution and Probability density function of a continuous random variable are given below:

- Probability Distribution Function: F(x) = P (X ≤ x)
- Probability Density Function: f(x) = d/dx (F(x)) where F(x) = $\int_{-\infty}^{x} f(u)du$

Procedure:
Import data set
Determine the measures of probability distribution using R functions
Visualize the probability distribution using R functions

Code and Results:

```
# Generating data x as a random variable
x=-3:3
x
```

```
## [1] -3 -2 -1  0  1  2  3
```

```
# discrete probability distribution of x
px=c(0.1,0.2,0.1,0.2,0.1,0.1,0.2)
px
```

```
## [1] 0.1 0.2 0.1 0.2 0.1 0.1 0.2
```

```
# mean of x
m=sum(x*px)
m
```

```
## [1] 0.1
```

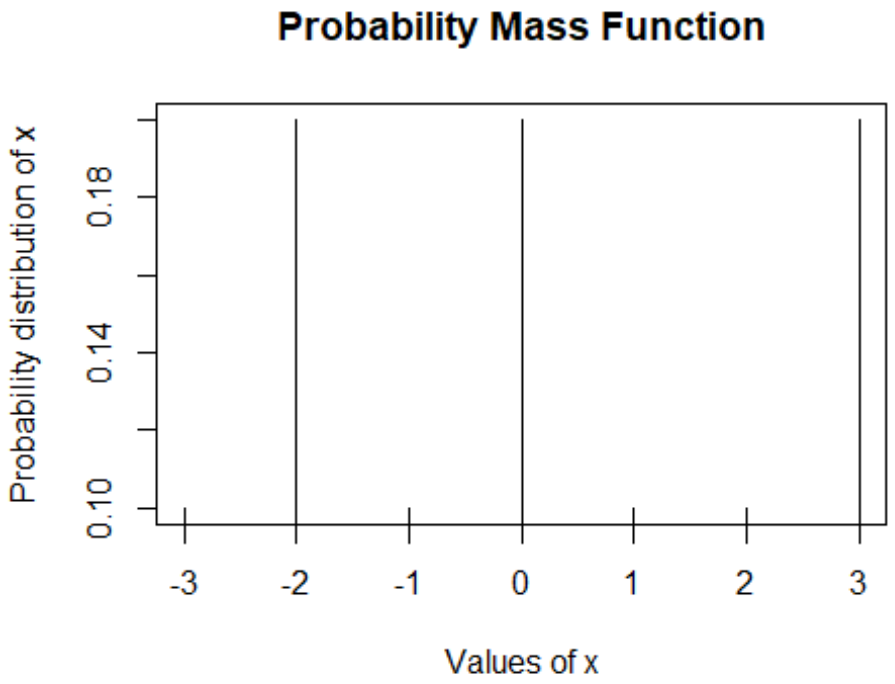
```r
# variance of x
v=sum(x^2*px)-m^2
v
```

```
## [1] 4.09
```

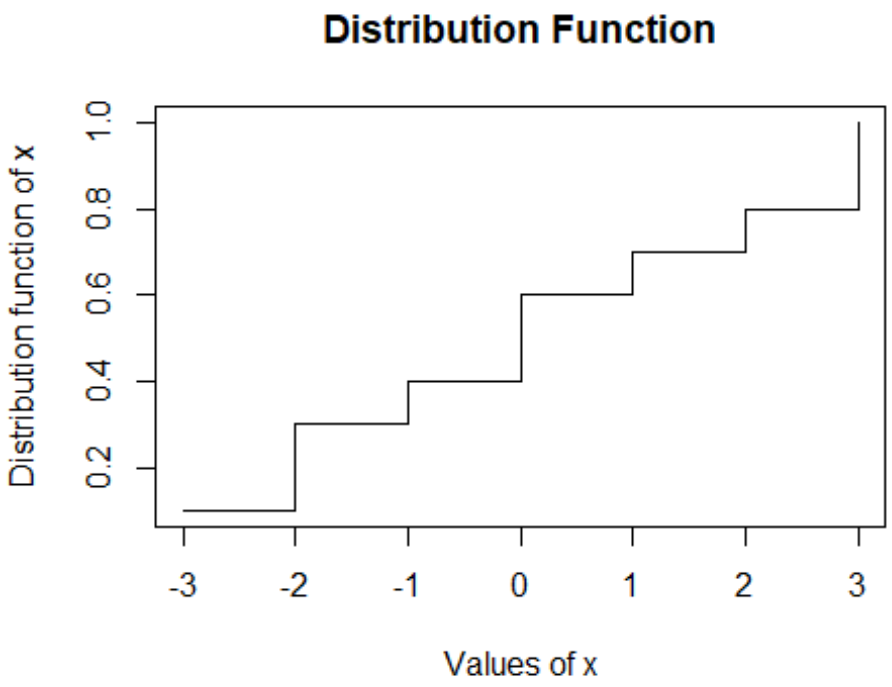
```r
# cumulative probability distribution of x
Fx=cumsum(px)
Fx
```

```
## [1] 0.1 0.3 0.4 0.6 0.7 0.8 1.0
```

```r
# Visualize the probability distribution
plot(x,px,xlab='Values of x', ylab='Probability distribution of
x',main='Probability Mass Function',type='h')
```




```r
# Visualize the distribution function
plot(x,Fx,xlab='Values of x', ylab='Distribution function of
x',main='Distribution Function',type='s')
```




```r
# Generating data for continuous random variable x
x=seq(0,1,length=100)
# probability density function
fx=3*x^2
fx
```

```
##   [1] 0.0000000000 0.0003060912 0.0012243649 0.0027548209 0.0048974594
##   [6] 0.0076522804 0.0110192837 0.0149984695 0.0195898378 0.0247933884
##  [11] 0.0306091215 0.0370370370 0.0440771350 0.0517294154 0.0599938782
##  [16] 0.0688705234 0.0783593511 0.0884603612 0.0991735537 0.1104989287
##  [21] 0.1224364861 0.1349862259 0.1481481481 0.1619222528 0.1763085399
##  [26] 0.1913070095 0.2069176615 0.2231404959 0.2399755127 0.2574227120
##  [31] 0.2754820937 0.2941536578 0.3134374043 0.3333333333 0.3538414448
##  [36] 0.3749617386 0.3966942149 0.4190388736 0.4419957147 0.4655647383
##  [41] 0.4897459443 0.5145393327 0.5399449036 0.5659626569 0.5925925926
##  [46] 0.6198347107 0.6476890113 0.6761554943 0.7052341598 0.7349250077
##  [51] 0.7652280380 0.7961432507 0.8276706459 0.8598102234 0.8925619835
##  [56] 0.9259259259 0.9599020508 0.9944903581 1.0296908479 1.0655035200
##  [61] 1.1019283747 1.1389654117 1.1766146312 1.2148760331 1.2537496174
##  [66] 1.2932353841 1.3333333333 1.3740434650 1.4153657790 1.4573002755
##  [71] 1.4998469544 1.5430058157 1.5867768595 1.6311600857 1.6761554943
##  [76] 1.7217630854 1.7679828589 1.8148148148 1.8622589532 1.9103152740
##  [81] 1.9589837772 2.0082644628 2.0581573309 2.1086623814 2.1597796143
##  [86] 2.2115090297 2.2638506275 2.3168044077 2.3703703704 2.4245485155
##  [91] 2.4793388430 2.5347413529 2.5907560453 2.6473829201 2.7046219773
##  [96] 2.7624732170 2.8209366391 2.8800122436 2.9397000306 3.0000000000
```

```r
# Visualize the probability density function
plot(x,fx,xlab='Values of x', ylab='Probability distribution of
x',main='Probability Density Function',type='l')
```