Tram Le

Homework 2:

1.Generate a random 1000 uniform between 0-1 then store to varible x.

```
n = 1000

x <- runif(n,0,1)
```

a) Using mean() to find mean of x: mean(x)
b) Using var() to find variance of x: var(x)
c) Using cumsum() to find cumulative sum of x then assign to cs: cs <- cumsum(x)
d) Using plot() with x = 1:n and y = cs / 1:n, type line: plot(1:n, cs/1:n, type = "l")
e) Using abline() to add horizontal line at y = .5: abline(h = .5)

2.

Finding mean E(X) by integrate from 0 to 1 of funtion x*dx:

```
f = function(x) {x}

m <- integrate(f,0,1)
```

Finding variance Var(X) by integrate from 0 to 1 of funtion (x-1/2)^2 * dx:

```
g = function(x) {(x-1/2)^2}

v <- integrate(g,0,1)
```

3. Generate 2 sets of n = 1000000 uniform between -1-1 then store them in x and y:

```
n = 1000000

x = runif(n,-1,1)

y = runif(n,-1,1)
```

a) Total Points(x,y) that satisfy x^2 + y^2 < 1:

```
count = 0
for (i in 1:n)
{
  if (x[i]^2 + y[i]^2 < 1)
    count = count + 1
}
print(count)
```

>> 785461

- *The figure that x^2 + y^2 < 1 is a circle part of region, the radius r= 1. The area of a circle is pi*r^2 = pi*1^1 = pi*

b) Ratio of total number satisfies x^2+y^2 < 1 and total number of points used (n):

ratio = count / n = 0.785461

c) The points(x,y) fall into a square that has side lengths 2. Multiply the ratio by 4. This gives the area of circle x^2 + y^2 = 1
*Area = 4 * ratio = 4*.785461 = 3.141844*

4. Generate 3 sets of n = 100000 uniform between -1-1 then store them in x, y and z:

```
n = 100000

x = runif(n,-1,1)

y = runif(n,-1,1)

z = runif(n,-1,1)
```

a) Total Points(x,y) that satisfy x^2 + y^4 + z^6 < 1:

```
for (i in 1: n)
{
 if (x[i]^2 + y[i]^4 + z[i]^6 < 1)
 {
  count = count + 1
 }

}
print(count)
```

>> 76703

b) Ratio of total number satisfies x^2+y^4+z^6< 1 and total number of points used (n):
Ratio = count / n = .76703

c) The points(x,y,z) fall into a square that has side lengths 2. Multiply the ratio by 8. This gives the volume of a cube = 2*2*2 = 8
*Volume = 8 * Ratio = 6.13624*

5. Generate 2 points randomly n = 10000.

```
for (i in 1:n)

{

 # create 2 random uniform between 0-1 then sort the order of values

 x = runif(2, 0, 1)

 x = sort(x)

 # create vector to put 1 and 0 in each row
```

```
  m = c(0,0,0,1)
  # assign each value in the 1st, 2nd column to the 2nd, 3rd value in vector
  m[2] = x[1]
  m[3] = x[2]
  # sort the  difference between pairs in vector (next - previous)
  m2 = sort(diff(m))
  #after the sort it becomes 3 segments
  #compare the sum of 1st two segments > the 3rd then count it
  if(m2[1] + m2[2] > m2[3])
  {
    count = count + 1
  }
}
print("The probability is: ")
print(count/n)
```

>> The probability is 0.2518