Monte Carlo Simulations Lab
Assignment 1

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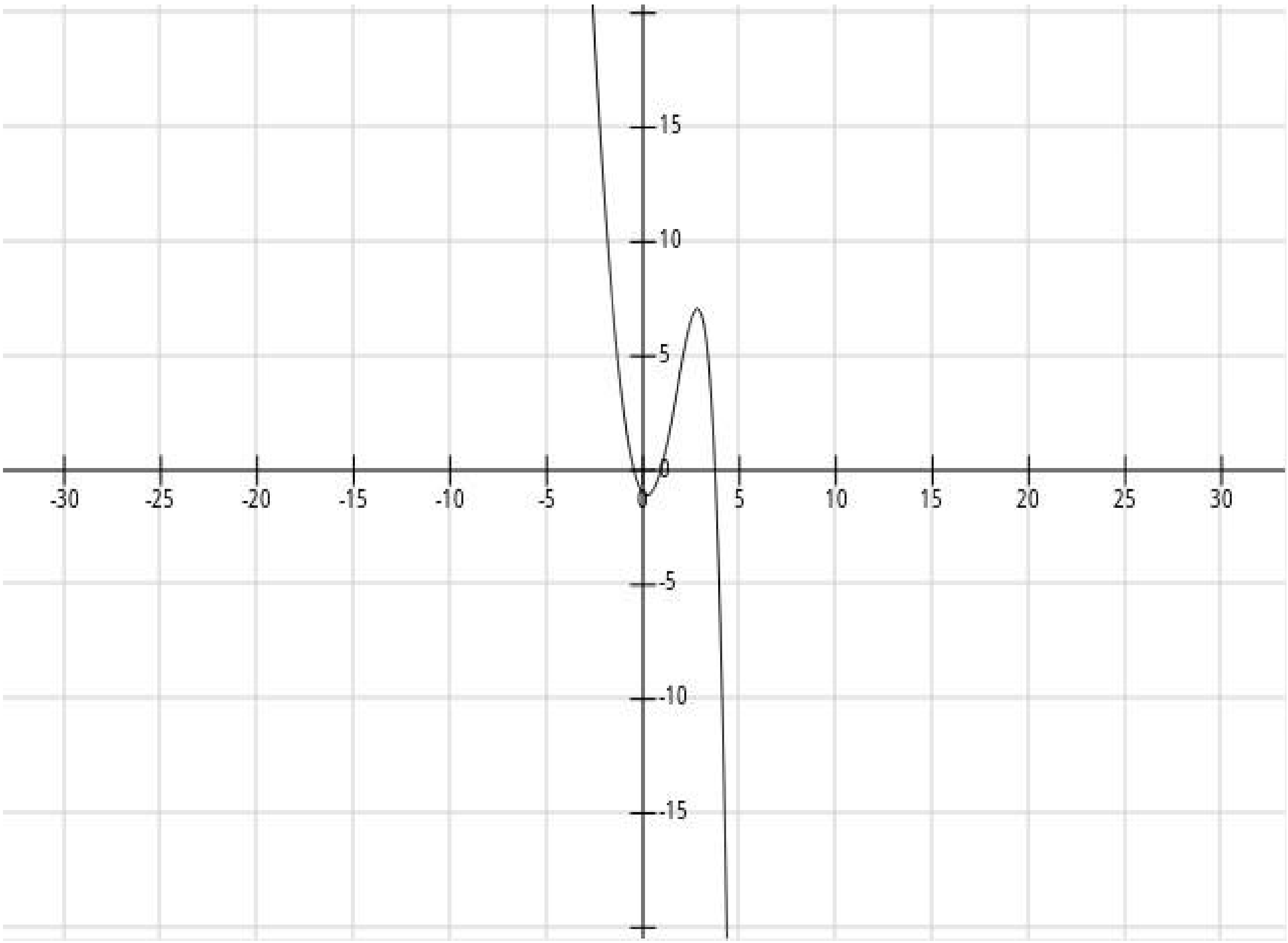
Date: Jan 18, 2017

The Graph of the function 3(x^2)-exp(x) through which guesses for the three zeroes were made



The C++ code for the given ASSIGNMENT is:

```
#include <iostream>
#include <cmath>

#define e 2.71828182845904523536
using namespace std;

//Given function: 3x^2-e^x


double function(double x) //Function to return value of
3x^2-e^x
{
	return 3.0*pow(x,2) - 1.0*pow(e,x);
}

double f_dash(double x) //Funtion which returns value
of the derivative of given function
{
	return 6.0*(x)-1.0*pow(e,x);
}

int main()
{
	//seting the tolerance value
	double epsilon= 1e-5;
```

```
double initial_guess;

//Taking Initial Guess as an
input cout<<"Enter Initial
Guess: "; cin>>initial_guess;

double x_i,x_j;
x_j=initial_guess;

/*The Newton-Raphson method is an iterative
process for solving the root of the equation f (x) = 0.
According to the method, starting with an initial guess
of x0 , apply the iterative formula xn+1 = xn −f
(xn )/f ′ (xn ) where f' denotes the derivative of the
function. The iteration stops when we arrive at an
acceptable limit |xn+1 − xn | < ϙ , where ϙ is
some pre-specified tolerance value*/
do
{
    x_i=x_j;
    x_j = x_j- (f(x_j)/f_dash(x_j));
}
while(abs(x_j-x_i)>epsilon); # whenver the estimated

cout<<"Value of f at found solution -> "<<f(x_j)<<endl;
cout<<"Found solution -> "<<x_j<<endl;
}
```

Initial Guesses roots:

x1<-1

x2<1

x3< 4

THE ROOTS SO OBTAINED FOR
F(x)=3x^2-e^x :
x1=--0.458962 and F(x1)= 2.22045e-16
x2=0.910008 and F(x2)=4.44089e-16
x3=3.73308 and F(x3)=-4.24492e-10

The value of tolerance(epsilon in this case) was given as 10^-5. This fixes how much accurate we want our answer to be. As soon as the x_i and x_j are close enough we stop our iterative loop and find an approximate solution. The result is accurate upto 5 decimal points.

Analysis of the Result and the Graph

The initial guesses for roots of the polynomail were made in accordance with the graph of the given function. It was visible that only three zeroes will be possible, as the value of funcition starts from negative infinitiy and thereafter goes to positive infinity. Hence the estimation stands correct. The value of the expression would have increased/decreased monotonically tremendously out side the (-5,+5) set for sure.

The rest was done in accordance with the given formula for the **Newton Raphson Method** for finding roots of an equation. It is seen that the values of the roots so obtained are very are quite close to the initiating guesses, thus justifying our guesses.

$$x_{n+1} = x_n - \frac{f(x_n)}{f'(x_n)}$$