Assignment

Prateek Naithani (204001)

In[•]:=
```
GaussJacobi[Ao_, bo_, Xp_, maxiter_] :=
  Module[{A = N[Ao], b = N[bo], xk = Xo, xk1, i, j, k = 0,
    n, m, OutputDetails},
   Size = Dimensions[A];
   n = Size[[1]];
   m = Size[[2]];
   If[n ≠ m, Print["Not a square matrix, cannot Proceed with Gauss Jacobi Method"];
    Return[]];
   OutputDetails = {xk};
   xk1 = Table[0, {n}];
   While[k < maxiter,
    For[i = 1, i ≤ n, i++,
     xk1[[i]] =
       1 / A[[i, i]] (b[[i]] - Sum[A[[i, j]] * xk[[j]], {j, 1, i-1}] - Sum[A[[i, j]] * xk[[j]], {j, i+1, n}]);]
    k++;
    OutputDetails = Append[OutputDetails, xk1];
    xk = xk1;];
   colHeading = Table[X[k], {k, 1, n}];
   Print[
    NumberForm[TableForm[OutputDetails, TableHeadings → {None, colHeading}], 6]];
   Print["Number of iterations Performed:- ", maxiter];];
A = {{2, 1, 1}, {3, 5, 2}, {2, 1, 4}};
b = {4, 15, 8};
Xo = {1, 1, 1};
GaussJacobi[A, b, Xo, 10];
```

X[1]	X[2]	X[3]
1	1	1
1.	2.	1.25
0.375	1.9	1.
0.55	2.375	1.3375
0.14375	2.135	1.13125
0.366875	2.46125	1.39438
0.0721875	2.22213	1.20125
0.288313	2.47619	1.40838
0.0577188	2.26366	1.2368
0.24977	2.47065	1.40523
0.0620625	2.28805	1.25745

```
Number of iterations Performed:- 10
```

In[]:=
```
f[x_] := Cos[x] - x * e^x;
x0 = 0.0;
x1 = 1.0;
n = 14;
If[f[x0] * f[x1] > 0,
  Print["These values do not fit in IVT. So, please change values"],
  For [i = 1, i ≤ n, i++, a = (x0 + x1) / 2;
     Print[i, "th iteration value is ", a];
    If[f[x0] * f[a] < 0, x1 = a, x0 = a];];];
```

```
1th iteration value is 0.5

2th iteration value is 0.75

3th iteration value is 0.625

4th iteration value is 0.5625

5th iteration value is 0.53125

6th iteration value is 0.515625

7th iteration value is 0.523438

8th iteration value is 0.519531

9th iteration value is 0.517578

10th iteration value is 0.518555

11th iteration value is 0.518066

12th iteration value is 0.517822

13th iteration value is 0.5177

14th iteration value is 0.517761
```

In[]:=
```
ClearAll;
RegulaFalsi[a0_, b0_, m_] :=
  Module[{a = N[a0], b = N[b0]},
   c = (a * f[b] - b * f[a]) / (f[b] - f[a]);
   k = 0;
   While[k < m,
    If[Sign[f[b]] == Sign[f[c]],
     b = c,
     a = c;
    ];
    c = (a * f[b] - b * f[a]) / (f[b] - f[a]);
    k = k + 1;
    Print["Value at ", k, "th iteration is = ", NumberForm[c, 16]];
   ];
  ];
RegulaFalsi[3, 2, 10];
f[x_] := x^2 - 2 * x - 6;
```

```
Value at 1th iteration is = 2.103763629968343
Value at 2th iteration is = 2.117873316375702
Value at 3th iteration is = 2.123930616922808
Value at 4th iteration is = 2.126512743981678
Value at 5th iteration is = 2.127610146619082
Value at 6th iteration is = 2.128075943763304
Value at 7th iteration is = 2.128273545537744
Value at 8th iteration is = 2.128357353325326
Value at 9th iteration is = 2.128392894787444
Value at 10th iteration is = 2.128407966691749
```

In[•]:=
```
x0 = 1.5;
NMax = 10;
f[x_] = x^4 + x - 10;
For[i = 1, i ≤ NMax, i++,
  x1 = N[x0 - (f[x0]) / (f'[x0])];
  x0 = x1;
  Print["The final approximation of the root is:", x1]];
```

```
The final approximation of the root is:1.73707
The final approximation of the root is:1.69874
The final approximation of the root is:1.69747
The final approximation of the root is:1.69747
The final approximation of the root is:1.69747
The final approximation of the root is:1.69747
The final approximation of the root is:1.69747
The final approximation of the root is:1.69747
The final approximation of the root is:1.69747
The final approximation of the root is:1.69747
```