Bisection Method

Mayank Pathania
204103314

February 4, 2021

1 Question No.2

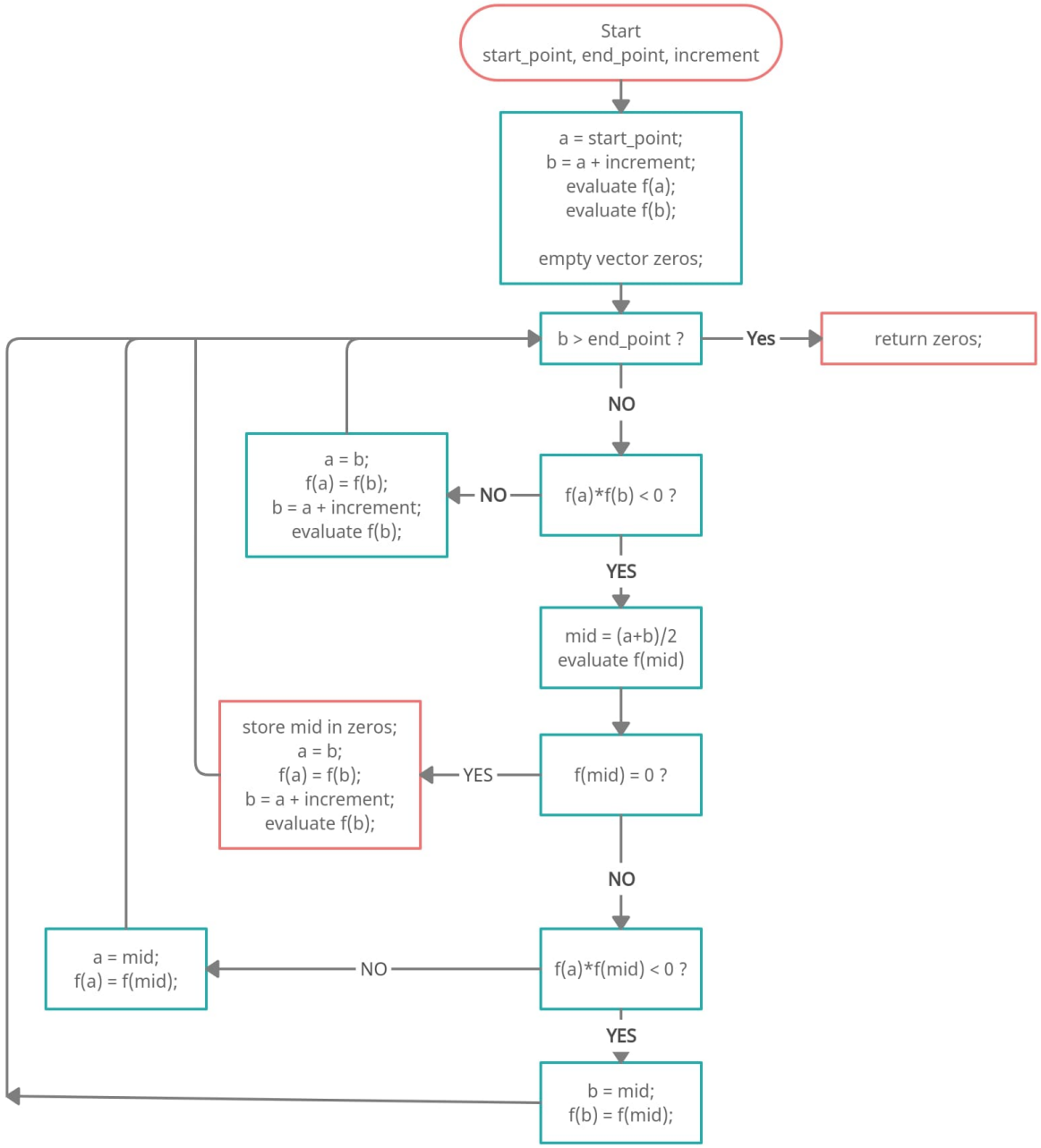
Algorithm 1 Bisection Method

```
procedure BISECTION_METHOD(start_point, end_point, increment)
    set a very low ϵ value.
    a = start_point;
    b = a + increment;
    evaluate f(a);
    evaluate f(b);

    initialize empty vector zeros;

    while (b <= end_point) do
        if (f(a) * f(b) < 0) then
            mid = (a+b)/2;
            evaluate f(mid);
            if (f(mid) < ϵ) then                          ▷ close to zero
                store mid in zeros;
                a = b;
                f(a) = f(b);
                b = a + increment;
                evaluate f(b);
            else if (f(mid) * f(a) < 0) then
                b = mid;
                f(b) = mid;
            else
                a = mid;
                f(a) = f(mid);
        else
            a = b;
            f(a) = f(b);
            b = a + increment;
            evaluate f(b);
        return zeros;                                     ▷ empty zeros means no solution found
```

2 Flow Chart



3 Result $x^3 - 2x + 1$

3.1 Parameters

start_point : -2
end_point : 2
increment : 0.5
ϵ : 10^{-9};

3.2 Output

root	function evaluations
-1.61803	32
0.618034	64
1	93
total	95

4 Remarks

- The function evaluations are cumulative.
- input arguments can be changed to get different solutions, if exist.
- for increment = 1 only one solution was found.
- for increment = 0.5 all three solutions were found.