Bisection Method

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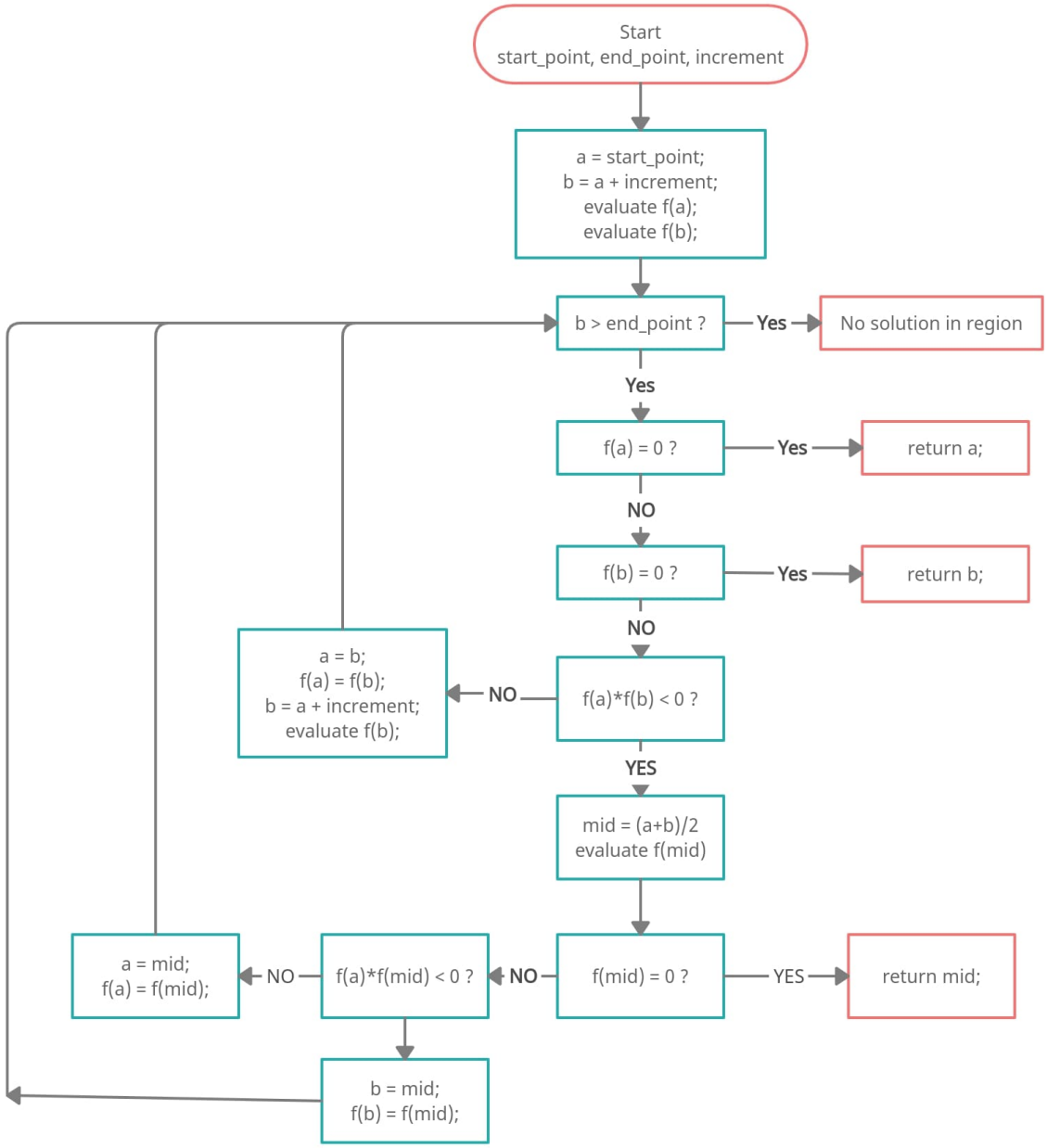
1 Question No.1

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);
    while (b <= end_point) do
        if (f(a) < ϵ) then                                   ▷ close to zero
            return a;
        if (f(b) < ϵ) then                                   ▷ close to zero
            return b;
        if (f(a) * f(b) < 0) then
            mid = (a+b)/2;
            evaluate f(mid);
            if (f(mid) < ϵ) then                             ▷ close to zero
                return mid;
            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);
```

2 Flow Chart



3 Results

3.1 Problem a) xe^x

3.1.1 Parameters

start_point : -2
end_point : 2
increment : 4
ϵ : 10^{-9};

3.1.2 Output

root	function evaluations
0	3

3.1.3 Observations

The algorithm converged in 3 iterations for the given region.

3.2 Problem b) $x^3 - 2x + 1$

3.2.1 Parameters

start_point : -2
end_point : 2
increment : 4
ϵ : 10^{-9};

3.2.2 Output

root	function evaluations
-1.61803	35

3.2.3 Observations

The algorithm converged in 35 iterations for the given region.

3.3 Problem c) $sin(x) - \frac{1}{x}$

3.3.1 Parameters

start_point : -2
end_point : 2
increment : 4
ϵ : 10^{-9};

3.3.2 Output

root	function evaluations
1.11416	28

3.3.3 Observations

The algorithm converged in 28 iterations for the given region.

4 Remarks

- increment is set to 1 by default in code.
- input arguments can be changed to get different solutions, if exist.