

# Quiz 0: MT3164: Numerical Analysis

11:00 am to 11:50 am on 13<sup>th</sup> August, 2025

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**This quiz contains series of tasks. Please complete all of them. Do not leave the lab before you got confirmation of your submission.**

1. Open Visual Studio (or some other editor).
2. Create a new file `q0p1.py` and save it on [Desktop](#).
3. A typical question will be of the following format.
  - (a) Write a program that takes as input an integer  $M$  and float values  $a, b, \delta, \epsilon$  and computes a 'reasonable' root of the following function in the range  $[a, b]$  using the bisection method.

$$f(x) = \frac{x^3 + 4x^2 + 3x + 5}{2x^3 - 9x^2 + 18x - 2}.$$

Output  $a, b, f(a), f(b)$  at each stage. We say a root  $c \in [a, b]$  is reasonable if one of the following conditions is true: (i) it is obtained after  $M^{\text{th}}$  iteration of the algorithm, (ii)  $|f(c)| < \epsilon$ , or (iii) the error between the actual root and  $c$  is at most  $\delta$ .

**Input:**  $M, a, b, \delta, \epsilon$

**Output:** Your name and roll number in the first line.

Next  $M$  lines should contains the following four values  $a, b, f(a), f(b)$ .

4. Before starting to solve the problem, it would be good to obtain sample input size.

`cp /nfscommon/common/prafullkumar/public/input_q0p1.txt ./`

5. An ideal program looks as follows.

```
1 def f(x):
2     # The given function
3     return (x**3 + 4*x**2 + 3*x + 5) / (2*x**3 - 9*x**2 + 18*x - 2)
4
5 def bisection_method(M, a, b, delta, epsilon):
6     fa = f(a)
7     fb = f(b)
8
9     if fa * fb > 0:
10         print("No root in the range.")
11         return None
12
13     for i in range(1, M + 1):
14         print(f"{i:4d} {a:12.4f} {b:12.4f} {fa:12.4e} {fb:12.4e}")
15
16         c = (a + b) / 2
17         fc = f(c)
18
19         # Check stopping conditions
20         if abs(fc) < epsilon or (b - a) / 2 <= delta:
21             return c
22
```

```

23     # Update the interval
24     if fa * fc < 0:
25         b = c
26         fb = fc
27     else:
28         a = c
29         fa = fc
30
31     # If reached M iterations, return c
32     c = (a + b) / 2
33     return c
34
35
36 M = int(input())
37 a = float(input())
38 b = float(input())
39 delta = float(input())
40 epsilon = float(input())
41
42 print("20001 \t Alan Turing")
43 # Replace 20001 by your roll number and 'Alan Turing' by your name.
44 bisection_method(M, a, b, delta, epsilon)

```

6. Check the output of your program using the following command.

```
python3 q0p1.py < input_q0p1.txt
```

Make sure that all these files are on your [Desktop](#).

7. Submit the solutions only if you are confident with it. **You can submit a solution only once.** Use the following command for submission.

```
/nfscommon/common/prafullkumar/submit q0p1.py
```

8. Please confirm with the instruction whether your submission is successful or not.

9. Use the following command to change your default password.

```
passwd
```

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