HW1 Report

碰到的問題 & 程式跑完之截圖

Problem Encountered

- With Bisection Method, my code seems to not be able to find a correct root

Approach

- Hence, I tried to draw the function by computing and printing its y-values every 0.005 interval

```
f(0): 2
f(0.005): 0.754891
f(0.01): 0.0104839
f(0.015): -0.249427
f(0.02): -0.0374141
f(0.025): 0.631709
f(0.03): 1.74575
```

- As shown here: the function was initially positive at x=0, goes down to negative, then climbs back up to positive and stays positive → two roots!
- Most importantly, the roots are very near x=0!

Conclusion

- After drawing out the function, I figured out what the problem was: The initial low/high range was not optimally set.
- Since the roots were very near x=0, `mid` obtain from `mid=(low+high)/2` results in `f(low)`, `f(mid)`, and `f(high)` all greater than 0 → cannot determine where root is (or if there even is a root!)
- In conclusion, Bisection Method may fail if range not optimally set
- After experimenting around with different ranges, here are the roots obtained from Bisection Method:

```
=== Bisection Method ===
IRR_1: 0.0101367
IRR_2: 0.0204492
```

Newton Method 驗證結果

- With Newton’s Method, after experimenting around with several staring points, the method converges to these two roots

```
=== Bisection Method ===
IRR_1: 0.0101367
IRR_2: 0.0204492
=== Newton's Method ===
IRR_1: 0.0101022
IRR_2: 0.0204106
```

  - As shown here, both roots found from Bisection and Newton’s method are very close

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解釋兩者差別

Bisection Method

- Iteratively bracken the root until satisfactory interval error
- However, it needs an initial range where the function changes sign → brackens root

Newton’s Method

- Iteratively use the derivative of the function to approximate the root: Xn+1 = Xn - f(Xn) / f'(Xn)

- Does not face the initial range problem of the Bisection Method. However, this method is quite sensitive to initial guess of starting point. If not close to root, may overshoot and diverge

→ We can see the importance of initial guesses on both methods!