**Exercise 9A and 9B**

**Approach:**

**Abstract base class:** Base options which forces the contract with the derived classes to implement the pure virtual functionalities

Both the EuropeanOption and Perpetual American inherit from Option.

Private data: Both EuropenOption and Perpetual American options have private data as well core calculating function as private ensuring encapsulation.

The MatrixPricer is an template and when has Option object as data(Composition)

The Global function Global functions to create meshes

**Results: All the results are reproducible and the associated**

**code for the results is in the main()**

1.

1. Call Price for batch\_1 is: 2.13337
2. Call Price for batch\_2 is: 7.96557
3. Call Price for batch\_3 is: 0.204058
4. Call Price for batch\_4 is: 92.1757
5. Put Price for batch\_1 is: 5.84628
6. Put Price for batch\_2 is: 7.96557
7. Put Price for batch\_3 is: 4.07326
8. Put Price for batch\_4 is: 1.2475

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### Part of Option Sensitivities aka Greeks

1. Call Delta for batch\_1 is: 0.372483
2. Call Delta for batch\_2 is: 0.539828
3. Call Delta for batch\_3 is: 0.185048
4. Call Delta for batch\_4 is: 0.988761
5. Call Gamma for batch\_1 is: 0.0420428
6. Call Gamma for batch\_2 is: 0.0198476
7. Call Gamma for batch\_3 is: 0.106789
8. Call Gamma for batch\_4 is: 0.000179578
9. Call Vega for batch\_1 is: 11.3515
10. Call Vega for batch\_2 is: 39.6953
11. Call Vega for batch\_3 is: 1.33486
12. Call Vega for batch\_4 is: 16.162
13. Call Theta for batch\_1 is: -8.42817
14. Call Theta for batch\_2 is: -3.96953
15. Call Theta for batch\_3 is: -0.420257
16. Call Theta for batch\_4 is: -0.616838
17. Put Delta for batch\_1 is: -0.627517
18. Put Delta for batch\_2 is: -0.460172
19. Put Delta for batch\_3 is: -0.814952
20. Put Delta for batch\_4 is: -0.0112394
21. Put Gamma for batch\_1 is: 0.0420428
22. Put Gamma for batch\_2 is: 0.0198476
23. Put Gamma for batch\_3 is: 0.106789
24. Put Gamma for batch\_4 is: 0.000179578
25. Put Vega for batch\_1 is: 11.3515
26. Put Vega for batch\_2 is: 39.6953
27. Put Vega for batch\_3 is: 1.33486
28. Put Vega for batch\_4 is: 16.162
29. Put Theta for batch\_1 is: -3.33114
30. Put Theta for batch\_2 is: -3.96953
31. Put Theta for batch\_3 is: 0.644047
32. Put Theta for batch\_4 is: 0.108905
33. Put Price with parity is: 5.84628
34. The Result of the Parity Check is: Call Put Difference:-3.71291
35. The Result of the Parity Check is: Parity Value:-3.71291

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### Part of Option Sensitivities for Futures options aka Greeks

1. Call Future Options Gamma Test: 0.0134936
2. Call Future Options Delta Test: 0.594629
3. Put Future Options Gamma Test: 0.0134936
4. Put Future Options Delta Test: -0.356601

The Delta with Matrix input for Multiple Options is: **C and D**

0.372483

0.539828

## **Divided differences(d)---- Options sensitivities**

Diff Delta is: 0.372619

Diff Gamma is: 0.0419997

## **Matrix Pricer Results**

European options

The Price with Monotonically Increasing Spot is:

2.13337

2.52699

2.96317

3.44196

3.96293

4.5252

The Price with Matrix input for Multiple Options is:

2.13337

7.96557

## **Section: Perpetual American Options a & b**

Price of Perpetual American Call option is: 18.5035

Price of Perpetual American Put Option is: 3.03106

## **Section: Matrix Pricing Perpetual American options c&d**

No Mesh

Price of the first and second option in the matrix is: 18.5035, 18.5035

Mesh:

Price of the first and second option in the matrix is: 13.6174, 14.0603

## **Section: Matrix Sensitivities European options c& d part of pricing**

**The Delta with Monotonically Increasing Spot is:**

0.372483

0.414849

0.457519

0.499993

0.541801

0.582516