Output:

A1

(a)

```
Batch 1: C= 2.13337,P= 5.84628
Batch 2: C= 7.96557,P= 7.96557
Batch 3: C= 0.204058,P= 4.07326
Batch 4: C= 92.1757,P= 1.2475
```

(b)

```
check the put-call parity for Batch 1 (1:True, 0:False)
1
calculate the option price by put-call parity for Batch 1
C= 2.13337,P= 5.84628
```

(c) T = 0.25, K = 65, sig = 0.30, r = 0.08

```
variation of S (from 10 to 100, interval=5)
C= 7.792e-36,P= 53.7129
C= 1.24529e-22,P= 48.7129
C= 3.76503e-15,P= 43.7129
C= 2.0405e-10,P= 38.7129
C= 3.11926e-07,P= 33.7129
C= 5.19359e-05,P= 28.713
C= 0.00199417,P= 23.7149
C= 0.0278174,P= 18.7407
C= 0.189181,P= 13.9021
C= 0.76652,P= 9.47943
C= 2.13337,P= 5.84628
C= 4.5252,P= 3.23811
C= 7.90027,P= 1.61319
C= 12.0153,P= 0.728169
C= 16.5879,P= 0.300857
C= 21.4021,P= 0.115044
C= 26.3282,P= 0.0411543
C= 31.301,P= 0.0139094
C= 36.2916,P= 0.00448099
```

(d) T = 0.25, K = 65, sig = 0.30, r = 0.08, S = 60

```
variation of T (from 0.1 to 1, interval=0.1)
C= 35.5179,P= 2.8421e-06
C= 36.0329,P= 0.0012151
C= 36.5525,P= 0.0110657
C= 37.0833,P= 0.0362458
C= 37.6259,P= 0.0771867
C= 38.1775,P= 0.131211
C= 38.735,P= 0.195039
C= 39.2954,P= 0.265729
C= 39.8564,P= 0.340906
C= 40.4162,P= 0.418731
variation of K (from 10 to 100, interval=10)
C= 90.7688,P= 1.09641e-15
C= 81.5377,P= 1.91228e-08
C= 72.3065,P= 3.11436e-05
C= 63.0775,P= 0.00212087
C= 53.876,P= 0.0317788
C= 44.8169,P= 0.203875
C= 36.157,P= 0.77519
C= 28.2411,P= 2.09039
C= 21.372,P= 4.45244
C= 15.7113,P= 8.02295
variation of sigma (from 0.1 to 1, interval=0.1)
C= 8.84245,P= 1.15409
C= 12.1058,P= 4.41747
C= 15.7113,P= 8.02295
C= 19.3864,P= 11.698
C= 23.0638,P= 15.3755
C= 26.7151,P= 19.0267
C= 30.323,P= 22.6346
C= 33.875,P= 26.1867
C= 37.3612,P= 29.6728
C= 40.7728,P= 33.0845
```

A2

(a)

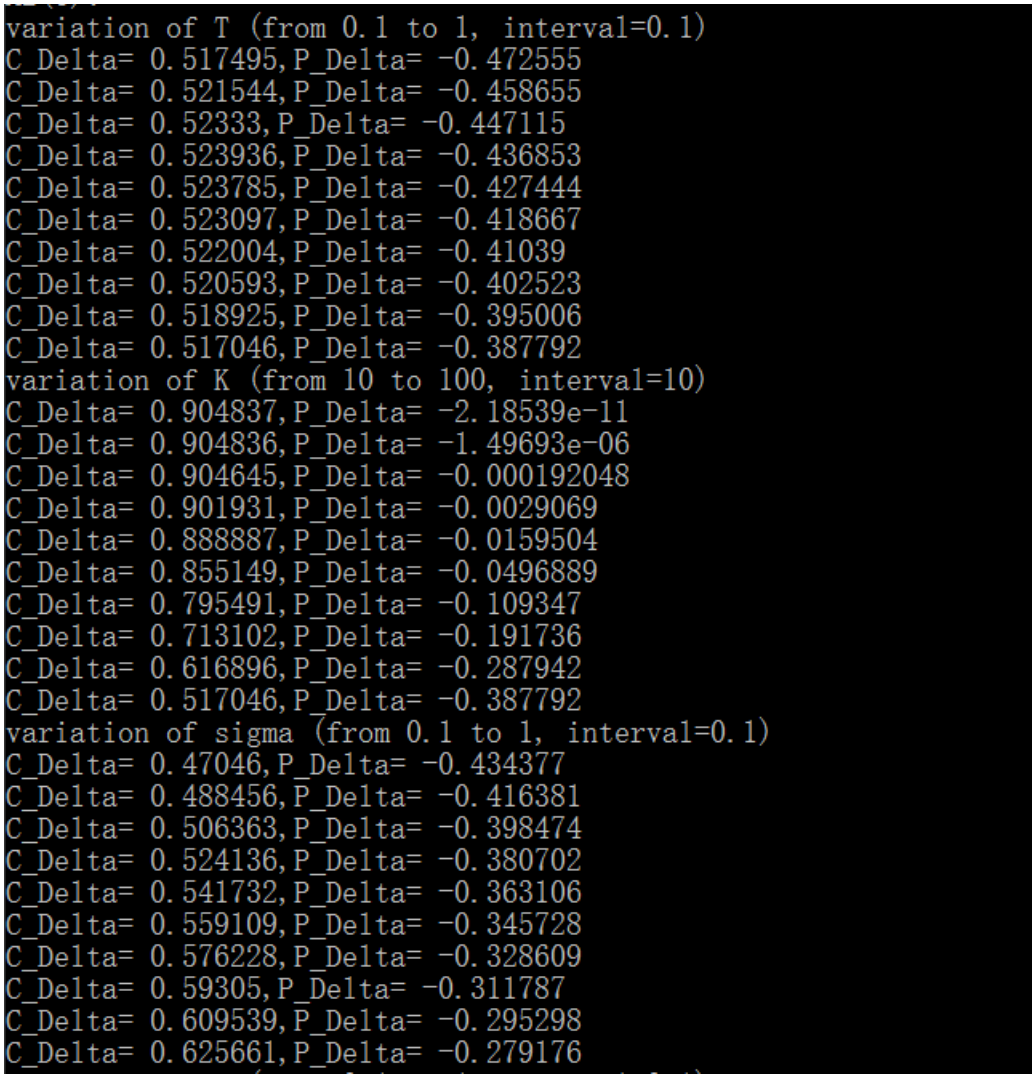
```
Batch 5: C= 0.594629,P= -0.356601
```

(b) K = 100, T = 0.5, r = 0.1, b = 0, sig = 0.36.

```
variation of S (from 10 to 100, interval=5)
C_Delta= 2.25551e-19,P_Delta= -0.951229
C_Delta= 1.1336e-13,P_Delta= -0.951229
C_Delta= 2.76878e-10,P_Delta= -0.951229
C_Delta= 4.97346e-08,P_Delta= -0.951229
C_Delta= 1.98667e-06,P_Delta= -0.951227
C_Delta= 3.05351e-05,P_Delta= -0.951199
C_Delta= 0.000245471,P_Delta= -0.950984
C_Delta= 0.00124435,P_Delta= -0.949985
C_Delta= 0.00449025,P_Delta= -0.946739
C_Delta= 0.012525,P_Delta= -0.938704
C_Delta= 0.028625,P_Delta= -0.922604
C_Delta= 0.0559246,P_Delta= -0.895305
C_Delta= 0.0964112,P_Delta= -0.854818
C_Delta= 0.150264,P_Delta= -0.800965
C_Delta= 0.215772,P_Delta= -0.735458
C_Delta= 0.289765,P_Delta= -0.661465
C_Delta= 0.368319,P_Delta= -0.58291
C_Delta= 0.447475,P_Delta= -0.503754
C_Delta= 0.523785,P_Delta= -0.427444
```

(c)

Delta: K = 100, S = 105, T = 0.5, r = 0.1, b = 0,sig = 0.36.



Gamma: K = 100, S = 105, T = 0.5, r = 0.1, b = 0,sig = 0.36.

```
variation of T (from 0.1 to 1, interval=0.1)
C_Gamma= 0.0176207,P_Gamma= 0.0176207
C_Gamma= 0.012898,P_Gamma= 0.012898
C_Gamma= 0.0107707,P_Gamma= 0.0107707
C_Gamma= 0.00948074,P_Gamma= 0.00948074
C_Gamma= 0.00858484,P_Gamma= 0.00858484
C_Gamma= 0.00791169,P_Gamma= 0.00791169
C_Gamma= 0.00737912,P_Gamma= 0.00737912
C_Gamma= 0.00694215,P_Gamma= 0.00694215
C_Gamma= 0.00657375,P_Gamma= 0.00657375
C_Gamma= 0.00625661,P_Gamma= 0.00625661
variation of K (from 10 to 100, interval=10)
C_Gamma= 0.00902544,P_Gamma= 0.00902544
C_Gamma= 0.00889045,P_Gamma= 0.00889045
C_Gamma= 0.0086485,P_Gamma= 0.0086485
C_Gamma= 0.00833948,P_Gamma= 0.00833948
C_Gamma= 0.00799509,P_Gamma= 0.00799509
C_Gamma= 0.00763638,P_Gamma= 0.00763638
C_Gamma= 0.00727659,P_Gamma= 0.00727659
C_Gamma= 0.00692385,P_Gamma= 0.00692385
C_Gamma= 0.00658297,P_Gamma= 0.00658297
C_Gamma= 0.00625661,P_Gamma= 0.00625661
variation of sigma (from 0.1 to 1, interval=0.1)
C_Gamma= 0.047046,P_Gamma= 0.047046
C_Gamma= 0.0244228,P_Gamma= 0.0244228
C_Gamma= 0.0168788,P_Gamma= 0.0168788
C_Gamma= 0.0131034,P_Gamma= 0.0131034
C_Gamma= 0.0108346,P_Gamma= 0.0108346
C_Gamma= 0.00931849,P_Gamma= 0.00931849
C_Gamma= 0.00823183,P_Gamma= 0.00823183
C_Gamma= 0.00741313,P_Gamma= 0.00741313
C_Gamma= 0.00677266,P_Gamma= 0.00677266
C_Gamma= 0.00625661,P_Gamma= 0.00625661
```

(d) K = 100, S = 105, T = 0.5, r = 0.1, b = 0,sig = 0.36.

```
variation of S (from 15 to 105, interval=10) and using divided differences approximationand h
= 0.01
C_Delta= 0.0734626,P_Delta= -0.831375
C_Delta= 0.169865,P_Delta= -0.734973
C_Delta= 0.263507,P_Delta= -0.64133
C_Delta= 0.346243,P_Delta= -0.558594
C_Delta= 0.417158,P_Delta= -0.487679
C_Delta= 0.477385,P_Delta= -0.427453
C_Delta= 0.528489,P_Delta= -0.376349
C_Delta= 0.571968,P_Delta= -0.332869
C_Delta= 0.609117,P_Delta= -0.29572
C_Delta= 0.64101,P_Delta= -0.263828
variation of S (from 15 to 105, interval=10) and using divided differences approximationand h
= 0.001
C_Gamma= 0.00906839,P_Gamma= 0.00906839
C_Gamma= 0.00974917,P_Gamma= 0.00974917
C_Gamma= 0.00886682,P_Gamma= 0.00886682
C_Gamma= 0.00767218,P_Gamma= 0.00767218
C_Gamma= 0.00653189,P_Gamma= 0.00653189
C_Gamma= 0.00554022,P_Gamma= 0.00554022
C_Gamma= 0.00470576,P_Gamma= 0.00470576
C_Gamma= 0.00401172,P_Gamma= 0.00401172
C_Gamma= 0.00343586,P_Gamma= 0.00343586
C_Gamma= 0.00295729,P_Gamma= 0.00295729
```

B

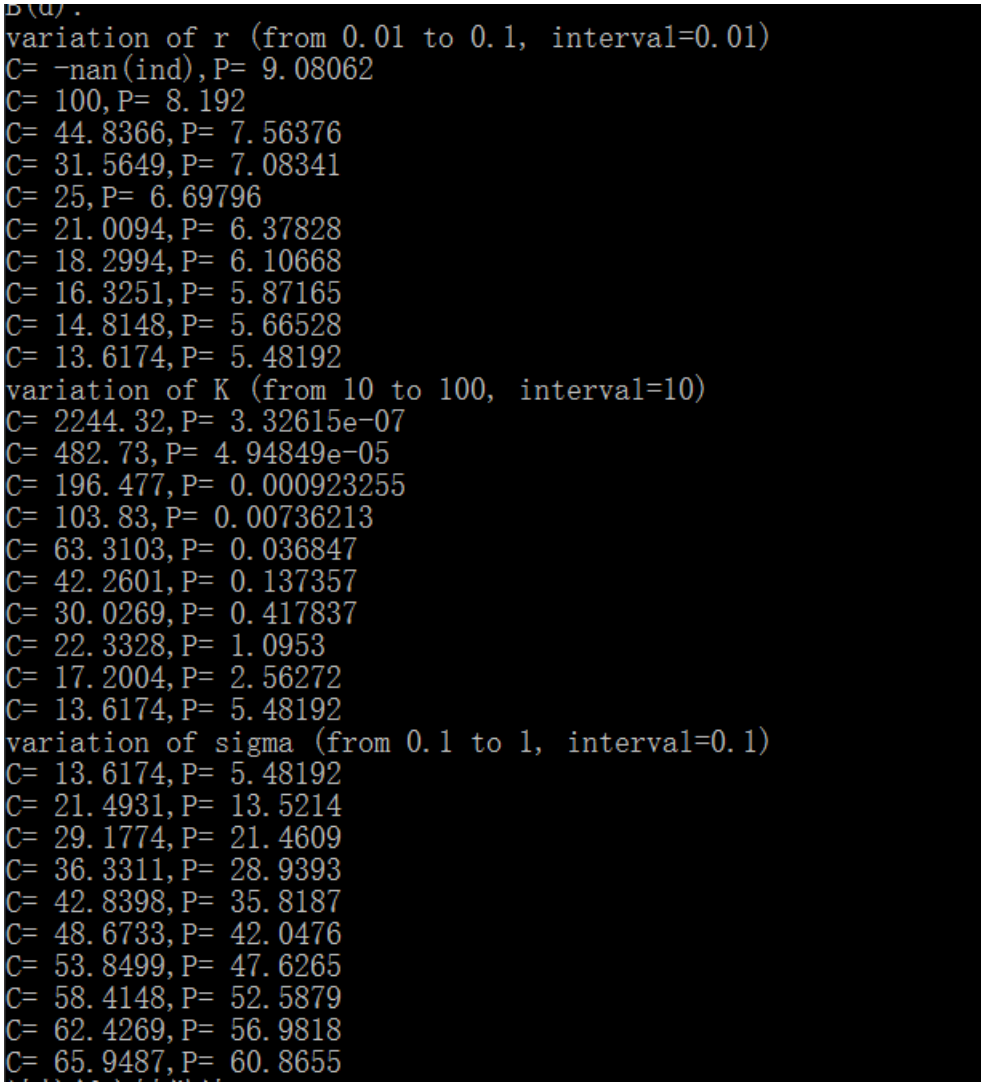
(b)

```
Batch 6: C= 18.5035,P= 3.03106
```

(c) K = 100, sig = 0.1, r = 0.1, b = 0.02, S = 110

```
variation of S (from 10 to 100, interval=5)
C= 0.00826235,P= 9.03489e+06
C= 0.03045,P= 726383
C= 0.076827,P= 121457
C= 0.157497,P= 30334.3
C= 0.283138,P= 9764.83
C= 0.464906,P= 3745.05
C= 0.714373,P= 1632.76
C= 1.04347,P= 785.068
C= 1.46448,P= 407.787
C= 1.98995,P= 225.473
C= 2.63274,P= 131.27
C= 3.40595,P= 79.8084
C= 4.32291,P= 50.345
C= 5.39718,P= 32.785
C= 6.64256,P= 21.9493
C= 8.07301,P= 15.0569
C= 9.7027,P= 10.5537
C= 11.546,P= 7.54093
C= 13.6174,P= 5.48192
```

(d) K = 100, sig = 0.1, r = 0.1, b = 0.02, S = 110



Justifications for design decisions

In Group A and B, there are two kinds of options, so I build two classes for each of them. For each class, I build the functions, such as computation of option and Greek (with single or multiple parameter input), for the requirement of the assignment.

Also, owing to the requirement of mesh array, I build two global functions for each of class.