Test Results:

\*\*\*European options\*\*\*

Batch 1:

Call: 2.13337

Put: 5.84628

Call calculated by parity: 2.13337

Put calculated by parity: 5.84628

Call and Put option prices match? Yes

Batch 2:

Call: 7.96557

Put: 7.96557

Call calculated by parity: 7.96557

Put calculated by parity: 7.96557

Call and Put option prices match? Yes

Batch 3:

Call: 0.204058

Put: 4.07326

Call calculated by parity: 0.204058

Put calculated by parity: 4.07326

Call and Put option prices match? Yes

Batch 4:

Call: 92.1757

Put: 1.2475

Call calculated by parity: 92.1757

Put calculated by parity: 1.2475

Call and Put option prices match? Yes

Batch 1

S=60; Call Price: 2.13337;Put Price: 5.84628

S=61; Call Price: 2.52699;Put Price: 5.2399

S=62; Call Price: 2.96317;Put Price: 4.67608

S=63; Call Price: 3.44196;Put Price: 4.15487

S=64; Call Price: 3.96293;Put Price: 3.67584

S=65; Call Price: 4.5252;Put Price: 3.23811

S=66; Call Price: 5.12747;Put Price: 2.84039

S=67; Call Price: 5.76813;Put Price: 2.48104

S=68; Call Price: 6.44526;Put Price: 2.15817

S=69; Call Price: 7.15673;Put Price: 1.86965

T K sig r S b C P

0.25 65 0.3 0.08 60 0.08 2.133 5.846

0.25 65 0.3 0.08 61 0.08 2.527 5.24

0.25 65 0.3 0.08 62 0.08 2.963 4.676

0.25 65 0.3 0.08 63 0.08 3.442 4.155

0.25 65 0.3 0.08 64 0.08 3.963 3.676

0.25 65 0.3 0.08 65 0.08 4.525 3.238

0.25 65 0.3 0.08 66 0.08 5.127 2.84

0.25 65 0.3 0.08 67 0.08 5.768 2.481

0.25 65 0.3 0.08 68 0.08 6.445 2.158

0.25 65 0.3 0.08 69 0.08 7.157 1.87

Test of Option Sensitivities

Delta Call: 0.594629

Delta Put: -0.356601

Vector Output

S=60; Call Delta: 0.594629;Put Delta: -0.356601

S=61; Call Delta: 0.607976;Put Delta: -0.343253

S=62; Call Delta: 0.621025;Put Delta: -0.330205

S=63; Call Delta: 0.633767;Put Delta: -0.317463

S=64; Call Delta: 0.646196;Put Delta: -0.305034

S=65; Call Delta: 0.658306;Put Delta: -0.292923

S=66; Call Delta: 0.670094;Put Delta: -0.281135

S=67; Call Delta: 0.681556;Put Delta: -0.269673

S=68; Call Delta: 0.692691;Put Delta: -0.258539

S=69; Call Delta: 0.703497;Put Delta: -0.247733

Matrix Output

T K sig r S b Delta\_C Delta\_P Gamma\_C Gamma\_P

0.5 100 0.36 0.1 105 0 0.5946 -0.3566 0.01349 0.01349

0.5 100 0.36 0.1 106 0 0.608 -0.3433 0.0132 0.0132

0.5 100 0.36 0.1 107 0 0.621 -0.3302 0.0129 0.0129

0.5 100 0.36 0.1 108 0 0.6338 -0.3175 0.01259 0.01259

0.5 100 0.36 0.1 109 0 0.6462 -0.305 0.01227 0.01227

0.5 100 0.36 0.1 110 0 0.6583 -0.2929 0.01195 0.01195

0.5 100 0.36 0.1 111 0 0.6701 -0.2811 0.01163 0.01163

0.5 100 0.36 0.1 112 0 0.6816 -0.2697 0.0113 0.0113

0.5 100 0.36 0.1 113 0 0.6927 -0.2585 0.01097 0.01097

0.5 100 0.36 0.1 114 0 0.7035 -0.2477 0.01064 0.01064

Using divided difference

Delta Call (Using divided difference): 0.594628

Absolute difference with exact solution: 4.82543e-07

Relative difference with exact solution: 8.11503e-07

Delta Put (Using divided difference): -0.356601

Absolute difference with exact solution: 4.82543e-07

Relative difference with exact solution: 1.35317e-06

\*\*\*American options\*\*\*

Test batch

Call Price: 18.5035

Put Price: 3.03106

Vector Output

S=110; Call Price: 18.5035;Put Price: 3.03106

S=111; Call Price: 19.0501;Put Price: 2.86523

S=112; Call Price: 19.6078;Put Price: 2.70985

S=113; Call Price: 20.1765;Put Price: 2.56416

S=114; Call Price: 20.7566;Put Price: 2.42748

S=115; Call Price: 21.3481;Put Price: 2.29919

S=116; Call Price: 21.951;Put Price: 2.1787

S=117; Call Price: 22.5656;Put Price: 2.06548

S=118; Call Price: 23.192;Put Price: 1.95904

S=119; Call Price: 23.8302;Put Price: 1.85891

Matrix Output

K sig r S b C P

100 0.1 0.1 110 0.02 18.5 3.031

100 0.1 0.1 111 0.02 19.05 2.865

100 0.1 0.1 112 0.02 19.61 2.71

100 0.1 0.1 113 0.02 20.18 2.564

100 0.1 0.1 114 0.02 20.76 2.427

100 0.1 0.1 115 0.02 21.35 2.299

100 0.1 0.1 116 0.02 21.95 2.179

100 0.1 0.1 117 0.02 22.57 2.065

100 0.1 0.1 118 0.02 23.19 1.959

100 0.1 0.1 119 0.02 23.83 1.859

Analysis:

In this program, I am using a class for European options and a class for American options. I have implemented the functionalities required in the assignment.

It should be noted that I am using member functions rather than global functions to do the vector or matrix output, since it requires less parameters for input.