**======Report of Level 9A and Level9B======**

**Jiayuan Li**

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**======Implementation======**

1. Structure of the project

|options.h // base class of options, virtual class

|options.cpp // implementation of option class

|European.h // European option class

|European.cpp // implementation of European class

|American.h // American option class

|American.cpp // implementation of American class

|utils.h // helper functions dealing with matrix and vector (i.e. matrix pricing, printing)

|utils.cpp // implementation of helper functions

|main.cpp // test case

2. Detailed Implementation

**Class Options**

Contains T, K, sig, r, S, C, P, b, delta\_c, delta\_p, gamma\_c, gamma\_p as protected member variables.

Public functions:

Getter functions

Protected functions:

virtual void calculate\_C() = 0; // pure virtual function

virtual void calculate\_P() = 0; // pure virtual function

virtual void calculate\_b() = 0; // pure virtual function

virtual void calculate\_delta() = 0; // pure virtual function

virtual void calculate\_gamma() = 0; // pure virtual function

**Class European: public Options**

Contains isfuture, m\_d1, m\_d2, m\_parity\_helper as private member variables.

Public:

virtual double C(double P); // getter using parity (overload)

virtual double P(double C); // getter using parity (overload)

virtual bool is\_parity(double P, double C); // check for parity

virtual double Numeric\_Delta(double h, bool put = false); // approximation for A.2.D

virtual double Numeric\_Gamma(double h, bool put = false); // approximation for A.2.D

Private:

virtual void calculate\_b(); // update b

virtual void calculate\_C(); // update Call price

virtual void calculate\_P(); // update Put price

virtual void calculate\_d(); // update d1 and d2

virtual void calculate\_delta(); // calculate Greek delta

virtual void calculate\_gamma(); // calculate Greek gamma

**Class American: public Options**

Contains m\_y1, m\_y2, as private member variables.

Public:

Getter functions

Private:

virtual void calculate\_b() // not implemented

virtual void calculate\_C(); // update Call price

virtual void calculate\_P(); // update Put price

virtual void calculate\_y(); // update y1 and y2

virtual void calculate\_delta(); // not implemented

virtual void calculate\_gamma(); // not implemented

**utils.h**

// helper function for Group A Part C

vector<double> generate\_array(double start, double end, double mesh\_size);

// helper function for Group A Part D: generate input matrix

vector<vector<double>> generate\_matrix(vector<double> start, vector<double> end, vector<double> mesh\_size);

// helper function for Group A Part D: given an matrix and calculate price

vector<vector<double>> pricing\_matrix(vector<vector<double>> input, unsigned mode = 0);

// helper function for Group A Part D: print the result out

void print\_matrix(vector<vector<double>> input, unsigned mode = 0);

**======Output of each question======**

--------Group A ---- part 1(a)--------

Batch 1:

Call Price: 2.13337, Put Price: 5.84628

Batch 2:

Call Price: 7.96557, Put Price: 7.96557

Batch 3:

Call Price: 0.204058, Put Price: 4.07326

Batch 4:

Call Price: 92.1757, Put Price: 1.2475

--------Group A ---- part 1(b)--------

Batch 1:

Call Price: 2.13337, Put Price: 5.84628

Satisfy Parity? (correct data): 1

Satisfy Parity? (wrong data): 1

Batch 2:

Call Price: 7.96557, Put Price: 7.96557

Satisfy Parity? (correct data): 1

Satisfy Parity? (wrong data): 0

Batch 3:

Call Price: 0.204058, Put Price: 4.07326

Satisfy Parity? (correct data): 1

Satisfy Parity? (wrong data): 0

Batch 4:

Call Price: 92.1757, Put Price: 1.2475

Satisfy Parity? (correct data): 1

Satisfy Parity? (wrong data): 0

--------Group A ---- part 1(c)--------

**Price as a function of S**

**(T=0.25,K=65,sig=0.3,r=0.08)**

S = 10, C = 7.792e-36, P = 53.7129

S = 11, C = 1.88964e-32, P = 52.7129

S = 12, C = 1.64204e-29, P = 51.7129

S = 13, C = 6.19303e-27, P = 50.7129

S = 14, C = 1.17207e-24, P = 49.7129

S = 15, C = 1.24529e-22, P = 48.7129

S = 16, C = 8.11387e-21, P = 47.7129

S = 17, C = 3.47944e-19, P = 46.7129

S = 18, C = 1.03991e-17, P = 45.7129

S = 19, C = 2.27042e-16, P = 44.7129

S = 20, C = 3.76503e-15, P = 43.7129

S = 21, C = 4.89964e-14, P = 42.7129

S = 22, C = 5.1436e-13, P = 41.7129

S = 23, C = 4.45934e-12, P = 40.7129

S = 24, C = 3.25772e-11, P = 39.7129

S = 25, C = 2.0405e-10, P = 38.7129

S = 26, C = 1.11246e-09, P = 37.7129

S = 27, C = 5.34891e-09, P = 36.7129

S = 28, C = 2.29454e-08, P = 35.7129

S = 29, C = 8.8713e-08, P = 34.7129

S = 30, C = 3.11926e-07, P = 33.7129

S = 31, C = 1.00545e-06, P = 32.7129

S = 32, C = 2.99241e-06, P = 31.7129

S = 33, C = 8.27565e-06, P = 30.7129

S = 34, C = 2.13896e-05, P = 29.7129

S = 35, C = 5.19359e-05, P = 28.713

S = 36, C = 0.000119024, P = 27.713

S = 37, C = 0.000258548, P = 26.7132

S = 38, C = 0.000534403, P = 25.7134

S = 39, C = 0.00105474, P = 24.714

S = 40, C = 0.00199417, P = 23.7149

S = 41, C = 0.00362244, P = 22.7165

S = 42, C = 0.00633924, P = 21.7193

S = 43, C = 0.010714, P = 20.7236

S = 44, C = 0.0175282, P = 19.7304

S = 45, C = 0.0278174, P = 18.7407

S = 46, C = 0.0429083, P = 17.7558

S = 47, C = 0.0644467, P = 16.7774

S = 48, C = 0.0944125, P = 15.8073

S = 49, C = 0.135117, P = 14.848

S = 50, C = 0.189181, P = 13.9021

--------Group A ---- part 1(d)--------

**Price as a function of T**

T:0.25,K:10,sig:0.05,R:0,S:10

Call Price:0.099733, Put Price:0.099733

T:0.5,K:10,sig:0.05,R:0,S:10

Call Price:0.14104, Put Price:0.14104

T:0.75,K:10,sig:0.05,R:0,S:10

Call Price:0.172734, Put Price:0.172734

T:1,K:10,sig:0.05,R:0,S:10

Call Price:0.19945, Put Price:0.19945

T:1.25,K:10,sig:0.05,R:0,S:10

Call Price:0.222986, Put Price:0.222986

T:1.5,K:10,sig:0.05,R:0,S:10

Call Price:0.244263, Put Price:0.244263

T:1.75,K:10,sig:0.05,R:0,S:10

Call Price:0.263827, Put Price:0.263827

T:2,K:10,sig:0.05,R:0,S:10

Call Price:0.282036, Put Price:0.282036

T:2.25,K:10,sig:0.05,R:0,S:10

Call Price:0.299137, Put Price:0.299137

T:2.5,K:10,sig:0.05,R:0,S:10

Call Price:0.315309, Put Price:0.315309

T:2.75,K:10,sig:0.05,R:0,S:10

Call Price:0.330691, Put Price:0.330691

T:3,K:10,sig:0.05,R:0,S:10

Call Price:0.345386, Put Price:0.345386

T:3.25,K:10,sig:0.05,R:0,S:10

Call Price:0.35948, Put Price:0.35948

T:3.5,K:10,sig:0.05,R:0,S:10

Call Price:0.37304, Put Price:0.37304

T:3.75,K:10,sig:0.05,R:0,S:10

Call Price:0.386123, Put Price:0.386123

T:4,K:10,sig:0.05,R:0,S:10

Call Price:0.398776, Put Price:0.398776

T:4.25,K:10,sig:0.05,R:0,S:10

Call Price:0.411038, Put Price:0.411038

T:4.5,K:10,sig:0.05,R:0,S:10

Call Price:0.422944, Put Price:0.422944

T:4.75,K:10,sig:0.05,R:0,S:10

Call Price:0.434522, Put Price:0.434522

T:5,K:10,sig:0.05,R:0,S:10

Call Price:0.445799, Put Price:0.445799

**Price as a function of K**

T:0.25,K:10,sig:0.05,R:0,S:10

Call Price:0.099733, Put Price:0.099733

T:0.25,K:14,sig:0.05,R:0,S:10

Call Price:2.96744e-43, Put Price:4

T:0.25,K:18,sig:0.05,R:0,S:10

Call Price:2.21274e-124, Put Price:8

T:0.25,K:22,sig:0.05,R:0,S:10

Call Price:1.5223e-220, Put Price:12

T:0.25,K:26,sig:0.05,R:0,S:10

Call Price:7.90505e-322, Put Price:16

T:0.25,K:30,sig:0.05,R:0,S:10

Call Price:0, Put Price:20

T:0.25,K:34,sig:0.05,R:0,S:10

Call Price:0, Put Price:24

T:0.25,K:38,sig:0.05,R:0,S:10

Call Price:0, Put Price:28

T:0.25,K:42,sig:0.05,R:0,S:10

Call Price:0, Put Price:32

T:0.25,K:46,sig:0.05,R:0,S:10

Call Price:0, Put Price:36

T:0.25,K:50,sig:0.05,R:0,S:10

Call Price:0, Put Price:40

T:0.25,K:54,sig:0.05,R:0,S:10

Call Price:0, Put Price:44

T:0.25,K:58,sig:0.05,R:0,S:10

Call Price:0, Put Price:48

T:0.25,K:62,sig:0.05,R:0,S:10

Call Price:0, Put Price:52

T:0.25,K:66,sig:0.05,R:0,S:10

Call Price:0, Put Price:56

T:0.25,K:70,sig:0.05,R:0,S:10

Call Price:0, Put Price:60

T:0.25,K:74,sig:0.05,R:0,S:10

Call Price:0, Put Price:64

T:0.25,K:78,sig:0.05,R:0,S:10

Call Price:0, Put Price:68

T:0.25,K:82,sig:0.05,R:0,S:10

Call Price:0, Put Price:72

T:0.25,K:86,sig:0.05,R:0,S:10

Call Price:0, Put Price:76

T:0.25,K:90,sig:0.05,R:0,S:10

Call Price:0, Put Price:80

**Price as a function of sig**

T:0.25,K:10,sig:0.05,R:0,S:10

Call Price:0.099733, Put Price:0.099733

T:0.25,K:10,sig:0.1,R:0,S:10

Call Price:0.19945, Put Price:0.19945

T:0.25,K:10,sig:0.15,R:0,S:10

Call Price:0.299137, Put Price:0.299137

T:0.25,K:10,sig:0.2,R:0,S:10

Call Price:0.398776, Put Price:0.398776

T:0.25,K:10,sig:0.25,R:0,S:10

Call Price:0.498353, Put Price:0.498353

T:0.25,K:10,sig:0.3,R:0,S:10

Call Price:0.597853, Put Price:0.597853

T:0.25,K:10,sig:0.35,R:0,S:10

Call Price:0.697259, Put Price:0.697259

T:0.25,K:10,sig:0.4,R:0,S:10

Call Price:0.796557, Put Price:0.796557

T:0.25,K:10,sig:0.45,R:0,S:10

Call Price:0.89573, Put Price:0.89573

T:0.25,K:10,sig:0.5,R:0,S:10

Call Price:0.994764, Put Price:0.994764

T:0.25,K:10,sig:0.55,R:0,S:10

Call Price:1.09364, Put Price:1.09364

T:0.25,K:10,sig:0.6,R:0,S:10

Call Price:1.19235, Put Price:1.19235

T:0.25,K:10,sig:0.65,R:0,S:10

Call Price:1.29088, Put Price:1.29088

T:0.25,K:10,sig:0.7,R:0,S:10

Call Price:1.3892, Put Price:1.3892

T:0.25,K:10,sig:0.75,R:0,S:10

Call Price:1.48731, Put Price:1.48731

T:0.25,K:10,sig:0.8,R:0,S:10

Call Price:1.58519, Put Price:1.58519

T:0.25,K:10,sig:0.85,R:0,S:10

Call Price:1.68283, Put Price:1.68283

T:0.25,K:10,sig:0.9,R:0,S:10

Call Price:1.78021, Put Price:1.78021

T:0.25,K:10,sig:0.95,R:0,S:10

Call Price:1.87731, Put Price:1.87731

**Price as a function of R**

T:0.25,K:10,sig:0.05,R:0,S:10

Call Price:0.099733, Put Price:0.099733

T:0.25,K:10,sig:0.05,R:0.05,S:10

Call Price:0.173361, Put Price:0.0491391

T:0.25,K:10,sig:0.05,R:0.1,S:10

Call Price:0.26747, Put Price:0.0205691

T:0.25,K:10,sig:0.05,R:0.15,S:10

Call Price:0.375246, Put Price:0.0071902

T:0.25,K:10,sig:0.05,R:0.2,S:10

Call Price:0.489776, Put Price:0.00207014

T:0.25,K:10,sig:0.05,R:0.25,S:10

Call Price:0.606355, Put Price:0.000485588

T:0.25,K:10,sig:0.05,R:0.3,S:10

Call Price:0.722657, Put Price:9.2016e-05

T:0.25,K:10,sig:0.05,R:0.35,S:10

Call Price:0.837825, Put Price:1.39934e-05

T:0.25,K:10,sig:0.05,R:0.4,S:10

Call Price:0.951628, Put Price:1.69907e-06

T:0.25,K:10,sig:0.05,R:0.45,S:10

Call Price:1.06403, Put Price:1.64048e-07

T:0.25,K:10,sig:0.05,R:0.5,S:10

Call Price:1.17503, Put Price:1.25547e-08

T:0.25,K:10,sig:0.05,R:0.55,S:10

Call Price:1.28466, Put Price:7.5963e-10

T:0.25,K:10,sig:0.05,R:0.6,S:10

Call Price:1.39292, Put Price:3.62621e-11

T:0.25,K:10,sig:0.05,R:0.65,S:10

Call Price:1.49984, Put Price:1.36339e-12

T:0.25,K:10,sig:0.05,R:0.7,S:10

Call Price:1.60543, Put Price:4.03181e-14

T:0.25,K:10,sig:0.05,R:0.75,S:10

Call Price:1.70971, Put Price:9.36657e-16

T:0.25,K:10,sig:0.05,R:0.8,S:10

Call Price:1.81269, Put Price:1.70781e-17

T:0.25,K:10,sig:0.05,R:0.85,S:10

Call Price:1.9144, Put Price:2.44184e-19

T:0.25,K:10,sig:0.05,R:0.9,S:10

Call Price:2.01484, Put Price:2.73594e-21

T:0.25,K:10,sig:0.05,R:0.95,S:10

Call Price:2.11403, Put Price:2.40074e-23

T:0.25,K:10,sig:0.05,R:1,S:10

Call Price:2.21199, Put Price:1.64894e-25

**Price as a function of S**

T:0.25,K:10,sig:0.05,R:0,S:10

Call Price:0.099733, Put Price:0.099733

T:0.25,K:10,sig:0.05,R:0,S:30

Call Price:20, Put Price:0

T:0.25,K:10,sig:0.05,R:0,S:50

Call Price:40, Put Price:0

T:0.25,K:10,sig:0.05,R:0,S:70

Call Price:60, Put Price:0

T:0.25,K:10,sig:0.05,R:0,S:90

Call Price:80, Put Price:0

--------Group A ---- part 2(a)--------

Gamma for Call: 0.0134936, Gamma for Put: 0.0134936

Delta for Call: 0.594629, Delta for Put: -0.356601

--------Group A ---- part 2(b)--------

**Delta under different S**

(T=0.25,K=65,sig=0.3,r=0.08)

S = 10, Call Delta = 2.25551e-19, Put Delta = -0.951229

S = 11, Call Delta = 6.18174e-18, Put Delta = -0.951229

S = 12, Call Delta = 1.12536e-16, Put Delta = -0.951229

S = 13, Call Delta = 1.46673e-15, Put Delta = -0.951229

S = 14, Call Delta = 1.44882e-14, Put Delta = -0.951229

S = 15, Call Delta = 1.1336e-13, Put Delta = -0.951229

S = 16, Call Delta = 7.27491e-13, Put Delta = -0.951229

S = 17, Call Delta = 3.93787e-12, Put Delta = -0.951229

S = 18, Call Delta = 1.83921e-11, Put Delta = -0.951229

S = 19, Call Delta = 7.55191e-11, Put Delta = -0.951229

S = 20, Call Delta = 2.76878e-10, Put Delta = -0.951229

S = 21, Call Delta = 9.18317e-10, Put Delta = -0.951229

S = 22, Call Delta = 2.78591e-09, Put Delta = -0.951229

S = 23, Call Delta = 7.80377e-09, Put Delta = -0.951229

S = 24, Call Delta = 2.0348e-08, Put Delta = -0.951229

S = 25, Call Delta = 4.97346e-08, Put Delta = -0.951229

S = 26, Call Delta = 1.14647e-07, Put Delta = -0.951229

S = 27, Call Delta = 2.50577e-07, Put Delta = -0.951229

S = 28, Call Delta = 5.21714e-07, Put Delta = -0.951229

S = 29, Call Delta = 1.03903e-06, Put Delta = -0.951228

S = 30, Call Delta = 1.98667e-06, Put Delta = -0.951227

S = 31, Call Delta = 3.65877e-06, Put Delta = -0.951226

S = 32, Call Delta = 6.5092e-06, Put Delta = -0.951223

S = 33, Call Delta = 1.1216e-05, Put Delta = -0.951218

S = 34, Call Delta = 1.87624e-05, Put Delta = -0.951211

S = 35, Call Delta = 3.05351e-05, Put Delta = -0.951199

S = 36, Call Delta = 4.84406e-05, Put Delta = -0.951181

S = 37, Call Delta = 7.50367e-05, Put Delta = -0.951154

S = 38, Call Delta = 0.00011368, Put Delta = -0.951116

S = 39, Call Delta = 0.000168682, Put Delta = -0.951061

S = 40, Call Delta = 0.000245471, Put Delta = -0.950984

S = 41, Call Delta = 0.000350761, Put Delta = -0.950879

S = 42, Call Delta = 0.000492699, Put Delta = -0.950737

S = 43, Call Delta = 0.000681019, Put Delta = -0.950548

S = 44, Call Delta = 0.000927157, Put Delta = -0.950302

S = 45, Call Delta = 0.00124435, Put Delta = -0.949985

S = 46, Call Delta = 0.00164771, Put Delta = -0.949582

S = 47, Call Delta = 0.00215423, Put Delta = -0.949075

S = 48, Call Delta = 0.00278276, Put Delta = -0.948447

S = 49, Call Delta = 0.00355398, Put Delta = -0.947675

S = 50, Call Delta = 0.00449025, Put Delta = -0.946739

--------Group A ---- part 2(c)--------

**Greek as a function of T**

T:0.5,K:100,sig:0.1,R:0.1,S:100

Call Delta:0.489029, Put Delta:-0.462201

T:1,K:100,sig:0.1,R:0.1,S:100

Call Delta:0.47046, Put Delta:-0.434377

T:1.5,K:100,sig:0.1,R:0.1,S:100

Call Delta:0.451368, Put Delta:-0.40934

T:2,K:100,sig:0.1,R:0.1,S:100

Call Delta:0.432442, Put Delta:-0.386289

T:2.5,K:100,sig:0.1,R:0.1,S:100

Call Delta:0.413938, Put Delta:-0.364863

T:3,K:100,sig:0.1,R:0.1,S:100

Call Delta:0.395972, Put Delta:-0.344846

T:3.5,K:100,sig:0.1,R:0.1,S:100

Call Delta:0.378603, Put Delta:-0.326085

T:4,K:100,sig:0.1,R:0.1,S:100

Call Delta:0.361857, Put Delta:-0.308463

T:4.5,K:100,sig:0.1,R:0.1,S:100

Call Delta:0.345744, Put Delta:-0.291884

T:5,K:100,sig:0.1,R:0.1,S:100

Call Delta:0.330262, Put Delta:-0.276268

T:5.5,K:100,sig:0.1,R:0.1,S:100

Call Delta:0.315403, Put Delta:-0.261547

T:6,K:100,sig:0.1,R:0.1,S:100

Call Delta:0.301154, Put Delta:-0.247658

T:6.5,K:100,sig:0.1,R:0.1,S:100

Call Delta:0.2875, Put Delta:-0.234546

T:7,K:100,sig:0.1,R:0.1,S:100

Call Delta:0.274424, Put Delta:-0.222162

T:7.5,K:100,sig:0.1,R:0.1,S:100

Call Delta:0.261907, Put Delta:-0.21046

T:8,K:100,sig:0.1,R:0.1,S:100

Call Delta:0.249931, Put Delta:-0.199398

T:8.5,K:100,sig:0.1,R:0.1,S:100

Call Delta:0.238476, Put Delta:-0.188939

T:9,K:100,sig:0.1,R:0.1,S:100

Call Delta:0.227524, Put Delta:-0.179046

T:9.5,K:100,sig:0.1,R:0.1,S:100

Call Delta:0.217054, Put Delta:-0.169687

T:10,K:100,sig:0.1,R:0.1,S:100

**Greek as a function of K**

Call Delta:0.207049, Put Delta:-0.160831

T:0.5,K:100,sig:0.1,R:0.1,S:100

Call Delta:0.489029, Put Delta:-0.462201

T:0.5,K:105,sig:0.1,R:0.1,S:100

Call Delta:0.243847, Put Delta:-0.707383

T:0.5,K:110,sig:0.1,R:0.1,S:100

Call Delta:0.0900529, Put Delta:-0.861177

T:0.5,K:115,sig:0.1,R:0.1,S:100

Call Delta:0.0248446, Put Delta:-0.926385

T:0.5,K:120,sig:0.1,R:0.1,S:100

Call Delta:0.00522634, Put Delta:-0.946003

T:0.5,K:125,sig:0.1,R:0.1,S:100

Call Delta:0.000859071, Put Delta:-0.95037

T:0.5,K:130,sig:0.1,R:0.1,S:100

Call Delta:0.000113109, Put Delta:-0.951116

T:0.5,K:135,sig:0.1,R:0.1,S:100

Call Delta:1.22124e-05, Put Delta:-0.951217

T:0.5,K:140,sig:0.1,R:0.1,S:100

Call Delta:1.10485e-06, Put Delta:-0.951228

T:0.5,K:145,sig:0.1,R:0.1,S:100

Call Delta:8.53991e-08, Put Delta:-0.951229

T:0.5,K:150,sig:0.1,R:0.1,S:100

Call Delta:5.7389e-09, Put Delta:-0.951229

T:0.5,K:155,sig:0.1,R:0.1,S:100

Call Delta:3.40554e-10, Put Delta:-0.951229

T:0.5,K:160,sig:0.1,R:0.1,S:100

Call Delta:1.80946e-11, Put Delta:-0.951229

T:0.5,K:165,sig:0.1,R:0.1,S:100

Call Delta:8.71523e-13, Put Delta:-0.951229

T:0.5,K:170,sig:0.1,R:0.1,S:100

Call Delta:3.84733e-14, Put Delta:-0.951229

T:0.5,K:175,sig:0.1,R:0.1,S:100

Call Delta:1.57201e-15, Put Delta:-0.951229

T:0.5,K:180,sig:0.1,R:0.1,S:100

Call Delta:5.99758e-17, Put Delta:-0.951229

T:0.5,K:185,sig:0.1,R:0.1,S:100

Call Delta:2.15344e-18, Put Delta:-0.951229

T:0.5,K:190,sig:0.1,R:0.1,S:100

Call Delta:7.32786e-20, Put Delta:-0.951229

T:0.5,K:195,sig:0.1,R:0.1,S:100

Call Delta:2.37822e-21, Put Delta:-0.951229

T:0.5,K:200,sig:0.1,R:0.1,S:100

Call Delta:7.4032e-23, Put Delta:-0.951229

**Greek as a function of sig**

T:0.5,K:100,sig:0.1,R:0.1,S:100

Call Delta:0.489029, Put Delta:-0.462201

T:0.5,K:100,sig:0.15,R:0.1,S:100

Call Delta:0.495731, Put Delta:-0.455499

T:0.5,K:100,sig:0.2,R:0.1,S:100

Call Delta:0.502426, Put Delta:-0.448803

T:0.5,K:100,sig:0.25,R:0.1,S:100

Call Delta:0.509113, Put Delta:-0.442116

T:0.5,K:100,sig:0.3,R:0.1,S:100

Call Delta:0.51579, Put Delta:-0.43544

T:0.5,K:100,sig:0.35,R:0.1,S:100

Call Delta:0.522454, Put Delta:-0.428775

T:0.5,K:100,sig:0.4,R:0.1,S:100

Call Delta:0.529104, Put Delta:-0.422126

T:0.5,K:100,sig:0.45,R:0.1,S:100

Call Delta:0.535737, Put Delta:-0.415493

T:0.5,K:100,sig:0.5,R:0.1,S:100

Call Delta:0.542351, Put Delta:-0.408878

T:0.5,K:100,sig:0.55,R:0.1,S:100

Call Delta:0.548945, Put Delta:-0.402284

T:0.5,K:100,sig:0.6,R:0.1,S:100

Call Delta:0.555516, Put Delta:-0.395713

T:0.5,K:100,sig:0.65,R:0.1,S:100

Call Delta:0.562063, Put Delta:-0.389167

T:0.5,K:100,sig:0.7,R:0.1,S:100

Call Delta:0.568583, Put Delta:-0.382647

T:0.5,K:100,sig:0.75,R:0.1,S:100

Call Delta:0.575074, Put Delta:-0.376155

T:0.5,K:100,sig:0.8,R:0.1,S:100

Call Delta:0.581535, Put Delta:-0.369694

T:0.5,K:100,sig:0.85,R:0.1,S:100

Call Delta:0.587964, Put Delta:-0.363265

T:0.5,K:100,sig:0.9,R:0.1,S:100

Call Delta:0.594359, Put Delta:-0.35687

T:0.5,K:100,sig:0.95,R:0.1,S:100

Call Delta:0.600718, Put Delta:-0.350511

T:0.5,K:100,sig:1,R:0.1,S:100

Call Delta:0.60704, Put Delta:-0.34419

**Greek as a function of r**

T:0.5,K:100,sig:0.1,R:0.1,S:100

Call Delta:0.489029, Put Delta:-0.462201

T:0.5,K:100,sig:0.1,R:0.15,S:100

Call Delta:0.476955, Put Delta:-0.450789

T:0.5,K:100,sig:0.1,R:0.2,S:100

Call Delta:0.465179, Put Delta:-0.439659

T:0.5,K:100,sig:0.1,R:0.25,S:100

Call Delta:0.453693, Put Delta:-0.428804

T:0.5,K:100,sig:0.1,R:0.3,S:100

Call Delta:0.442492, Put Delta:-0.418216

T:0.5,K:100,sig:0.1,R:0.35,S:100

Call Delta:0.431566, Put Delta:-0.407891

T:0.5,K:100,sig:0.1,R:0.4,S:100

Call Delta:0.420911, Put Delta:-0.39782

T:0.5,K:100,sig:0.1,R:0.45,S:100

Call Delta:0.410519, Put Delta:-0.387998

T:0.5,K:100,sig:0.1,R:0.5,S:100

Call Delta:0.400383, Put Delta:-0.378418

T:0.5,K:100,sig:0.1,R:0.55,S:100

Call Delta:0.390497, Put Delta:-0.369075

T:0.5,K:100,sig:0.1,R:0.6,S:100

Call Delta:0.380856, Put Delta:-0.359962

T:0.5,K:100,sig:0.1,R:0.65,S:100

Call Delta:0.371453, Put Delta:-0.351075

T:0.5,K:100,sig:0.1,R:0.7,S:100

Call Delta:0.362281, Put Delta:-0.342407

T:0.5,K:100,sig:0.1,R:0.75,S:100

Call Delta:0.353337, Put Delta:-0.333953

T:0.5,K:100,sig:0.1,R:0.8,S:100

Call Delta:0.344613, Put Delta:-0.325707

T:0.5,K:100,sig:0.1,R:0.85,S:100

Call Delta:0.336104, Put Delta:-0.317666

T:0.5,K:100,sig:0.1,R:0.9,S:100

Call Delta:0.327806, Put Delta:-0.309822

T:0.5,K:100,sig:0.1,R:0.95,S:100

Call Delta:0.319712, Put Delta:-0.302173

T:0.5,K:100,sig:0.1,R:1,S:100

Call Delta:0.311819, Put Delta:-0.294712

**Greek as a function of S**

T:0.5,K:100,sig:0.1,R:0.1,S:100

Call Delta:0.489029, Put Delta:-0.462201

T:0.5,K:100,sig:0.1,R:0.1,S:105

Call Delta:0.72853, Put Delta:-0.2227

T:0.5,K:100,sig:0.1,R:0.1,S:110

Call Delta:0.871997, Put Delta:-0.0792326

T:0.5,K:100,sig:0.1,R:0.1,S:115

Call Delta:0.930192, Put Delta:-0.0210373

T:0.5,K:100,sig:0.1,R:0.1,S:120

Call Delta:0.94697, Put Delta:-0.00425908

T:0.5,K:100,sig:0.1,R:0.1,S:125

Call Delta:0.950555, Put Delta:-0.000674142

T:0.5,K:100,sig:0.1,R:0.1,S:130

Call Delta:0.951144, Put Delta:-8.55432e-05

T:0.5,K:100,sig:0.1,R:0.1,S:135

Call Delta:0.951221, Put Delta:-8.90991e-06

T:0.5,K:100,sig:0.1,R:0.1,S:140

Call Delta:0.951229, Put Delta:-7.78384e-07

T:0.5,K:100,sig:0.1,R:0.1,S:145

Call Delta:0.951229, Put Delta:-5.81572e-08

T:0.5,K:100,sig:0.1,R:0.1,S:150

Call Delta:0.951229, Put Delta:-3.78152e-09

T:0.5,K:100,sig:0.1,R:0.1,S:155

Call Delta:0.951229, Put Delta:-2.17335e-10

T:0.5,K:100,sig:0.1,R:0.1,S:160

Call Delta:0.951229, Put Delta:-1.11943e-11

T:0.5,K:100,sig:0.1,R:0.1,S:165

Call Delta:0.951229, Put Delta:-5.23137e-13

T:0.5,K:100,sig:0.1,R:0.1,S:170

Call Delta:0.951229, Put Delta:-2.24265e-14

T:0.5,K:100,sig:0.1,R:0.1,S:175

Call Delta:0.951229, Put Delta:-8.88178e-16

T:0.5,K:100,sig:0.1,R:0.1,S:180

Call Delta:0.951229, Put Delta:0

T:0.5,K:100,sig:0.1,R:0.1,S:185

Call Delta:0.951229, Put Delta:0

T:0.5,K:100,sig:0.1,R:0.1,S:190

Call Delta:0.951229, Put Delta:0

T:0.5,K:100,sig:0.1,R:0.1,S:195

Call Delta:0.951229, Put Delta:0

T:0.5,K:100,sig:0.1,R:0.1,S:200

Call Delta:0.951229, Put Delta:0

--------Group A ---- part 2(d)--------

**Numeric approximation for Gamma and Delta in (a) under h=0.01**

Gamma for Call: 0.0134936, Gamma for Put: 0.0134936

Delta for Call: 0.594629, Delta for Put: -0.356601

**Numeric approximation for Delta in (b) under h=0.01 and S between 10 and 50**

S = 10, Call Delta = 2.25596e-19, Put Delta = -0.951229

S = 11, Call Delta = 6.18269e-18, Put Delta = -0.951229

S = 12, Call Delta = 1.12549e-16, Put Delta = -0.951229

S = 13, Call Delta = 1.46687e-15, Put Delta = -0.951229

S = 14, Call Delta = 1.44893e-14, Put Delta = -0.951229

S = 15, Call Delta = 1.13367e-13, Put Delta = -0.951229

S = 16, Call Delta = 7.27527e-13, Put Delta = -0.951229

S = 17, Call Delta = 3.93804e-12, Put Delta = -0.951229

S = 18, Call Delta = 1.83927e-11, Put Delta = -0.951229

S = 19, Call Delta = 7.55213e-11, Put Delta = -0.951229

S = 20, Call Delta = 2.76885e-10, Put Delta = -0.951229

S = 21, Call Delta = 9.18336e-10, Put Delta = -0.951229

S = 22, Call Delta = 2.78596e-09, Put Delta = -0.951229

S = 23, Call Delta = 7.80389e-09, Put Delta = -0.951229

S = 24, Call Delta = 2.03483e-08, Put Delta = -0.951229

S = 25, Call Delta = 4.97352e-08, Put Delta = -0.951229

S = 26, Call Delta = 1.14648e-07, Put Delta = -0.951229

S = 27, Call Delta = 2.50579e-07, Put Delta = -0.951229

S = 28, Call Delta = 5.21718e-07, Put Delta = -0.951229

S = 29, Call Delta = 1.03904e-06, Put Delta = -0.951228

S = 30, Call Delta = 1.98668e-06, Put Delta = -0.951227

S = 31, Call Delta = 3.65879e-06, Put Delta = -0.951226

S = 32, Call Delta = 6.50923e-06, Put Delta = -0.951223

S = 33, Call Delta = 1.1216e-05, Put Delta = -0.951218

S = 34, Call Delta = 1.87624e-05, Put Delta = -0.951211

S = 35, Call Delta = 3.05352e-05, Put Delta = -0.951199

S = 36, Call Delta = 4.84407e-05, Put Delta = -0.951181

S = 37, Call Delta = 7.50369e-05, Put Delta = -0.951154

S = 38, Call Delta = 0.00011368, Put Delta = -0.951116

S = 39, Call Delta = 0.000168682, Put Delta = -0.951061

S = 40, Call Delta = 0.000245472, Put Delta = -0.950984

S = 41, Call Delta = 0.000350761, Put Delta = -0.950879

S = 42, Call Delta = 0.0004927, Put Delta = -0.950737

S = 43, Call Delta = 0.00068102, Put Delta = -0.950548

S = 44, Call Delta = 0.000927158, Put Delta = -0.950302

S = 45, Call Delta = 0.00124435, Put Delta = -0.949985

S = 46, Call Delta = 0.00164771, Put Delta = -0.949582

S = 47, Call Delta = 0.00215423, Put Delta = -0.949075

S = 48, Call Delta = 0.00278276, Put Delta = -0.948447

S = 49, Call Delta = 0.00355398, Put Delta = -0.947675

S = 50, Call Delta = 0.00449025, Put Delta = -0.946739

**Numeric approximation for Gamma under different h**

h: 100, Gamma Call: 0.00750379, Gamma Put: 0.00750379

h: 10, Gamma Call: 0.0134098, Gamma Put: 0.0134098

h: 1, Gamma Call: 0.0134928, Gamma Put: 0.0134928

h: 0.1, Gamma Call: 0.0134936, Gamma Put: 0.0134936

h: 0.01, Gamma Call: 0.0134936, Gamma Put: 0.0134936

h: 0.001, Gamma Call: 0.0134937, Gamma Put: 0.0134936

h: 0.0001, Gamma Call: 0.0134946, Gamma Put: 0.0134932

h: 1e-05, Gamma Call: 0.0139977, Gamma Put: 0.0136424

h: 1e-06, Gamma Call: 0.049738, Gamma Put: 0.0284217

h: 1e-07, Gamma Call: 2.84217, Gamma Put: 0

h: 1e-08, Gamma Call: 355.271, Gamma Put: 71.0543

h: 1e-09, Gamma Call: 28421.7, Gamma Put: 7105.43

h: 1e-10, Gamma Call: 710543, Gamma Put: 0

h: 1e-11, Gamma Call: 2.84217e+08, Gamma Put: -7.10543e+07

h: 1e-12, Gamma Call: 2.13163e+10, Gamma Put: 0

h: 1e-13, Gamma Call: 2.13163e+12, Gamma Put: 0

h: 1e-14, Gamma Call: 7.10543e+13, Gamma Put: 7.10543e+13

h: 1e-15, Gamma Call: 0, Gamma Put: 0

h: 1e-16, Gamma Call: 0, Gamma Put: 0

h: 1e-17, Gamma Call: 0, Gamma Put: 0

**Numeric approximation for Delta under different h**

h: 100, Delta Call: 0.499518, Delta Put: -0.451711

h: 10, Delta Call: 0.589918, Delta Put: -0.361311

h: 1, Delta Call: 0.59458, Delta Put: -0.356649

h: 0.1, Delta Call: 0.594628, Delta Put: -0.356601

h: 0.01, Delta Call: 0.594629, Delta Put: -0.356601

h: 0.001, Delta Call: 0.594629, Delta Put: -0.356601

h: 0.0001, Delta Call: 0.594629, Delta Put: -0.356601

h: 1e-05, Delta Call: 0.594629, Delta Put: -0.356601

h: 1e-06, Delta Call: 0.594629, Delta Put: -0.356601

h: 1e-07, Delta Call: 0.594629, Delta Put: -0.356601

h: 1e-08, Delta Call: 0.594629, Delta Put: -0.3566

h: 1e-09, Delta Call: 0.594625, Delta Put: -0.356604

h: 1e-10, Delta Call: 0.594689, Delta Put: -0.356621

h: 1e-11, Delta Call: 0.594724, Delta Put: -0.357048

h: 1e-12, Delta Call: 0.586198, Delta Put: -0.355271

h: 1e-13, Delta Call: 0.603961, Delta Put: -0.355271

h: 1e-14, Delta Call: 0.355271, Delta Put: -0.355271

h: 1e-15, Delta Call: 0, Delta Put: 0

h: 1e-16, Delta Call: 0, Delta Put: 0

h: 1e-17, Delta Call: 0, Delta Put: 0

--------Group B ---- part b--------

Call Price: 18.5035, Put Price: 3.03106

--------Group B ---- part c--------

**(K=100, sig=0.1, r=0.1, b=0.02)**

**S is between 10 to 50**

S = 10, Call Price = 0.00826235, Put Price = 9.03489e+06

S = 11, Call Price = 0.011227, Put Price = 4.99557e+06

S = 12, Call Price = 0.0148535, Put Price = 2.9084e+06

S = 13, Call Price = 0.0192158, Put Price = 1.76823e+06

S = 14, Call Price = 0.0243891, Put Price = 1.11544e+06

S = 15, Call Price = 0.03045, Put Price = 726383

S = 16, Call Price = 0.0374762, Put Price = 486308

S = 17, Call Price = 0.0455465, Put Price = 333599

S = 18, Call Price = 0.054741, Put Price = 233828

S = 19, Call Price = 0.0651405, Put Price = 167076

S = 20, Call Price = 0.076827, Put Price = 121457

S = 21, Call Price = 0.0898835, Put Price = 89678.6

S = 22, Call Price = 0.104394, Put Price = 67156

S = 23, Call Price = 0.120442, Put Price = 50940.7

S = 24, Call Price = 0.138115, Put Price = 39097.9

S = 25, Call Price = 0.157497, Put Price = 30334.3

S = 26, Call Price = 0.178677, Put Price = 23770.5

S = 27, Call Price = 0.201742, Put Price = 18799.2

S = 28, Call Price = 0.226781, Put Price = 14995

S = 29, Call Price = 0.253883, Put Price = 12055.9

S = 30, Call Price = 0.283138, Put Price = 9764.83

S = 31, Call Price = 0.314637, Put Price = 7964.02

S = 32, Call Price = 0.348471, Put Price = 6537.48

S = 33, Call Price = 0.384732, Put Price = 5399.17

S = 34, Call Price = 0.423512, Put Price = 4484.6

S = 35, Call Price = 0.464906, Put Price = 3745.05

S = 36, Call Price = 0.509007, Put Price = 3143.37

S = 37, Call Price = 0.555908, Put Price = 2651.05

S = 38, Call Price = 0.605706, Put Price = 2246.02

S = 39, Call Price = 0.658495, Put Price = 1911.08

S = 40, Call Price = 0.714373, Put Price = 1632.76

S = 41, Call Price = 0.773434, Put Price = 1400.4

S = 42, Call Price = 0.835777, Put Price = 1205.56

S = 43, Call Price = 0.901499, Put Price = 1041.49

S = 44, Call Price = 0.970699, Put Price = 902.784

S = 45, Call Price = 1.04347, Put Price = 785.068

S = 46, Call Price = 1.11993, Put Price = 684.8

S = 47, Call Price = 1.20015, Put Price = 599.097

S = 48, Call Price = 1.28425, Put Price = 525.597

S = 49, Call Price = 1.37233, Put Price = 462.36

S = 50, Call Price = 1.46448, Put Price = 407.787

--------Group B ---- part d--------

**Price as a function of K**

K:100,sig:0.1,r:0.1,S:110,b:0.02

Call Price:18.5035, Put Price:3.03106

K:105,sig:0.1,r:0.1,S:110,b:0.02

Call Price:16.6065, Put Price:4.3104

K:110,sig:0.1,r:0.1,S:110,b:0.02

Call Price:14.9791, Put Price:6.03011

K:115,sig:0.1,r:0.1,S:110,b:0.02

Call Price:13.5734, Put Price:8.31094

K:120,sig:0.1,r:0.1,S:110,b:0.02

Call Price:12.3512, Put Price:11.2991

K:125,sig:0.1,r:0.1,S:110,b:0.02

Call Price:11.2825, Put Price:15.1703

K:130,sig:0.1,r:0.1,S:110,b:0.02

Call Price:10.3429, Put Price:20.1337

K:135,sig:0.1,r:0.1,S:110,b:0.02

Call Price:9.51273, Put Price:26.437

K:140,sig:0.1,r:0.1,S:110,b:0.02

Call Price:8.77585, Put Price:34.3716

K:145,sig:0.1,r:0.1,S:110,b:0.02

Call Price:8.119, Put Price:44.2778

K:150,sig:0.1,r:0.1,S:110,b:0.02

Call Price:7.53115, Put Price:56.5514

K:155,sig:0.1,r:0.1,S:110,b:0.02

Call Price:7.0031, Put Price:71.6501

K:160,sig:0.1,r:0.1,S:110,b:0.02

Call Price:6.52712, Put Price:90.1004

K:165,sig:0.1,r:0.1,S:110,b:0.02

Call Price:6.09669, Put Price:112.506

K:170,sig:0.1,r:0.1,S:110,b:0.02

Call Price:5.70625, Put Price:139.554

K:175,sig:0.1,r:0.1,S:110,b:0.02

Call Price:5.35107, Put Price:172.028

K:180,sig:0.1,r:0.1,S:110,b:0.02

Call Price:5.0271, Put Price:210.811

K:185,sig:0.1,r:0.1,S:110,b:0.02

Call Price:4.73082, Put Price:256.904

K:190,sig:0.1,r:0.1,S:110,b:0.02

Call Price:4.45923, Put Price:311.427

K:195,sig:0.1,r:0.1,S:110,b:0.02

Call Price:4.20969, Put Price:375.64

K:200,sig:0.1,r:0.1,S:110,b:0.02

Call Price:3.97991, Put Price:450.947

**Price as a function of sig**

K:100,sig:0.1,r:0.1,S:110,b:0.02

Call Price:18.5035, Put Price:3.03106

K:100,sig:0.15,r:0.1,S:110,b:0.02

Call Price:22.5052, Put Price:6.85143

K:100,sig:0.2,r:0.1,S:110,b:0.02

Call Price:26.5984, Put Price:10.9261

K:100,sig:0.25,r:0.1,S:110,b:0.02

Call Price:30.6563, Put Price:15.0293

K:100,sig:0.3,r:0.1,S:110,b:0.02

Call Price:34.6188, Put Price:19.0713

K:100,sig:0.35,r:0.1,S:110,b:0.02

Call Price:38.4512, Put Price:23.0055

K:100,sig:0.4,r:0.1,S:110,b:0.02

Call Price:42.1321, Put Price:26.8039

K:100,sig:0.45,r:0.1,S:110,b:0.02

Call Price:45.6484, Put Price:30.4492

K:100,sig:0.5,r:0.1,S:110,b:0.02

Call Price:48.9929, Put Price:33.9308

K:100,sig:0.55,r:0.1,S:110,b:0.02

Call Price:52.1626, Put Price:37.2432

K:100,sig:0.6,r:0.1,S:110,b:0.02

Call Price:55.158, Put Price:40.3847

K:100,sig:0.65,r:0.1,S:110,b:0.02

Call Price:57.9821, Put Price:43.3567

K:100,sig:0.7,r:0.1,S:110,b:0.02

Call Price:60.6398, Put Price:46.1624

K:100,sig:0.75,r:0.1,S:110,b:0.02

Call Price:63.1375, Put Price:48.8071

K:100,sig:0.8,r:0.1,S:110,b:0.02

Call Price:65.4822, Put Price:51.2969

K:100,sig:0.85,r:0.1,S:110,b:0.02

Call Price:67.6818, Put Price:53.6389

K:100,sig:0.9,r:0.1,S:110,b:0.02

Call Price:69.7443, Put Price:55.8403

K:100,sig:0.95,r:0.1,S:110,b:0.02

Call Price:71.6778, Put Price:57.9091

K:100,sig:1,r:0.1,S:110,b:0.02

Call Price:73.4904, Put Price:59.8527

**Price as a function of r**

K:100,sig:0.1,r:0.1,S:110,b:0.02

Call Price:18.5035, Put Price:3.03106

K:100,sig:0.1,r:0.15,S:110,b:0.02

Call Price:14.9385, Put Price:2.41857

K:100,sig:0.1,r:0.2,S:110,b:0.02

Call Price:13.1933, Put Price:2.02021

K:100,sig:0.1,r:0.25,S:110,b:0.02

Call Price:12.165, Put Price:1.7358

K:100,sig:0.1,r:0.3,S:110,b:0.02

Call Price:11.4978, Put Price:1.52065

K:100,sig:0.1,r:0.35,S:110,b:0.02

Call Price:11.04, Put Price:1.35131

K:100,sig:0.1,r:0.4,S:110,b:0.02

Call Price:10.7154, Put Price:1.21409

K:100,sig:0.1,r:0.45,S:110,b:0.02

Call Price:10.4812, Put Price:1.10041

K:100,sig:0.1,r:0.5,S:110,b:0.02

Call Price:10.3117, Put Price:1.00455

K:100,sig:0.1,r:0.55,S:110,b:0.02

Call Price:10.19, Put Price:0.922553

K:100,sig:0.1,r:0.6,S:110,b:0.02

Call Price:10.1049, Put Price:0.851579

K:100,sig:0.1,r:0.65,S:110,b:0.02

Call Price:10.0487, Put Price:0.789526

K:100,sig:0.1,r:0.7,S:110,b:0.02

Call Price:10.0155, Put Price:0.734805

K:100,sig:0.1,r:0.75,S:110,b:0.02

Call Price:10.0012, Put Price:0.686189

K:100,sig:0.1,r:0.8,S:110,b:0.02

Call Price:10.0025, Put Price:0.642717

K:100,sig:0.1,r:0.85,S:110,b:0.02

Call Price:10.0171, Put Price:0.603619

K:100,sig:0.1,r:0.9,S:110,b:0.02

Call Price:10.0428, Put Price:0.568275

K:100,sig:0.1,r:0.95,S:110,b:0.02

Call Price:10.0783, Put Price:0.536179

K:100,sig:0.1,r:1,S:110,b:0.02

Call Price:10.1223, Put Price:0.50691

**Price as a function of S**

K:100,sig:0.1,r:0.1,S:110,b:0.02

Call Price:18.5035, Put Price:3.03106

K:100,sig:0.1,r:0.1,S:115,b:0.02

Call Price:21.3481, Put Price:2.29919

K:100,sig:0.1,r:0.1,S:120,b:0.02

Call Price:24.4804, Put Price:1.76467

K:100,sig:0.1,r:0.1,S:125,b:0.02

Call Price:27.916, Put Price:1.36913

K:100,sig:0.1,r:0.1,S:130,b:0.02

Call Price:31.67, Put Price:1.07287

K:100,sig:0.1,r:0.1,S:135,b:0.02

Call Price:35.7583, Put Price:0.848494

K:100,sig:0.1,r:0.1,S:140,b:0.02

Call Price:40.1963, Put Price:0.676793

K:100,sig:0.1,r:0.1,S:145,b:0.02

Call Price:45.0001, Put Price:0.544138

K:100,sig:0.1,r:0.1,S:150,b:0.02

Call Price:50.1855, Put Price:0.440732

K:100,sig:0.1,r:0.1,S:155,b:0.02

Call Price:55.7685, Put Price:0.359453

K:100,sig:0.1,r:0.1,S:160,b:0.02

Call Price:61.7655, Put Price:0.295067

K:100,sig:0.1,r:0.1,S:165,b:0.02

Call Price:68.1927, Put Price:0.24369

K:100,sig:0.1,r:0.1,S:170,b:0.02

Call Price:75.0665, Put Price:0.202411

K:100,sig:0.1,r:0.1,S:175,b:0.02

Call Price:82.4034, Put Price:0.169031

K:100,sig:0.1,r:0.1,S:180,b:0.02

Call Price:90.2201, Put Price:0.141875

K:100,sig:0.1,r:0.1,S:185,b:0.02

Call Price:98.5333, Put Price:0.119654

K:100,sig:0.1,r:0.1,S:190,b:0.02

Call Price:107.36, Put Price:0.101373

K:100,sig:0.1,r:0.1,S:195,b:0.02

Call Price:116.717, Put Price:0.0862562

K:100,sig:0.1,r:0.1,S:200,b:0.02

Call Price:126.621, Put Price:0.073694

**Price as a function of b**

K:100,sig:0.1,r:0.1,S:110,b:0.02

Call Price:18.5035, Put Price:3.03106

K:100,sig:0.1,r:0.1,S:110,b:0.03

Call Price:22.456, Put Price:2.1912

K:100,sig:0.1,r:0.1,S:110,b:0.04

Call Price:27.3822, Put Price:1.58538

K:100,sig:0.1,r:0.1,S:110,b:0.05

Call Price:33.4204, Put Price:1.15397

K:100,sig:0.1,r:0.1,S:110,b:0.06

Call Price:40.8219, Put Price:0.846901

K:100,sig:0.1,r:0.1,S:110,b:0.07

Call Price:50.0413, Put Price:0.626991

K:100,sig:0.1,r:0.1,S:110,b:0.08

Call Price:61.9543, Put Price:0.468088

K:100,sig:0.1,r:0.1,S:110,b:0.09

Call Price:78.588, Put Price:0.352155

K:100,sig:0.1,r:0.1,S:110,b:0.1

Call Price:-nan(ind), Put Price:0.266772

K:100,sig:0.1,r:0.1,S:110,b:0.11

Call Price:-nan(ind), Put Price:0.203339

K:100,sig:0.1,r:0.1,S:110,b:0.12

Call Price:-nan(ind), Put Price:0.155839

K:100,sig:0.1,r:0.1,S:110,b:0.13

Call Price:-nan(ind), Put Price:0.120016

K:100,sig:0.1,r:0.1,S:110,b:0.14

Call Price:-nan(ind), Put Price:0.0928288

K:100,sig:0.1,r:0.1,S:110,b:0.15

Call Price:-nan(ind), Put Price:0.0720786

K:100,sig:0.1,r:0.1,S:110,b:0.16

Call Price:-nan(ind), Put Price:0.0561613

K:100,sig:0.1,r:0.1,S:110,b:0.17

Call Price:-nan(ind), Put Price:0.0438961

K:100,sig:0.1,r:0.1,S:110,b:0.18

Call Price:-nan(ind), Put Price:0.0344066

K:100,sig:0.1,r:0.1,S:110,b:0.19

Call Price:-nan(ind), Put Price:0.0270379

K:100,sig:0.1,r:0.1,S:110,b:0.2

Call Price:-nan(ind), Put Price:0.021297