Level 9 Homework

Zstar

Groups C&D: Monte Carlo Pricing Methods

C. Monte Carlo 101

a). The code runs successfully.

b). Experiment results using data from **Batch 1**:

N	NSim	Call Price	Call Error	Call SD	Call SE	Put Price	Put Error	Put SD	Put SE
100	10000	2.1378	0.00443	4.54234	0.045423	5.90649	0.06021	6.05727	0.060573
100	100000	2.13628	0.002911	4.5113	0.014266	5.81293	0.033352	6.02739	0.01906
100	1000000	2.12751	0.00586	4.50672	0.004507	5.85292	0.006638	6.05189	0.006052
200	10000	2.15694	0.023568	4.60961	0.046096	5.81645	0.029833	6.09047	0.060905
200	100000	2.13753	0.004162	4.50433	0.014244	5.85699	0.010708	6.04022	0.019101
200	1000000	2.13498	0.001613	4.5196	0.00452	5.84155	0.004729	6.04742	0.006047
300	10000	2.14237	0.009001	4.47283	0.044728	5.75335	0.092933	5.97845	0.059785
300	100000	2.15174	0.018368	4.52959	0.014324	5.83792	0.008361	6.04264	0.019109
300	1000000	2.13016	0.003212	4.50921	0.004509	5.84022	0.00606	6.04391	0.006044

Experiment results using data from **Batch 2**:

N	NSim	Call Price	Call Error	Call SD	Call SE	Put Price	Put Error	Put SD	Put SE
100	10000	7.94097	0.024605	13.212	0.13212	8.01361	0.048045	10.4813	0.104813
100	100000	7.96498	0.000585	13.1449	0.041568	7.90847	0.0571	10.366	0.03278
100	1000000	7.94918	0.016392	13.1285	0.013129	7.98184	0.016269	10.4166	0.010417
200	10000	8.00518	0.039608	13.3716	0.133716	7.91735	0.048222	10.5102	0.105102
200	100000	7.97717	0.011599	13.1284	0.041516	7.98377	0.018195	10.3905	0.032858
200	1000000	7.97472	0.009151	13.1573	0.013157	7.95702	0.00855	10.4077	0.010408
300	10000	8.04902	0.083451	13.057	0.13057	7.77918	0.186391	10.2715	0.102715
300	100000	8.02499	0.05942	13.1871	0.041701	7.95548	0.010092	10.3921	0.032863
300	1000000	7.96352	0.002051	13.1319	0.013132	7.95272	0.012852	10.4002	0.0104

From the tables above, different values for NT/NSim seem don't follow a fixed pattern. But in general, larger NT and larger NSim are corresponding to smaller errors. If we fixed N, we can see that the errors become smaller as the NSim goes larger, however, exception exists. If we fixed NSim, for small N, there seems no general pattern, for large N, the errors decrease as the N becomes larger. In conclusion, the trends might be more complicated than we thought, and I think optimal choice of parameter set exists.

c).

Experiment results using data from **Batch 4**:

N	NSim	Call Price	Call Error	Call SD	Call SE	Put Price	Put Error	Put SD	Put SE
100	10000	88.0412	4.13449	254.914	2.54914	1.30114	0.053644	2.52276	0.025228
100	100000	88.9885	3.18721	314.706	0.995187	1.279	0.031501	2.49279	0.007883
100	1000000	89.1499	3.02582	326.665	0.326665	1.29374	0.046237	2.50468	0.002505
200	10000	97.2245	5.04881	503.935	5.03935	1.26993	0.022431	2.49693	0.024969
200	100000	89.9871	2.18856	336.437	1.06391	1.26797	0.020472	2.47364	0.007822
200	1000000	90.99	1.18565	352.36	0.35236	1.26428	0.016782	2.47411	0.002474
300	10000	91.4229	0.752848	358.164	3.58164	1.21514	0.032363	2.42441	0.024244
300	100000	92.1999	0.024166	407.506	1.28865	1.26034	0.012844	2.46495	0.007795
300	1000000	90.8223	1.35341	341.523	0.341523	1.25817	0.01067	2.46481	0.002465

In addition, I test this set with larger NT:

N	NSim	Call Price	Call Error	Call SD	Call SE	Put Price	Put Error	Put SD	Put SE
1000	1000000	91.5646	0.611135	352.824	0.352824	1.24998	0.00248	2.45393	0.002454

For put option, the accuracy is already two places behind the decimal point. However, this criterion for call option is very hard to achieve, as we can see, the call error generally decreases with larger parameters. The optimal choice of parameter set probably requires larger NT and NSim.

D. Advanced Monte Carlo

a). The TestMC.cpp is atteched with this file. It works fine.

b). The SD & SE have been computed in the tables above.

The SE tend to decrease as NSim, its has no apparent relationship with NT.

No general pattern can be found between SD and NT/NSim, however, we can notice that the volatility of SD/SE is very small. What's more, larger errors are not necessarily corresponding to larger SD/SE.