Group C:

b). The table below is the results of call and put price using the Monte Carlo simulation, when the time steps go from 50 to 600 under the same simulation times N, the accuracy would not always increase linearly, it has some peak value. However, the result can get a better performance getting closer to the standard value from with the same time steps and different simulation times, when the simulations times change to a larger number, it would increase the accuracy of the result.

Batch 1:

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| put | 5.84584 |  |  |  |
| Time  Simulation | 50 | 100 | 200 | 600 |
| 10000 | 5.91306 | 5.88443 | 5.9558 | 5.9639 |
| 100000 | 5.85897 | 5.8726 | 5.86236 | 5.84583 |
| 500000 | 5.84055 | 5.84404 | 5.85815 |  |
| 1000000 | 5.84087 | 5.85106 | 5.85722 |  |

Table average put option price from different simulations

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| call | 2.13293 |  |  |  |
| Time  Simulation | 50 | 100 | 200 | 600 |
| 10000 | 2.1206 | 2.10932 | 2.09925 | 2.12619 |
| 100000 | 2.11001 | 2.13295 | 2.16282 | 2.13139 |
| 500000 | 2.13784 | 2.14306 | 2.13755 |  |
| 1000000 | 2.13521 | 2.13288 | 2.13152 |  |

Table average call option price from different simulations

From table 1, in order to get the same accuracy as the exact solution, the time steps and simulation times for put option are NT >= 100, NSIM >= 1000000, or NT >=600, NSIM >= 100000.  
From table 2, in order to get the same accuracy as the exact solution, the time steps and simulation times for call option are NT >= 100, NSIM >= 1000000, or NT >=600, NSIM >= 100000.  
Batch 2:

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| put | 7.96632 |  |  |  |
| Time  Simulation | 50 | 100 | 200 | 600 |
| 10000 | 8.08646 | 8.02358 | 8.14035 | 8.17801 |
| 100000 | 7.99014 | 8.01715 | 7.99534 | 7.96541 |
| 500000 | 7.96599 | 7.96816 | 7.98153 |  |
| 1000000 | 7.9644 | 7.97643 | 7.98176 |  |
|  |  |  |  |  |

Table 3 average put option price from different simulations

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| call | 7.96632 |  |  |  |
| Time  Simulation | 50 | 100 | 200 | 600 |
| 10000 | 7.91664 | 7.88566 | 7.82969 | 7.91222 |
| 100000 | 7.91079 | 7.96187 | 8.03125 | 7.96295 |
| 500000 | 7.99036 | 7.997 | 7.96598 |  |
| 1000000 | 7.98158 | 7.96603 | 7.95417 |  |

Table 4 average call option price from different simulations

From table 3, in order to get the same accuracy as the exact solution, the time steps and simulation times for put option are NT >= 100, NSIM >= 500000, or NT >=600, NSIM >= 100000.  
From table 4, in order to get the same accuracy as the exact solution, the time steps and simulation times for call option are NT >= 100, NSIM >= 100000, or NT >=600, NSIM >= 100000.

Batch 4:

|  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- |
| put | 1.24651 |  |  |  |  |  |
| Time  Simulation | 100 | 500 | 1000 | 1200 | 1500 | 1700 |
| 10000 |  | 1.257 | 1.28144 |  |  |  |
| 100000 |  | 1.255 | 1.25723 | 1.25183 50000 |  | 1.2608 |
| 150000 | 1.26076 |  | 1.2557 |  |  |  |
| 400000 |  |  |  |  | 1.24944 |  |
| 500000 | 1.29122 |  |  |  |  |  |
| 1000000 |  | 1.25418 |  | 1.2567 | 1.2528 |  |
| 1500000 |  |  |  |  | 1.2577 |  |
| 2000000 |  |  |  |  | 1.25006 |  |

Table 5 average put option price from different simulations

|  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- |
| call | 92.1749 |  |  |  |  |  |
| Time  Simulation | 50 | 100 | 200 | 600 | 1000 | 1500 |
| 10000 |  |  |  |  |  |  |
| 100000 |  | 90.1399 | 93.4132 | 92.75 | 92.34 | 91.4715 |
| 500000 |  |  | 91.5246 | 91.1488 | 91.9491 |  |
| 1000000 |  |  |  |  |  |  |
| 1500000 |  |  |  |  | 92.1759 |  |

Table 6 average call option price from different simulations

From table 5, in order to get an accuracy to two places hind the decimal point as the result from the exact solution, the time steps and simulation times for put option are NT >= 1500, NSIM >= 400000.  
From table 6, in order to get an accuracy to two places hind the decimal point as the result from the exact solution, the time steps and simulation times for call option are NT >= 1500, NSIM >= 100000.

Group D:

b)

Batch 1:

|  |  |
| --- | --- |
| call | 2.13293 |
| Time  Simulation | 50 | 100 | 200 | 600 |
| 10000 | 0.0439799 | 0.043864 | 0.0446853 | 0.0448318 |
| 100000 | 0.0139359 | 0.0140415 | 0.0142132 | 0.014072 |
| 500000 | 0.00626698 | 0.00629253 | 0.00628368 |  |
| 1000000 | 0.0044214 | 0.00443198 | 0.00442794 |  |

Table 7 standard deviation of call simulations

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
|  |  |  |  |  |
| Time  Simulation | 50 | 100 | 200 | 600 |
| 10000 | 0.000439799 | 0.00043864 | 0.000446853 | 0.000448318 |
| 100000 | 4.40692E-05 | 4.44033E-05 | 4.49462E-05 | 4.44994E-05 |
| 500000 | 8.86285E-06 | 8.89898E-06 | 8.88646E-06 |  |
| 1000000 | 4.4214E-06 | 4.43198E-06 | 4.42794E-06 |  |

Table 8 standard error of call simulations

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| Time  Simulation | 50 | 100 | 200 | 600 |
| 10000 | 0.0599305 | 0.0594961 | 0.0594961 | 0.059496 |
| 100000 | 0.018788 | 0.0188212 | 0.00838129 | 2.13139 |
| 500000 | 0.00839669 | 0.00838988 | 0.00838988 |  |
| 1000000 | 0.0059355 | 0.0059355 | 0.0059355 |  |

Table 9 standard deviation of put simulations

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| Time  Simulation | 50 | 100 | 200 | 600 |
| 10000 | 0.000599305 | 0.000594961 | 0.000594961 | 0.000595 |
| 100000 | 0.000059413 | 5.95177E-05 | 5.95177E-05 | 2.13139 |
| 500000 | 1.18747E-05 | 1.18651E-05 | 1.18529E-05 |  |
| 1000000 | 5.9355E-06 | 5.9355E-06 | 5.9355E-06 |  |

Table 10 standard error of put simulations

Batch 2:

|  |  |
| --- | --- |
| put | 7.96632 |
| Time  Simulation | 50 | 100 | 200 | 600 |
| 10000 | 0.10567 | 0.10468 | 0.105264 | 0.105074 |
| 100000 | 0.0330425 | 0.0330771 | 0.0329496 | 0.032894 |
| 500000 | 0.0147557 | 0.0147313 | 0.0147183 |  |
| 1000000 | 0.010431 | 0.010425 | 0.0104169 |  |

Table 11 standard deviation of put simulations

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| Time  Simulation | 50 | 100 | 200 | 600 |
| 10000 | 0.0010567 | 0.0010468 | 0.00105264 | 0.001051 |
| 100000 | 0.00010449 | 0.000104599 | 0.000104196 | 0.000104 |
| 500000 | 2.08677E-05 | 2.08331E-05 | 2.08149E-05 |  |
| 1000000 | 0.000010431 | 0.000010425 | 1.04169E-05 |  |

Table 12 standard error of put simulations

|  |  |
| --- | --- |
| call | 7.96632 |
| Time  Simulation | 50 | 100 | 200 | 600 |
| 10000 | 0.130876 | 0.130583 | 0.132367 | 0.132809 |
| 100000 | 0.0414105 | 0.0416884 | 0.0421094 | 0.0417366 |
| 500000 | 0.0186136 | 0.0186731 | 0.0186558 |  |
| 1000000 | 0.0131395 | 0.0131624 | 0.0131544 |  |

Table 1 standard deviation of call simulations

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| Time  Simulation | 50 | 100 | 200 | 600 |
| 10000 | 0.00130876 | 0.00130583 | 0.00132367 | 0.00132809 |
| 100000 | 0.000130951 | 0.00013183 | 0.000133162 | 0.000131983 |
| 500000 | 2.63236E-05 | 2.64078E-05 | 2.63833E-05 |  |
| 1000000 | 1.31395E-05 | 1.31624E-05 | 1.31544E-05 |  |

Table 1 standard error of call simulations