Worksheet 4

Practical Lab Numerical Computing

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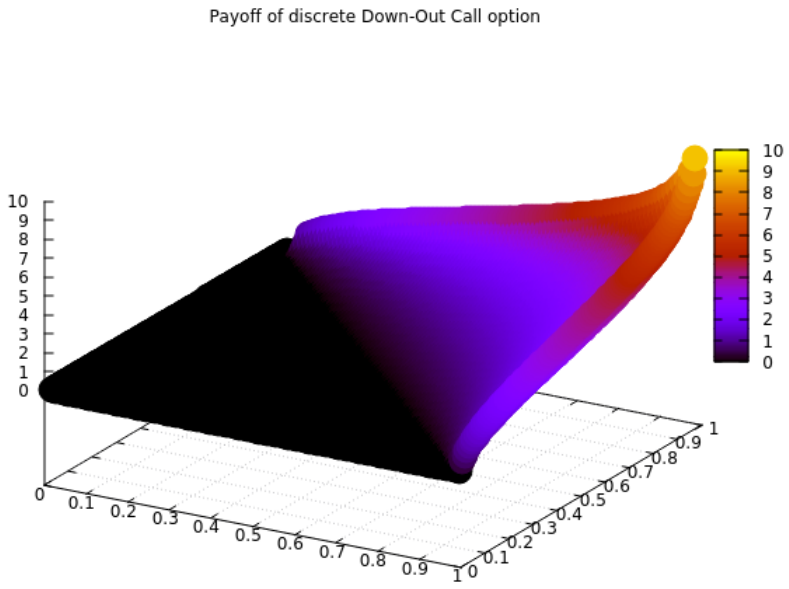
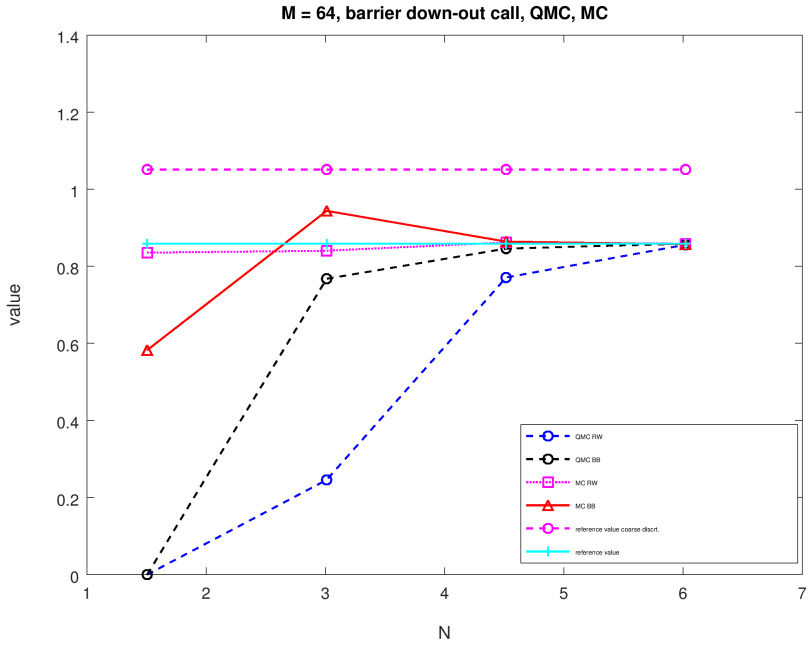
Task 1

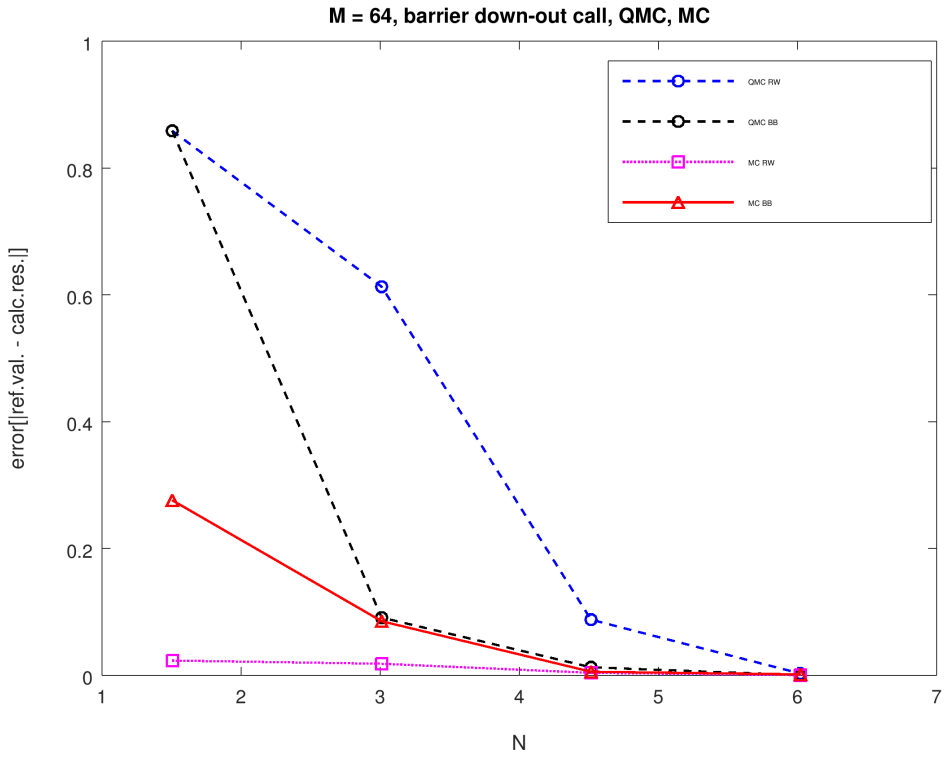


Task 2



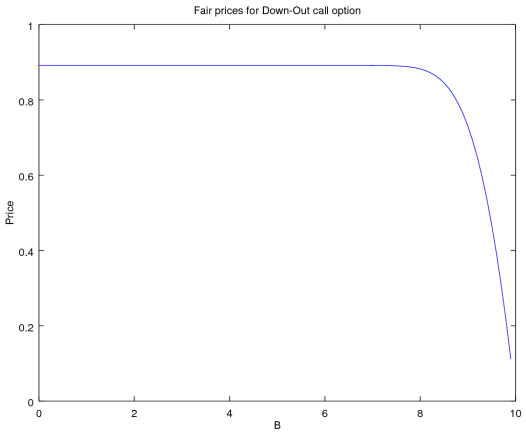
- On this figure the value of Barrier Down-Out Call Option using different methods is plotted against number of points(10^N)
- The pink dashed line is the reference value obtained if precision is too low. So, if precision is too low, the reference value lies above or below the actual price.
- From the plots, one can observe that for QMC Brownian-Bridge shows faster convergence than Random-Walk, but for MC it is vice versa

The next figure represents error convergence rates of the above figure:



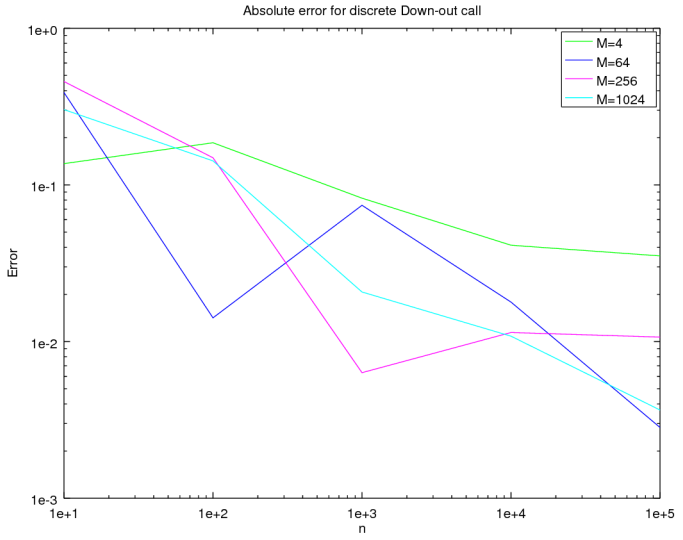
Task 3

The picture below shows the fair price for a Down-Out call option with barrier B. One can see that the fair price is going down if the barrier is larger then about $B = 8$. This makes sense, because when the barrier is high, the payoff is 0 in many cases (because for this value of B it happens more often that the price of the underlying is below the barrier).

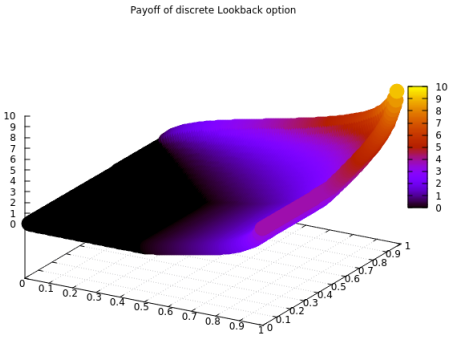


Task 4

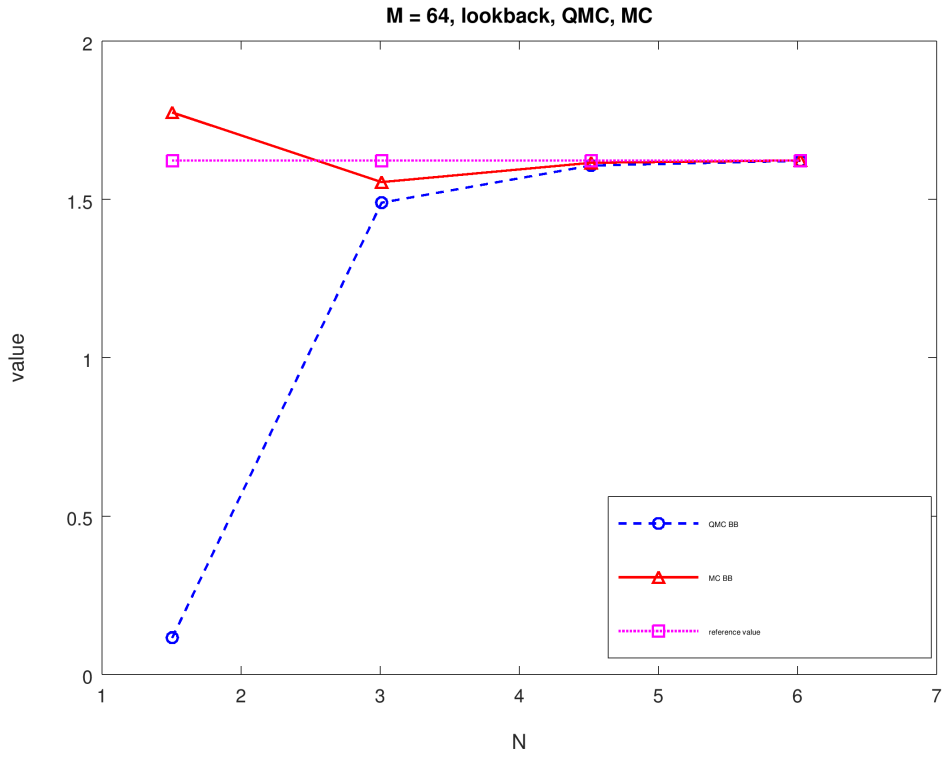
The next plot shows the absolute error for the discrete Down-Out call option for different values of M. One can see that for $M \geq 64$ the convergence is much better then for $M = 4$.



Task 5



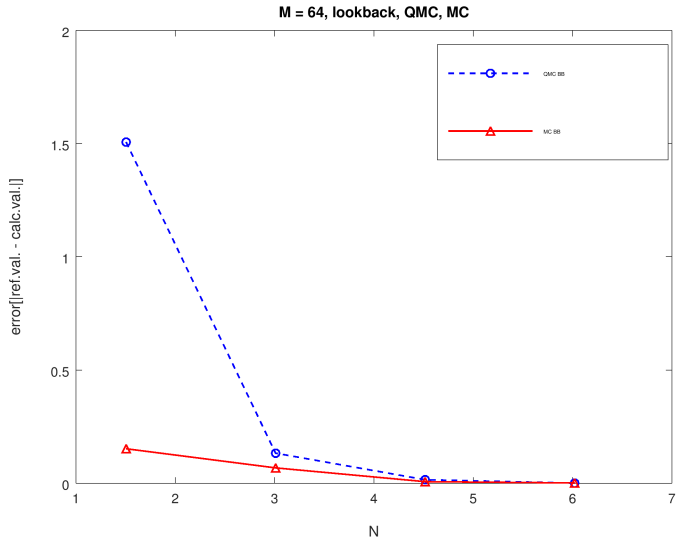
Task 6



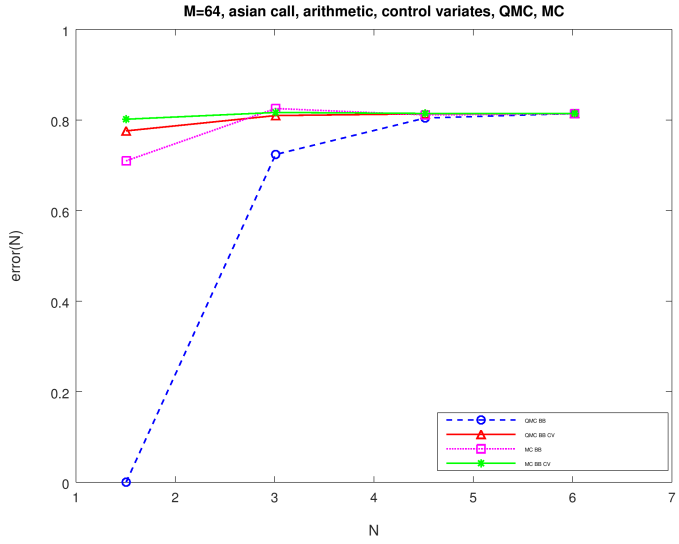
- On this figure the value of Lookback Call Option computed with QMC and MC methods using Brownian-Bridge is plotted against the number of points used

Here, once more, error between the reference value computed numerically and

the value computed with QMC and MC using Brownian-Bridge against number of points.

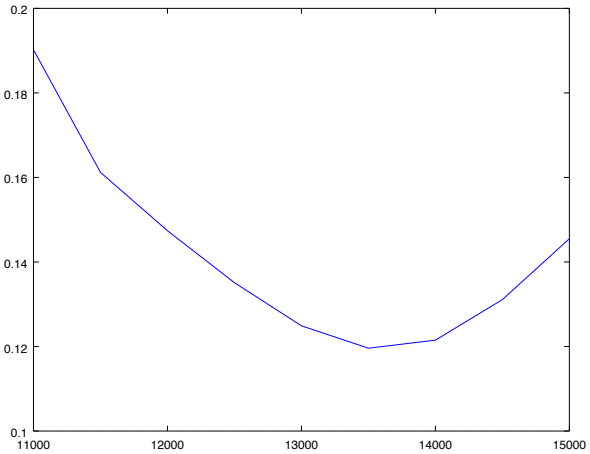


Task 7



- On this figure, results of the **control variate** method are presented. The idea was presented on the worksheet, we observe that this method improves variance slightly in case of an arithmetic Asian Call Option.

Task 9



Volatility of Call-Options for DAX, expiring in December, 2017. In this case, the volatility smile is clearly visible. The current value of the DAX is at about 12450 points.