Task 1(First part)

First we set up the parameters. Then we calculate the theoretical values for the expectation and variance when the stock price is at time 3, S(3) using the formula listed in the Python editor(line 8 and 9).

Then I created the Brownian path for the stock prices from time 0 to 3, with step size of 1/1001. First I generate the random number dB matrix using the function randn and then initializing all the first columns in all the rows of the matrix to 0. Then only I obtained the Brownian motion matrix, B by finding the cumulative sum(row wise) of the matrix B using the function cumsum.

Then I calculated the stock price. First I generated the matrix S from the matrix B using the function zeros\_like, but initializing all the first columns in all the rows of the matrix to the stock value at time 0, S(0)=39. Then I calculated the stock prices from time 0 to 3 by using the formula in the python editor(line 21). Then I plot the graph of the stock prices which is following the geometric Brownian motion, with the x-axis being the time(t) and the y-axis being the transposed matrix S.

Then to calculate the expected value of the stock price at time 3, first, I assign the transposed matrix S to the matrix Z. Then I assign the last row of the matrix Z to matrix C. After that, I used the loop to find the total of the stock prices in the matrix C. Later the expected value is calculated using the total divided by the path travelled, which is 5.

To calculate the variance of, first we calculate the square value of each values in the matrix C and the total it up using a loop. Then use the formula in the line 48 to compute the variance. To calculate the probability of the stock prices more than 39, P(S>39), I used a counter control loop for this. When there is a stock price in the matrix C which is more than 1, the counter will be increased by 1 and the stock price will be added to the total, to be used for the calculation of the conditional expectation of S(3) given the S(3) is more than 39, by dividing the total by count. Then the probability is found by dividing the count by the path travelled.

Task 1(Second part)

First I set up the parameters. Then I created the Brownian path for the stock prices from time 0 to 1, with step size of 1/1000. First I generate the random number dB matrix using the function randn and then initializing all the first columns in all the rows of the matrix to 0. Then only I obtained the Brownian motion matrix, B by finding the cumulative sum(row wise) of the matrix B using the function cumsum.

Then I calculated the stock price. First I generated the matrix X from the matrix B using the function zeros\_like, but initializing all the first columns in all the rows of the matrix to the stock value at time 0, X(0)=3. Then I obtained the solution for the Mean Reversal, which is the matrix X, by the approximation of the Euler-Maruyama Scheme to the solution of the SDE. The R(t) is X[:,col]. Then by equating R to the transpose of the matrix X, I plot the graph of realizations of the mean reversal process. The x-axis is the time and the y-axis is the matrix R.

The calculation of the expected value of the stock price at time 1, R(1) is done by initializing matrix R1 to the last row of matrix R. Then the sum of the matrix R1 is divided by the number of paths to get the expectation. To calculate the probability of R(1) more than 2, I used the counter control loop by initializing the count to 0 first. Then when the stock price in the matrix R1 is more than 2, the count is increased by 1. Then I divided the count by the number of paths to get the probability.

Task 2

There are 30 components stocks. To find the moving average, the data downloaded for the counter 3182.KL and KLSE is initialized into the matrix data\_close and KLSE\_close respectively. Then I find the dimensions of both of the matrices by using the function “shape”. Then the zero array is generated by using the function “np.zeros”. Then the 5 day moving average is found by using the loop. The sum is the total of all the prices in the matrix data\_close, which I initially it initialize it to 0. Then average is calculated for each time.

The graph is then plotted (line 39-42). Then the correlation is found by the function “corr()”. The table is below.

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
| **Stock Code** | **Stock Name** | **Stock Sector** | **Weightage** | **PE Ratio** | **Net Market Capital**  **(MYR in millions)** |
| 1295 | Public Bank Bhd | Financials | 11.60 | 16.31 | 73682.979 |
| 1155 | Malayan Banking Bhd | Financials | 9.32 | 13.07 | 87750.513 |
| 5347 | Tenaga Nasional Bhd | Trading Services | 9.28 | 10.79 | 69754.896 |
| 1023 | CIMB Group Holdings | Financials | 5.76 | 14.97 | 46524.058 |
| 6888 | Axiata Group Bhd | Trading Services | 5.62 | 23.60 | 55544.741 |
| 4197 | Sime Darby Bhd | Trading Services | 5.51 | 15.91 | 53354.208 |
| 6947 | DiGi.Com Bhd | Infrastructure Proj | 4.16 | 20.71 | 42062.750 |
| 3182 | Genting Bhd | Trading Service | 3.68 | 20.77 | 31068.523 |
| 5183 | PETRONAS Chemicals Group Bhd | Industrial Products | 3.55 | 20.77 | 51200.000 |
| 6012 | Maxis Bhd | Trading Services | 3.45 | 28.46 | 48883.526 |
| 6033 | Petronas Gas Bhd | Industrial Products | 3.40 | 22.91 | 42226.141 |
| 5225 | IHH Healthcare Bhd | Trading Services | 3.28 | 63.97 | 48251.265 |
| 1961 | IOI Corp Bhd | Plantation | 2.99 | 8.25 | 27837.135 |
| 4863 | Telekom Malaysia Bhd | Trading Services | 2.96 | 30.22 | 25140.584 |
| 4715 | Genting Malaysia Bhd | Trading Services | 2.50 | 20.18 | 23985.949 |
| 3816 | MISC Bhd | Trading Services | 2.45 | 16.28 | 35888.904 |
| 1015 | AMMB Holdings Bhd | Financial | 2.38 | 9.94 | 17723.408 |
| 2445 | Kuala Lumpur Kepong Berhad | Plantation | 2.28 | 24.76 | 24552.615 |
| 5218 | SapuraKencana Petroleum Bhd | Trading Services | 1.98 | 9.88 | 14153.159 |
| 4065 | PPB Group Bhd | Consumer Products | 1.80 | 19.45 | 17829.920 |
| 4162 | British American Tobacco (Malaysia) Bhd | Consumer Products | 1.70 | 21.08 | 19016.298 |
| 5819 | Hong Leong Bank Bhd | Financial | 1.67 | 12.02 | 25265.977 |
| 4677 | YTL Corp Berhad | Trading Services | 1.63 | 11.11 | 17270.384 |
| 4588 | UMW Holdings Bhd | Consumer Product | 1.37 | 18.21 | 11869.867 |
| 6399 | Astro Malaysia Holdings Berhad | Trading Services | 1.22 | 30.45 | 15813.168 |
| 5681 | Petronas Dagangan Bhd | Trading Services | 1.21 | 40.88 | 20504.891 |
| 1066 | RHB Capital Berhad | Financial | 1.06 | 9.67 | 19698.345 |
| 5246 | Westports Holdings Berhad | Trading Services | 0.93 | 32.98 | 14,356.10 |
| 1082 | Hong Leong Financial Group Berhad | Financial | 0.64 | 11.20 | 16654.790 |
| 5235SS | KLCC Real Estate Investment Trust | Trusts | 0.63 | 15.31 | 12637.331 |