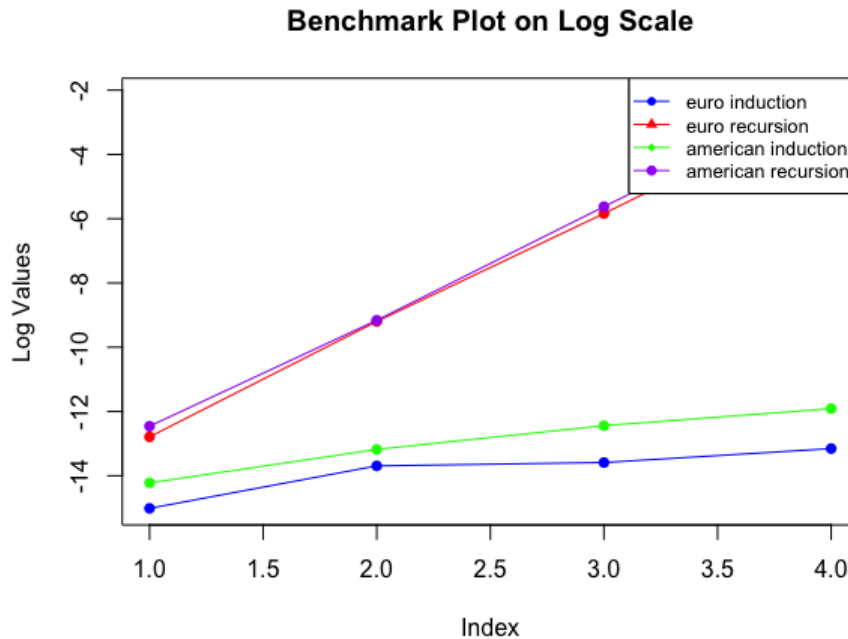


C project

Benchmark:

The plot provided below shows the execution times for the European and American options for both induction and recursive methods.



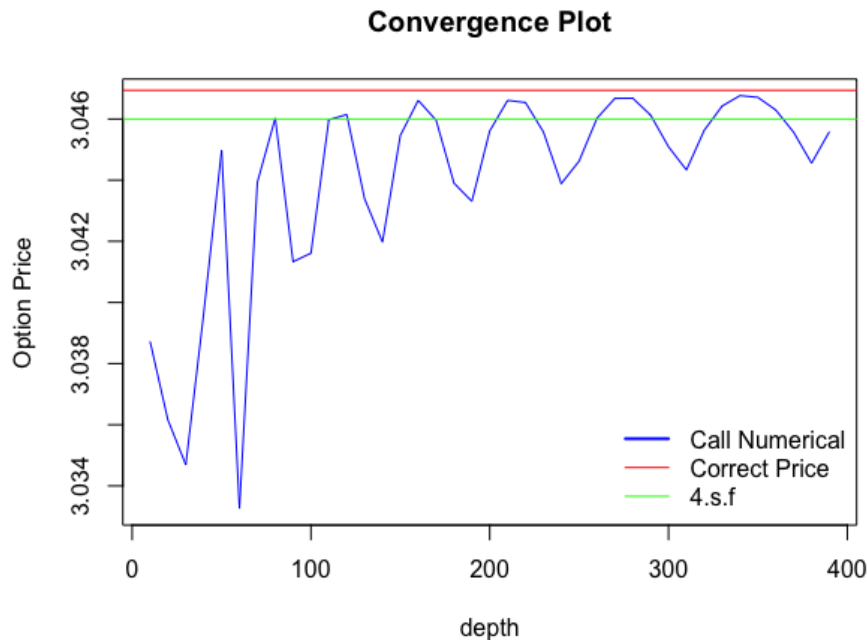
From this plot, it is clear to see that the induction methods are computationally more efficient than recursion as they have a shorter execution time. It is also worth noting that European options for both methods have a smaller execution time than American options, however, this is not surprising as the American option requires additional code to compute the exercise price at each t .

Also, worth mentioning, the x axis is the depth values $5x$, i.e. depth values of 5, 10, 15 and 20. Therefore, we can also see that in both methods the execution time increases with depth. Expected as more computationally challenging.

As both methods provide an accurate answer, I would advise using the induction method when pricing options as it is significantly more efficient.

Convergence:

The plot below shows the convergence behaviour of the inductive algorithm.



From the plot above, we can see that as depth increases the option price converges to the correct analytical solution (red line).

From this plot, it looks like the error fluctuates a lot and does not provide an accurate answer, however, note that the y-axis is quite small so the fluctuation is not as big as it seems.

The binomial method is not strictly converging with respect to depth so we will expect the error to fluctuate. However, the fluctuations are less with a higher depth.

To get an accuracy of 4 significant figures I have provided a green line at 3.046. From the plot, we can see that a depth of just under 100 gives a result which is accurate up to 4 significant figures. Therefore, I would recommend using a depth of at least 100 in order to achieve an accurate answer.

For an American option, we can use Monte-Carlo methods to generate a fair price for the option. We can then use this fair price as our benchmark, in which we can compare our price (from our C code) to the benchmark and see how accurate we are at different depths.

Also for an American option using binomial method, we can actually compute correct analytical answers by hand for trees with small depths.