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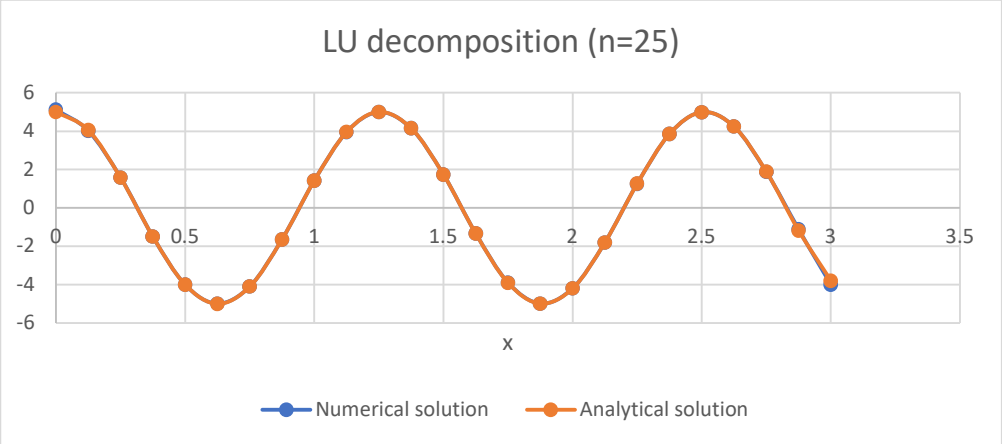
ID5130 - Parallel Scientific Computing

Assignment - 1

1.a)

Status of code: runs-and-gives-correct-result

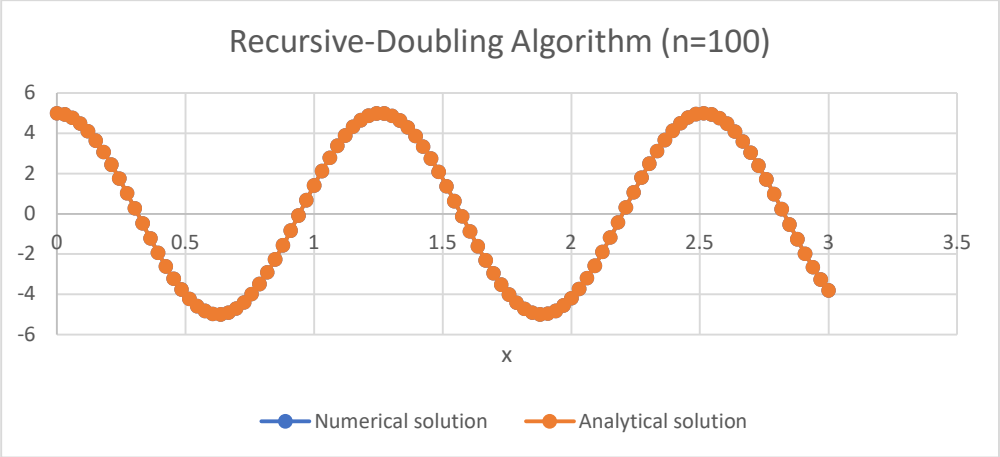
The following plot represents obtained the numerical and analytical solution as a function of x using LU decomposition. Both the numerical and analytical solution plots are overlapping one another. Therefore, the result of LU decomposition is correct.



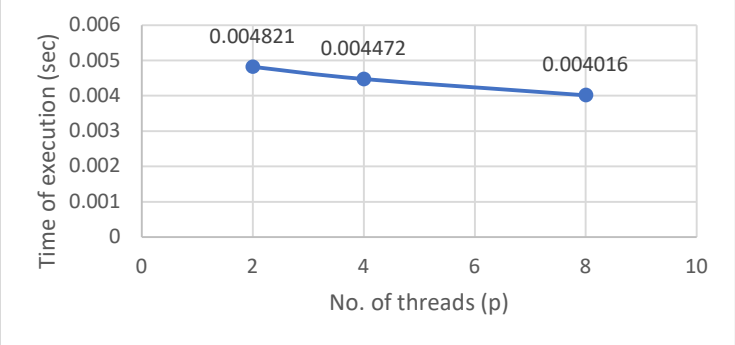
1.b)

Status of code: runs-and-gives-correct-result

The following plot represents obtained the numerical and analytical solution as a function of x using Recursive-Doubling Algorithm (for n=100 using p = 2 threads). Both the numerical and analytical solution plots are overlapping one another. Therefore, the result Recursive-Doubling Algorithm is correct.



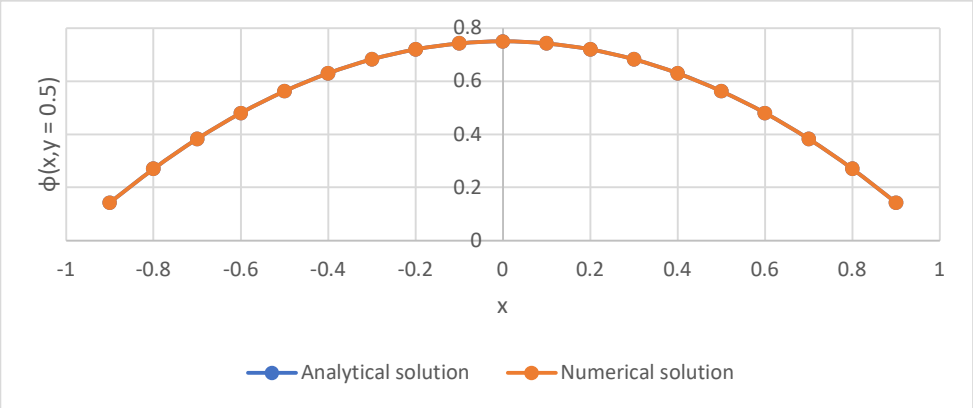
The following plot represents the time of execution for when different no. of threads was used.



2.a)

Status of code: runs-and-gives-correct-result

The following plot represents obtained the numerical and analytical solution as a function of x using serial Gauss-Seidel program (using $\Delta = \Delta x = \Delta y = 0.1$). Both the numerical and analytical solution plots are overlapping one another. Therefore, the result of serial Gauss-Seidel program is correct.



The no. of iterations required to bring the numerical solution to within 1% of the exact solution was equal to '**395'**.

2.b)

Diagonal approach:

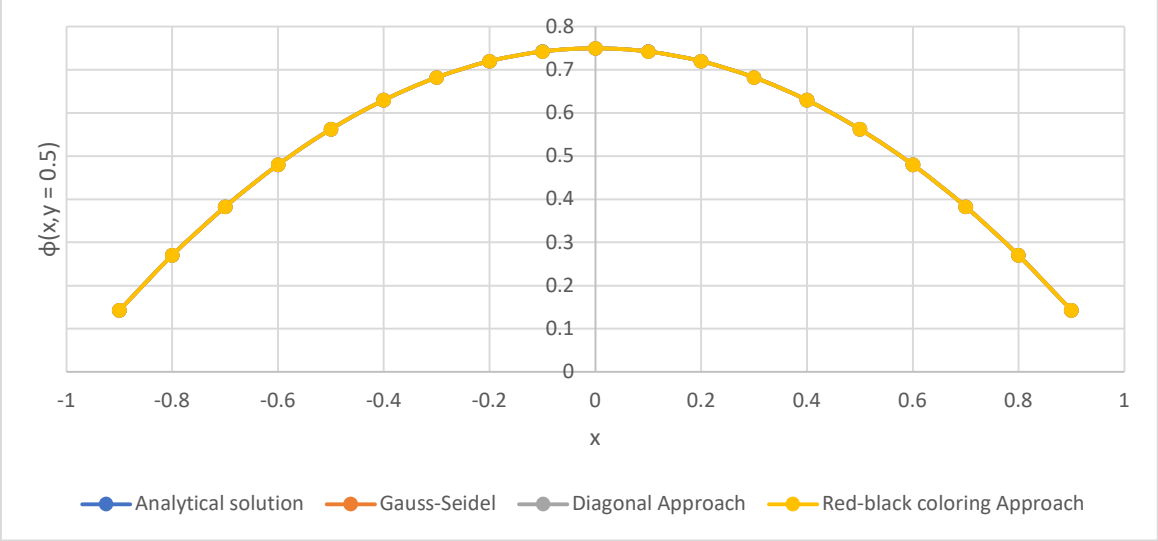
Status of code: runs-and-gives-correct-result

Red-black colouring approach:

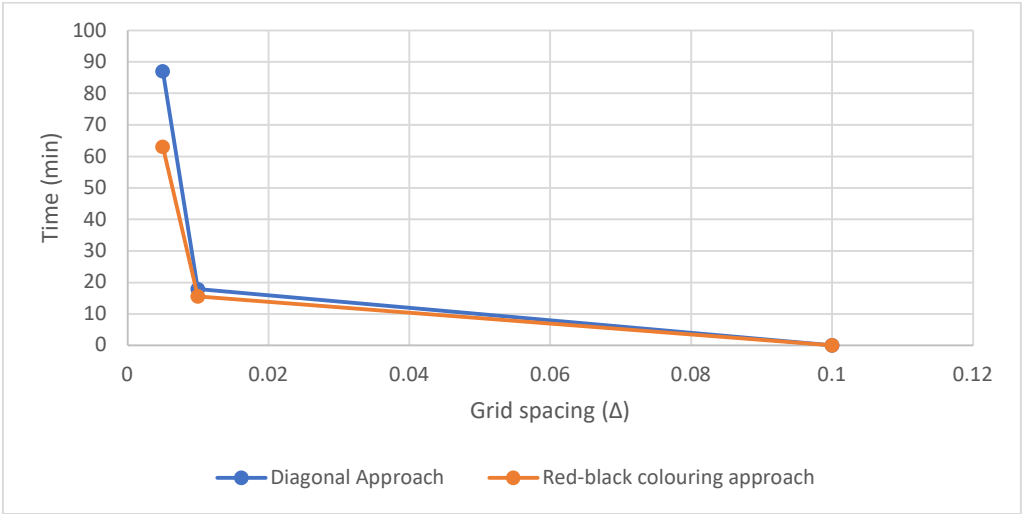
Status of code: runs-and-gives-correct-result

2.c)

The following plot represents obtained the numerical (Gauss-Seidel v/s Diagonal approach v/s Red-black colouring Approach) and analytical solution as a function of x for $\Delta = \Delta x = \Delta y = 0.1$. Both the numerical and analytical solution plots overlap one another. Therefore, we can safely say that the parallel programs are giving the same result as that of the serial program. Hence, verification is successful.



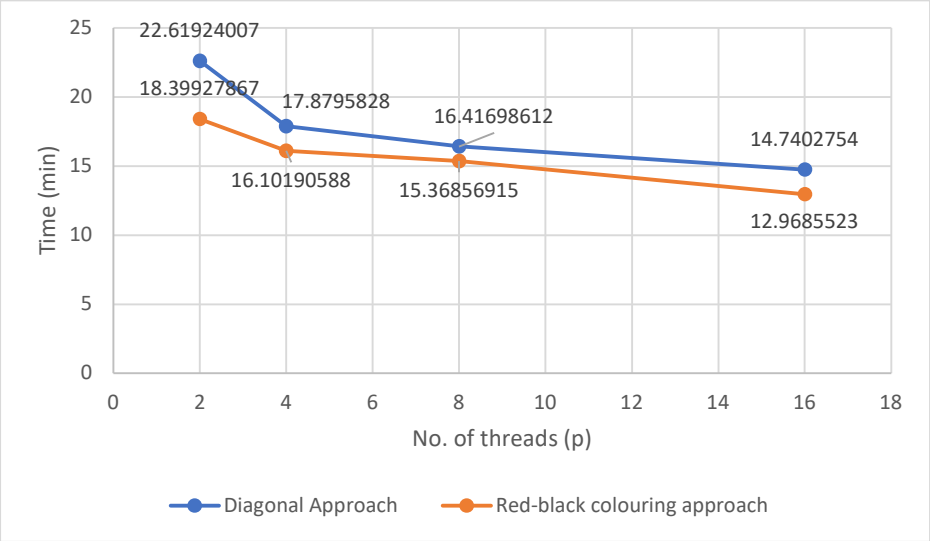
The following plot shows the time of execution for different values of grid spacing (Δ = 0.1, 0.01, 0.05) using p = 8 threads,



From the results obtained using the above parallel programs performance (accuracy) of red-black approach is better.

2.d)

The following plot shows the time of execution for different values of p = 2,4,8,16 using grid spacing Δ =0.01 (I used 0.01 instead of 0.05 because my pc was very slow and took long to converge to 1% of exact solution),



From the results obtained using the above parallel programs it is evident that red-black approach is better than diagonal approach.