# COMP526: Computational Methods for Scientists, Fall 2022
# Assignment 6 - Due Friday 11/16/22

Under your home directory create a directory assign6. cd assign6 and create your fortran 90 source file assign6.f90 in it. Investigate in Wikipedia

https://en.wikipedia.org/wiki/List_of_numerical_analysis_topics#Numerical_methods_for_ordinary_differential_equations

and write your Fortran 90 code for:

Solve the linear system $Ax = b$ with solution $(\phi(h), \cdots, \phi(7h))^T, \phi(x) = x\,\cos x, h = \frac{\pi}{4}$

$$A = \begin{bmatrix} 2 & -1 & 0 & 0 & 0 & 0 & 0 \\ -1 & 2 & -1 & 0 & 0 & 0 & 0 \\ 0 & -1 & 2 & -1 & 0 & 0 & 0 \\ 0 & 0 & -1 & 2 & -1 & 0 & 0 \\ 0 & 0 & 0 & -1 & 2 & -1 & 0 \\ 0 & 0 & 0 & 0 & -1 & 2 & -1 \\ 0 & 0 & 0 & 0 & 0 & -1 & 2 \end{bmatrix}, \quad b = h^2 \begin{bmatrix} \rho(h) \\ \rho(2h) \\ \rho(3h) \\ \rho(4h) \\ \rho(5h) \\ \rho(6h) \\ \rho(7h) + 2\pi \end{bmatrix}, \quad \rho(x) = 2\,\sin(x) + x\,\cos(x)$$

For the matrix multiplication algorithms, use $C = AB$, $B = A$. $A$ symmetric and positive-definite matrix.

Topics:

1. Farid: Strassen algorithm (matrix multiplication)
2. Jenna: Coppersmith-Winograd algorithm (matrix multiplication)
3. Hiro: Freivalds' algorithm (matrix multiplication)
4. Carlos: Jacobi method (solving systems of linear equations)
5. Ben: Gauss-Seidel method (solving systems of linear equations)
6. Shuchi: Successive over-relaxation or SOR (solving systems of linear equations)
7. Audrey: Symmetric successive over-relaxation or SSOR (solving systems of linear equations)
8. Keerthan: Modified Richardson iteration (solving systems of linear equations)
9. Shivani: Conjugate gradient method or CG (solving systems of linear equations)
10. Harresh: Biconjugate gradient method or BiCG (solving systems of linear equations)
11. Kshitij: Biconjugate gradient stabilized method or BiCGSTAB (solving systems of linear equations)
12. Vedika: Conjugate residual method (solving systems of linear equations)
13. Hayden: Kaczmarz method (solving systems of linear equations)
14. Amartya: Uzawa iteration (solving systems of linear equations)
15. Mohsin: Power iteration (eigenvalue algorithms)
16. Thomas: Arnoldi iteration (eigenvalue algorithms)
17. Karthik: Incomplete Choleski factorization (preconditioner for solving systems of linear equations)
18. Venkata: Row echelon form (solving systems of linear equations)
19. Monisha: Bareiss algorithm (solving systems of linear equations)
20. Zachary: Tridiagonal matrix algorithm (solving systems of linear equations)
21. Harshith: Crout matrix decomposition (solving systems of linear equations)
22. Devin: Choleski-Banachiewicz algorithm (Choleski decomposition in solving systems of linear equations)
23. Lukeman: Choleski-Crout algoritm (Choleski decomposition in solving systems of linear equations)