CMPT-439 Numerical Computation
Project 4

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1. (**70 points including 15 extra credit points. If you do not want to get extra credit, just start from Task 2**). If you work on this problem, you should proceed right to #3, you do not need #2. Use C++ or any other high-level language, but not Matlab.

   a) Design a function for evaluation of the determinant of an *n* x *n* matrix. This function shall have a single argument – a matrix whose determinant is evaluated. You may look for an algorithm or a code on the web (including generative AI). But if you found it on the web and use it in your program, you need to refer where you found it and comment on every single line showing that you understand it.
   b) Design a function to utilize the Cramer's rule for solving a system of *n* equations in *n* unknowns. The only input argument of this function should be the augmented matrix of the system. The function shall check whether the determinant of the system matrix is non-zero, and if so, then a vector containing the solutions should be returned; otherwise, a message that the system is singular should be displayed. To evaluate determinants, use a function, which you designed in a)

2. (**55 points – Alternative to Task 1 for those who did not work on Task 1**) Design a function in MATLAB using the m-language to utilize the Cramer's rule for solving a system of *n* equations in *n* unknowns. The only input argument of this function should be the augmented matrix of the system. The function shall check whether the determinant of the system matrix is non-zero, and if so, then a vector containing the solutions should be returned; otherwise a message that the system is singular should be displayed.

3. (**40/100**) Using the Cramer's rule and functions, which you designed, solve the following systems of linear equations determined by the following augmented matrices

   a) $\left[\begin{array}{rrr|r} 3 & 1 & -4 & 7 \\ -2 & 3 & 1 & -5 \\ 2 & 0 & 5 & 10 \end{array}\right]$

   b) $\left[\begin{array}{rrr|r} 1 & -2 & 4 & 6 \\ 8 & -3 & 2 & 2 \\ -1 & 10 & 2 & 4 \end{array}\right]$

4. (**5 points**) Write a brief report presenting your solution and demonstrating your understanding of this solution.
5. Turn in your source code, a screen shot of its test run and your technical report with the results.