

# ASDS 5303 Project 1

**DUE BY: Friday Sept 13th**

For this project use Word or Latex to type up your report. Also include the R-code you have used. Manual calculations will not be accepted unless asked in the question.

- Q1: Use sample function to generate a random 20x20 matrix A with integers in [-10, 10]. Print A
- Q2: Generate a 20-dimensional vector b with real numbers in [-10, 10]. Print b
- Q3: Print the 2<sup>nd</sup> row of A
- Q4: Print the element in the 2<sup>nd</sup> row and 3<sup>rd</sup> column of A
- Q5: Print all the diagonal elements of A.
- Q6: Print the upper triangular part of A, including the diagonal elements
- Q7: Print the low triangular part of A, not including the diagonal elements.
- Q8: Combine A and b to one augmented matrix  $M = [A | b]$ . Print M
- Q9: Think of a way to double check M is correct. Remember M, A are large size.
- Q10: Solve the equation  $Ax = b$  for x using row echelon form.
- Q11: Is A invertible? Defend your answer. You need to show **at least 2** different methods to check the invertibility of A. If A is invertible, find the inverse of A.
- Q12: If A is invertible, compute A's inverse and A's inverse multiplying b. If A is not invertible, what does it say about the solution for  $Ax = b$ ?
- Q13: Check whether A's inverse multiplying b is the same as the solution of equation  $Ax = b$ . Yes or No.
- Q14: Use sample function to generate a random 20x20 matrix B with integers in [11, 20]. Print B
- Q15: Verify transpose of  $A + B$  is equal to transpose of A + transpose of B
- Q16: Verify transpose of (A multiplies B) is equal to transpose of B multiplies transpose of A
- Q17: Create a 20x20 identity matrix, I20
- Q18: Create matrix  $M2 = [A | I20]$
- Q19: Compute the reduced echelon form of M2
- Q20: Obtain inverse of A from reduced echelon form of M2

**Bonus Question:**

*The following questions will not be graded as bonus points. Completing this section is optional but highly recommended*

- a) Create two matrices A is 30x30, and B is 30 x30, and I20 and I30 identity matrices,
- b) Create matrix  $M2 = \begin{bmatrix} A & I_{30} \\ I_{30} & B \end{bmatrix}$
- c) Compute the reduced echelon form of M2
- d) Obtain inverse of A from reduced echelon form of M2
- e) Compare the reduced echelon form of D with D itself. Can you tell some similarities?

**Challenge Yourself:**

*The following questions will not be graded but are provided as means to challenge yourself. Material for these questions may not have been covered in class so completing this section is optional*

Q1: Generate a random 20x20 matrix A from uniform distribution. Print A

Q2: Generate a 20-dimensional vector b from Normal distribution. Print b

Q3: Print the 2<sup>nd</sup> and 5<sup>th</sup> row of A together

Q4: Print the 3<sup>rd</sup> and 13<sup>th</sup> column of A together

Q5: In Q11 of the assignment you identified two ways to check if the matrix is invertible, can you think of any other ways to check if A is invertible