

## COMP3670/6670: Introduction to Machine Learning

- Points possible: 5 (if your score is no greater than 2, you should consider to drop this course.)

### Problem 1: Matrix addition and Multiplication

(1pt) We have three matrices:  $\mathbf{A} \in R^{3 \times 2}$ , *i.e.*, real-valued 3 by 2 matrix;  $\mathbf{B} \in R^{2 \times 1}$ ;  $\mathbf{C} \in R^{3 \times 1}$ .

$$\mathbf{A} = \begin{bmatrix} 1 & -1 \\ 0 & 1 \\ 2 & -1 \end{bmatrix}, \mathbf{B} = \begin{bmatrix} 1 \\ 2 \end{bmatrix}, \mathbf{C} = \begin{bmatrix} -3 \\ -1 \\ 0 \end{bmatrix}. \text{ Calculate } \mathbf{AB} + \mathbf{C}.$$

**Problem 2: Gaussian Elimination for System of Linear Equations**

(2 pts) Solve the following system of linear equations. You can use any method you know of, such as intuitively solving it, or using the constructive Gaussian Elimination method.

$$\begin{cases} x_1 + x_2 + x_3 = 4 \\ 2x_2 + x_3 = 2 \end{cases}$$

**Problem 3: Group**

(1pt) Consider the set  $\{1, -1\}$  together with the operation multiplication (*i.e.*,  $\times$ ). Is this set a Group? Please explain.

**Problem 4: properties of matrix transpose**

(1pt) For  $\mathbf{A} \in \mathbb{R}^{m \times n}$ ,  $\mathbf{B} \in \mathbb{R}^{m \times n}$ , prove that  $(\mathbf{A} + \mathbf{B})^T = \mathbf{A}^T + \mathbf{B}^T$