Master of Science in Analytics
MSCA 37016 – Advanced Linear Algebra for Machine Learning

Instructions:
- Mark the question number and your final answer clearly (use a textbox.)
- Remember to show and explain your work (*If you can't explain it, you don't understand it.*)
- Please submit your solution through Canvas.

Let

$$A = \begin{bmatrix} 0 & 3 & -1 \\ -1 & 4 & -2 \\ 1 & 3 & 1 \end{bmatrix}$$

$$B = \begin{bmatrix} 2 & -1 & 2 \\ -1 & 0 & 1 \\ -1 & 2 & 2 \end{bmatrix}$$

$$v = \begin{bmatrix} 2 \\ -1 \\ 4 \end{bmatrix}$$

$$u = \begin{bmatrix} -2 \\ 1 \\ 5 \end{bmatrix}$$

$$a = -2$$

$$b = 1$$

(3 points) Question 1:
1) 2% - Calculate

$$\|v\|_1 v + au$$

2) 1% - Validate your answer using Python.

(4 points) Question 2:
1) 3% - Using the cosine formula, and assuming the angle between vectors v and u is equal to θ, calculate $\cos\theta$.
2) 1% - Validate your answer using Python.

(4 points) Question 3:
1) 3% - Calculate

$$a(A \cdot v)$$

2) 1% - Validate your answer using Python.

(4 points) Question 4:
1) 3% - Let $tr(B)$ and L be the trace and lower triangular matrix of matrix B, respectively. Calculate

$$A \cdot B^T + tr(B) * L$$

2) 1% - Validate your answer using Python.