MATH3200: APPLIED LINEAR ALGEBRA
PRACTICE MODULE 5: ADDITION, SUBTRACTION, TRANSPOSE OF MATRICES AND MULTIPLICATION BY A SCALAR

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This module uses the terminology and notation of Lecture 4.

Consider the following matrices:

$$\mathbf{A} = \begin{bmatrix} 1 & 2 \\ 3 & 4 \\ 5 & 6 \end{bmatrix} \qquad \mathbf{B} = \begin{bmatrix} 0 & -1 & 4 \\ -2 & 2.5 & 6 \end{bmatrix}$$

Question 5.1: Compute $\mathbf{A} - \mathbf{B}$ or indicate that it is undefined.

Question 5.2: Compute $\mathbf{B}^T$ or indicate that it is undefined.

Question 5.3: Compute $3\mathbf{A}$ or indicate that it is undefined.

Question 5.4: Compute $\mathbf{A}^T + 4\mathbf{B}$ or indicate that it is undefined.

Question 5.5: Compute $3\mathbf{A}^T + \mathbf{B}^T$ or indicate that it is undefined.

Question 5.6: Suppose $\mathbf{D}$ represents flying times, in hours, between certain airports. Express the matrix $\mathbf{M}$ of flying times in minutes by using one of the operations that you learned in Lecture 4.

Question 5.7: Suppose $\vec{\mathbf{d}}$ is the vector of departure times of n direct flights from Columbus, Ohio to Orlando, FL that take λ hours each. Let $\vec{\mathbf{1}} = [1, 1, \dots, 1]$ be the row vector of length n that contains only 1s as its elements. Express the vector $\vec{\mathbf{a}}$ of arrival times in terms of operations on these vectors.

Question 5.8: Suppose $\vec{\mathbf{d}}$ is the vector of departure times of n direct flights from Columbus, Ohio to Los Angeles, CA that take λ hours each. Let $\vec{\mathbf{1}} = [1, 1, \dots, 1]$ be the row vector of length n that contains only 1s as its elements. Express the vector of arrival times in terms of operations on suitable vectors. *Hint:* Here you need to account for the different time zones.

Question 5.9: Prove that for any matrices $\mathbf{A}$, $\mathbf{B}$ of the same order and scalar λ the distributivity law $\lambda\mathbf{A} + \lambda\mathbf{B} = \lambda(\mathbf{A} + \mathbf{B})$ holds. *Hint:* Prove the law first for matrices of order 2×2, and then generalize to matrices of arbitrary order.