

ECE 3340 Numerical Methods

Homework 3: Complexity Analysis

Name: ID:

Solve the following problems from **Chapter 3, Discrete Math and Complexity**. Use any available space to work out the problem and **place your final solution in the box provided**.

Problem 1: Provide the computational complexity of each operation using big-O notation.

$\mathbf{A}\mathbf{v}$ where $\mathbf{A} \in \mathbb{R}^{N \times N}$

Multiply N vectors $\mathbf{v}_i \in \mathbb{R}^3$ by a transformation matrix $T \in \mathbb{R}^{3 \times 3}$

$\mathbf{Y} = \mathbf{A}\mathbf{B}\mathbf{x}$ where $\mathbf{A} \in \mathbb{R}^{N \times M}$, $\mathbf{B} \in \mathbb{R}^{M \times N}$ and $\mathbf{x} \in \mathbb{R}^N$

$\mathbf{x} \cdot \mathbf{y}$ where $\mathbf{x}, \mathbf{y} \in \mathbb{R}^N$ (this is known as the *dot product*: $\mathbf{x}^T \mathbf{y}$)

$\mathbf{x} \otimes \mathbf{y}$ where $\mathbf{x}, \mathbf{y} \in \mathbb{R}^N$ (this is known as the *tensor product*: \mathbf{xy}^T)

Problem 2: Use two iterations of Horner's algorithm to calculate $p(x)$ and $p'(x)$

$$p(x) = 3x^4 - x^2 + 2x + 13 \quad \text{for} \quad x = 5$$

calculate $p(5)$ using synthetic division:

calculate $p'(5)$ using synthetic division:

$p(5) =$

$p'(5) =$