

MATH 4334.001/CS 4334.001
Fall 2023
Paper Homework 1 Solutions

1. Evaluate the polynomial $p(x) = x^6 - 4x^4 + 2x^2 + 1$ at $x = 1/2$ using nested multiplication.

We have

$$\begin{aligned} p(x) &= 1 + 2x^2 - 4x^4 + x^6 \\ &= 1 + x^2(2 + x^2(-4 + x^2)) \end{aligned}$$

so that

$$\begin{aligned} p\left(\frac{1}{2}\right) &= 1 + \left(\frac{1}{2}\right)^2 \left(2 + \left(\frac{1}{2}\right)^2 \left(-4 + \left(\frac{1}{2}\right)^2\right)\right) \\ &= \frac{81}{64} \end{aligned}$$

2. Write a pseudocode for the following doubly scripted sum

$$\sum_{j=1}^n \sum_{i=1}^n a_{ij}$$

Here's one possible pseudocode:

```
sum ← 0.0
for j = 1 to n do
  for i = 1 to n do
    sum ← sum + aij
  end for
end for
```

3. Using summation and product notation, write mathematical expressions for the following pseudocode:

```
 $v \leftarrow a_0$   
for  $i = 1$  to  $n$  do  
     $v \leftarrow vx + a_i$   
end for
```

We get

$$\begin{aligned} v &= \sum_{i=0}^n a_i x^{n-i} \\ &= a_0 x^n + a_1 x^{n-1} + a_2 x^{n-2} + \cdots + a_{n-1} x + a_n \\ &= a_n + a_{n-1} x + \cdots + a_2 x^{n-2} + a_1 x^{n-1} + a_0 x^n \\ &= a_n + x(a_{n-1} + \cdots + x(a_2 + x(a_1 + a_0 x)) \cdots) \end{aligned}$$