**MAT 230 Module Three Homework**

**General:**

* Before beginning this homework, be sure to read the textbook sections and the material in Module Three.
* Type your solutions into this document and be sure to show all steps for arriving at your solution. Just giving a final number may not receive full credit.
* You may copy and paste mathematical symbols from the statements of the questions into your solution. This document was created using the Arial Unicode font.
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1. The following function, written in pseudocode, inputs *INCOME* as a variable and outputs the *TAX* corresponding to that income. You can think of this as a greatly simplified income tax.
2. **IF** (*INCOME* ≥ 90,000) **THEN**
   1. *TAX* ← 14,000 + 0.3 (*INCOME* – 90,000)
3. **ELSE**
   1. **IF** (*INCOME* ≥ 40,000) **THEN**
      1. *TAX* ← 4,000 + 0.2 (*INCOME* – 40,000)
   2. **ELSE**
      1. *TAX* ← 0.10 *INCOME*

What is the pseudocode output for the following inputs? Explain your solution.

1. 27,000
2. 98,000
3. 65,000

This problem is similar to Example 6 and to Exercise 1 in Appendix A of your SNHU MAT230 textbook.

1. TAX 2,700 because income is less than 90K and 40K so the second branch of the else statement executes.
2. TAX 16,400 because income is greater than 90K so the first branch of the if statement executes.
3. TAX 9,000 because the income is less than 90K but greater than 40K so the first branch of the else statement executes.
4. Suppose that the array X consists of real numbers X[1], X[2], …, X[N]. Write a pseudocode program to compute the minimum of these numbers.

This problem is similar to Example 12 and to Exercises 13–16 in Appendix A of your SNHU MAT230 textbook.

* 1. MAX ← X[1]
  2. FOR I = 2 THRU N
     1. IF (MAX < X[I]) THEN
        1. MAX ← X[I]
  3. RETURN (MAX)

1. Consider the following algorithm; assume N to be a positive integer.
2. X ← 0
3. Y ← 1
4. WHILE (X < N)
   1. X ← X + 1
   2. Y ← Y + 2 X
5. Y ← Y / N

Calculate what value of Y the algorithm will compute for the following values of N. Explain your solution.

1. N = 3
2. N = 5

This problem is similar to Example 7 and to Exercise 22 in Appendix A of your SNHU MAT230 textbook.

1. , because this algorithm sets N to 3. It then checks if X, which is 0, is less than N (3), which it is. So, we add 1 to X to get 1. Then we set Y, which is initially 1, to Y + 2X, which gives us 1 + 2(1), or 3. The loop then iterates again because X(1) is still less than N(3). It will iterate 3 times total. At the end of the iterations X = 3 and Y = 13. Finally we divide Y (13) by N (3) and set that value to Y. That value is .
2. , because this algorithm sets N to 5. It then checks if X, which is 0, is less than N (5), which it is. So, we add 1 to X to get 1. Then we set Y, which is initially 1, to Y + 2X, which gives us 1 + 2(1), or 3. The loop then iterates again because X(1) is still less than N(3). It will iterate 5 times total. At the end of the iterations X = 5 and Y = 31. Finally we divide Y (31) by N (5) and set that value to Y. That value is .
3. Use the Euclidean algorithm to find the greatest common divisor d of 313,626 and 152,346. Then use this algorithm to find integers s and t to write d as 313,626 s + 152,346 t. Solving these types of equations, for much larger integers, is central to encryption schemes such as RSA (public key) encryption.

This problem is similar to Examples 5 and 6 and to Exercises 6–9 in Section 1.4 of your SNHU MAT230 textbook.

In terms of 313,626s + 152,346t:

1. If f6 is the mod-6 function, compute each of the following.
2. f6(22) + f6(27)
3. f6(22 + 27)
4. f6(22) × f6(27)
5. f6(22 × 27)

This problem is similar to Example 9 and to Exercises 16–17 in Section 1.4 of your SNHU MAT230 textbook.

1. 7
2. 7
3. 12
4. 0
5. Write the binary (base 2) and hexadecimal (base 16) expansions for each of the following numbers:
6. 46 (this represents the symbol for the period in Unicode)
7. 945 (this represents the symbol for the Greek letter “alpha” in Unicode)

This problem is similar to Example 13 and to Exercise 43 in Section 1.4 of your SNHU MAT230 textbook.

1. ,
2. Use Bacon’s code to create a dummy message for THEORY. For the sake of readability, use lowercase letters “a”, “b”, etc. for letters corresponding to 0 and uppercase letters “A”, “B”, etc. for letters corresponding to 1. For example, in Example 15, the letter F would be coded as onCeU.

This problem is similar to Examples 15 and 16 and to Exercise 45 in Section 1.4 of your SNHU MAT230 textbook.

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1. Prove, for n ≥ 1, that 7 + 14 + 21 + … + 7n = 7 n (n + 1) / 2

This problem is similar to Example 1 and to Exercise 4 in Section 2.4 of your SNHU MAT230 textbook.

Base case (n = 1): 7 = =

Assume true for :

Want to show true for :

1. Prove that, for if C, D1, D2, …, Dn are n + 1 sets, that



This problem is similar to Example 2 and to Exercises 18 and 19 in Section 2.4 of your SNHU MAT230 textbook.

Base case (n=1):

Assume true for n = k:

Want to show true for n = k + 1: