**ASSIGNMENT 1**

**chapter 1**

**QUESTION 1**

1. Prove that 0.1n^3 is in Omega(n^2)

Let's consider the function f(n) = 0.1n^3 and g(n) = c \* n^2, where c is a constant.

We want to find c and n0 such that f(n) ≥ g(n) for all n ≥ n0.

0.1n^3 ≥ c \* n^2

Divide both sides by n^2 (assuming n is non-zero):

0.1n ≥ c

Let's choose c = 0.1 and n0 = 1.

For n ≥ 1, we have:

0.1n ≥ 0.1 (since n ≥ 1)

Thus, for c = 0.1 and n0 = 1, we have 0.1n^3 ≥ c \* n^2 for all n ≥ 1.

Therefore, we have proven that 0.1n^3 is in Ω(n^2) with the constants c = 0.1 and n0 = 1.

**QUESTION 2**

1. Solve the following recurrence relationship M(n) = 3M(n-1) + 1, M(0) = 5

M(0) = 5

M(1) = 3M(0) + 1 = 3(5) + 1 = 16

M(2) = 3M(1) + 1 = 3(16) + 1 = 49

M(3) = 3M(2) + 1 = 3(49) + 1 = 148

M(n) = 3M(n-1) + 1

= 3[3M(n-2) + 1] + 1

= 3^2 M(n-2) + 3 + 1

= 3^2 [3M(n-3) + 1] + 3 + 1

= 3^3 M(n-3) + 3^2 + 3 + 1

M(n) = 3^n M(0) + 3^(n-1) + 3^(n-2) + ... + 3^2 + 3 + 1

= 3^n (5) + 3^(n-1) + 3^(n-2) + ... + 3^2 + 3 + 1

Therefore, the general formula for M(n) in terms of n is:

M(n) = 3^n (5) + 3^(n-1) + 3^(n-2) + ... + 3^2 + 3 + 1

**QUESTION 3**

1. Using your Euclid Algorithm code, answer the following questions:

GCD of 43263 and 5052 is  .

GCD of 42138 and 5130 is  .

GCD of 10890 and 5370 is  .

GCD of 35568 and 5052 is  .

GCD of 18684 and 5394 is  .

**Chapter 2**

**QUESTION 1**

1. Consider the following 2D points: P = {(79, 49), (37, 16), (21, 79), (9, 11), (78, 30), (21, 24), (39, 54), (56, 10), (23, 41), (65, 11), }. Use brute force approach to find the closest pair.

Write the index numbers of the closest points in next two boxes:   . Write the distance betweem them here:  .

**QUESTION 2**

1. Using the brute force approach, solve the following knapsack problem: The capacity of the knapsack W = 10. The number of available items = 10. The weights of the items w = ( 3 5 3 4 1 5 4 1 4 2 ). The values of the items v = ( 1 3 3 3 8 8 6 6 7 10 ).

Was item 1 picked? (write 1 if picked and 0 otherwise) 

Was item 2 picked? (write 1 if picked and 0 otherwise) 

Was item 3 picked? (write 1 if picked and 0 otherwise) 

Was item 4 picked? (write 1 if picked and 0 otherwise) 

Was item 5 picked? (write 1 if picked and 0 otherwise) 

Was item 6 picked? (write 1 if picked and 0 otherwise) 

Was item 7 picked? (write 1 if picked and 0 otherwise) 

Was item 8 picked? (write 1 if picked and 0 otherwise) 

Was item 9 picked? (write 1 if picked and 0 otherwise) 

Was item 10 picked? (write 1 if picked and 0 otherwise) 

What is the total value of the picked items? 

What is the total weight of the picked items? 

**QUESTION 3**

1. You are given the following data: Text = 1100111010101000010011110000000100010101101010010001100011010011010101100111010010101010000000010101; Pattern = 011010; Use brute force approach to search the pattern in the text. Write the index of the first character in text where the match is found. Write -1 if a match is not found. 

**QUESTION 4**

1. A Travel Salesperson needs to visit 5 nodes, and come back to the starting node. All nodes are connected to each other, and their distances from each other are given by the following distance matrix. D = {0 6 6 2 6 ; 6 0 7 5 9 ; 6 7 0 8 4 ; 2 5 8 0 5 ; 6 9 4 5 0 }. Use Exhaustive Search approach to find the best path and minimum distance travelled by the salesperson. Write the best path here starting and ending at the first node (for example 135421, without spaces or comma).  Write the minimum distance here: 18.

**Chapter 3**

**QUESTION 1**

1. Consider the following 2D points: P = {(99, 65), (58, 62), (24, 47), (82, 58), (46, 92), (25, 38), (96, 23), (15, 43), (52, 28), (98, 45), }. Use Divide and Conquer approach to find the distance between the closest pair. Write your answer here:  .