



**Answer All Questions (use any programming language .)**

**Question One**

1- Give the complexity in terms of Big O notation for the following algorithm equations?

(b)  $6 \cdot 2^n - 6$

(a)  $5 \cdot n^2 - 6n + 2$

2- Sort the given values using Odd-Even ?

65	70	75	80	85	60	55	50	45
----	----	----	----	----	----	----	----	----

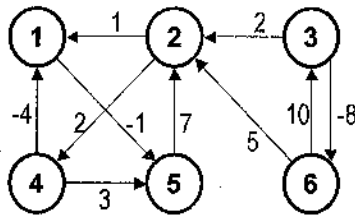
3- The following table show the hourly cost of four types of manufacturing processes. It also shows the number of hours required of each process to produce three different products. Use flow chart or Pseduo code (or any programming lag.) to solve the following:

- - Determine the cost to make one unit of each product
- Suppose we produce 10 units of product 1, 5 of product 2 and 7 of product 3, Compute the total cost.

Process	Hourly Costs (\$)	Required hours to produce one unit		
		Product 1	Product 2	Product 3
Lathe	10	6	5	4
Grinding	12	2	3	1
Milling	14	3	2	5
Welding	9	4	0	3

**Question Two**

- 1- Give the differences between Big O, Theta and Omega complexity?
- 2- According to the following graph :Write adjacency matrix for this graph and Adjacency List . Then find the complexity at each case.



3- A supervisor in the same manufacturing company wants to produce a report from the PRODUCTION input file showing bonuses she is planning to give based on this year's production. She wants to have a report with three columns: last name, first name, and bonus. The bonuses is distributed as follows.

If this year's production is:

- 1,000 units or fewer, the bonus is \$25
- 1,001 to 3,000 units, the bonus is \$50
- 3,001 to 6,000 units, the bonus is \$100
- 6,001 units and up, the bonus is \$200

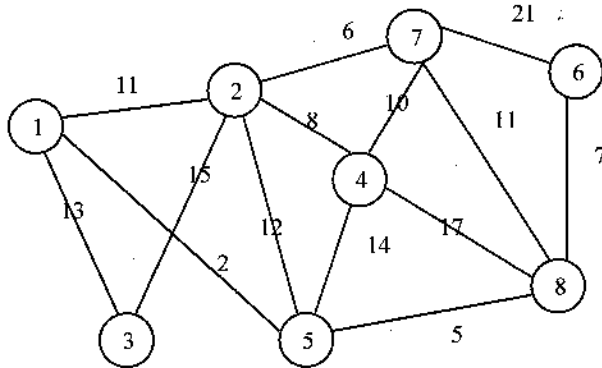
Create the flowchart or pseudocode for this program.

**Question Three**

1- Our coins come in units of 1 cent, 5 cents, 10 cents, 20 cents, 50 cents and 1 dollar. Assuming that there are limited numbers of coin as follows 100, 500, 500, 200, 200 and 1000 respectively , how would you derive a *coin-change algorithm* to compute the **minimum** number of coins required to make up a particular amount?

For example, for 46 cents you need 4 coins: two 20-cent coins, one 5-cent coin, and one 1-cent coin. (Write pseudo code or flow chart for the proposed algorithm)

2- Compute a minimum cost spanning tree for the following graph using Prim's Algorithm or Kruskal's Algorithm



Find the time complexity of the above algorithm

2- The following questions are related to quick sort algorithm is given.

a- What is the best case cost of quicksort? When does it happen? Justify your answer.

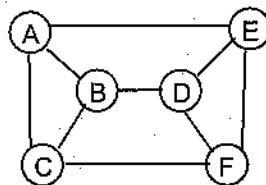
b- If we use quicksort to sort array  $A[9] = \{8, 21, 11, 9, 17, 7, 20, 1, 15\}$ . Show the content of array A after first time partition(), i.e., partition(A, 0, 8), is called. What value does this call return?

```
int partition(A, p, r)
{
    x = A[r]; // use A[r] as the pivot
    i = p-1;
    for (j=p; j<=r-1; j++) {
        if (A[j] <= x) {
            i++;
            exchange(A[i], A[j]);
        }
    }
    exchange(A[i+1], A[r]);
    return i+1;
}
```

**Question Four**

1- Develop an algorithm to implement a system for generating 16 number for mobile charging cards . Consider the constrains (Number reuse, Fabricated number , collision with other numbers

2- Draw the Breadth-First Search suitable data structure that result from a Breadth-First Search of the following graph starting with node A as the source.



**With My Best Wishes Dr. Hatem January 2020**