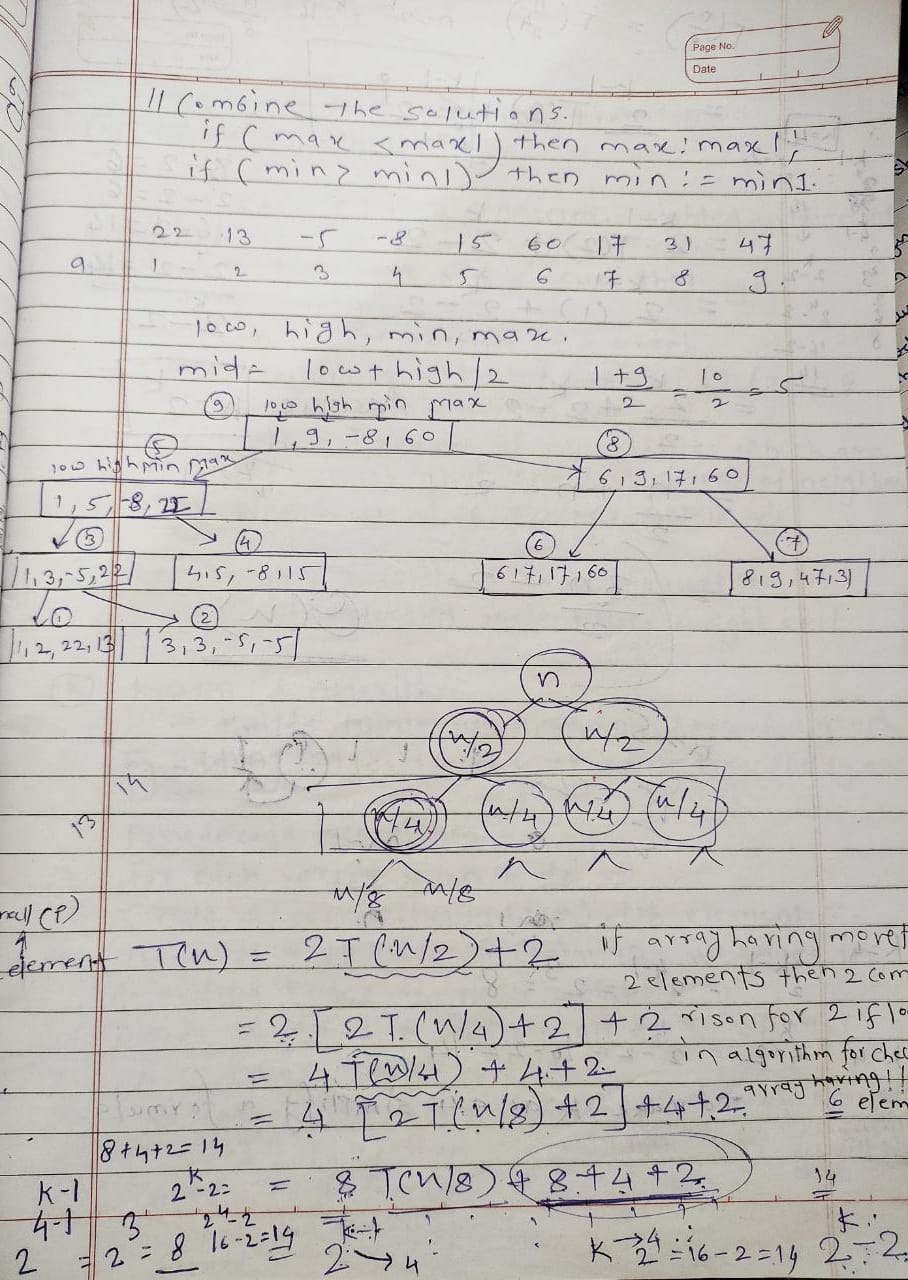
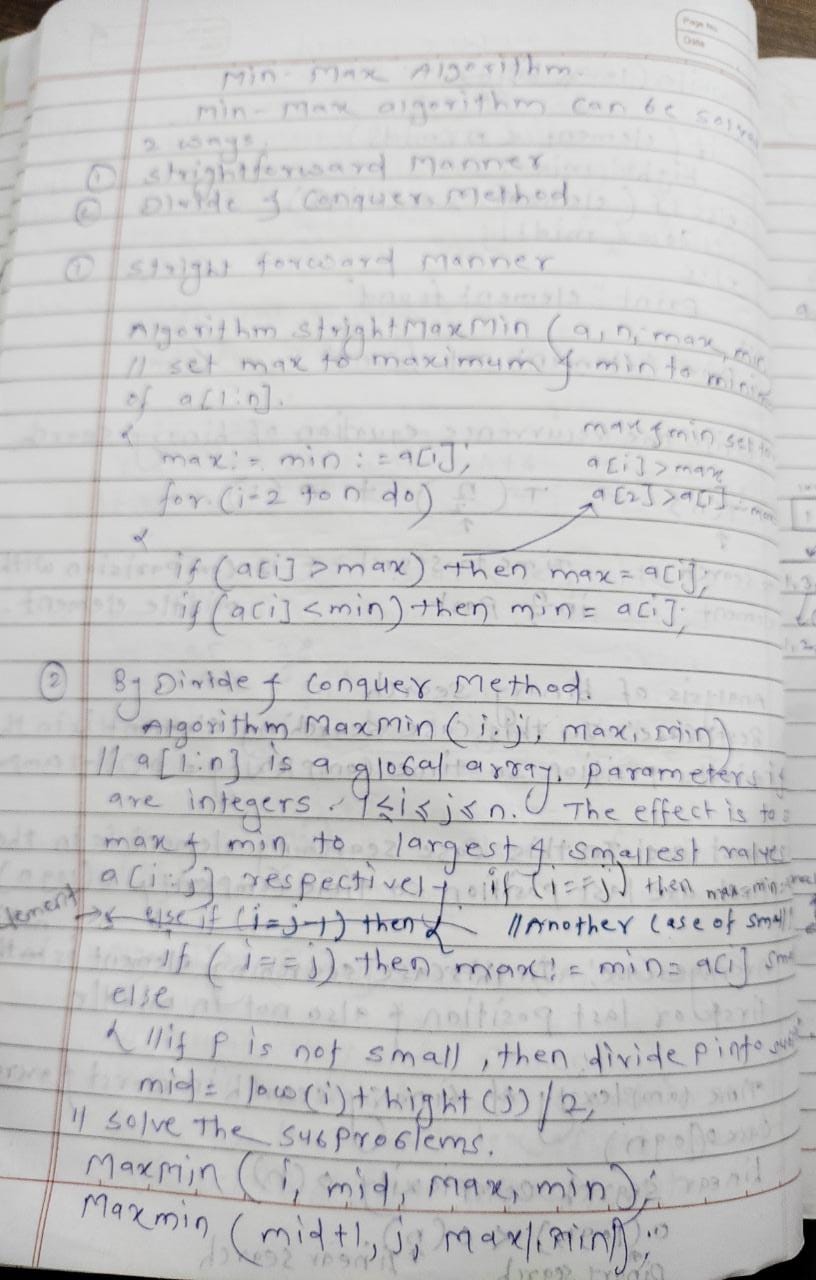
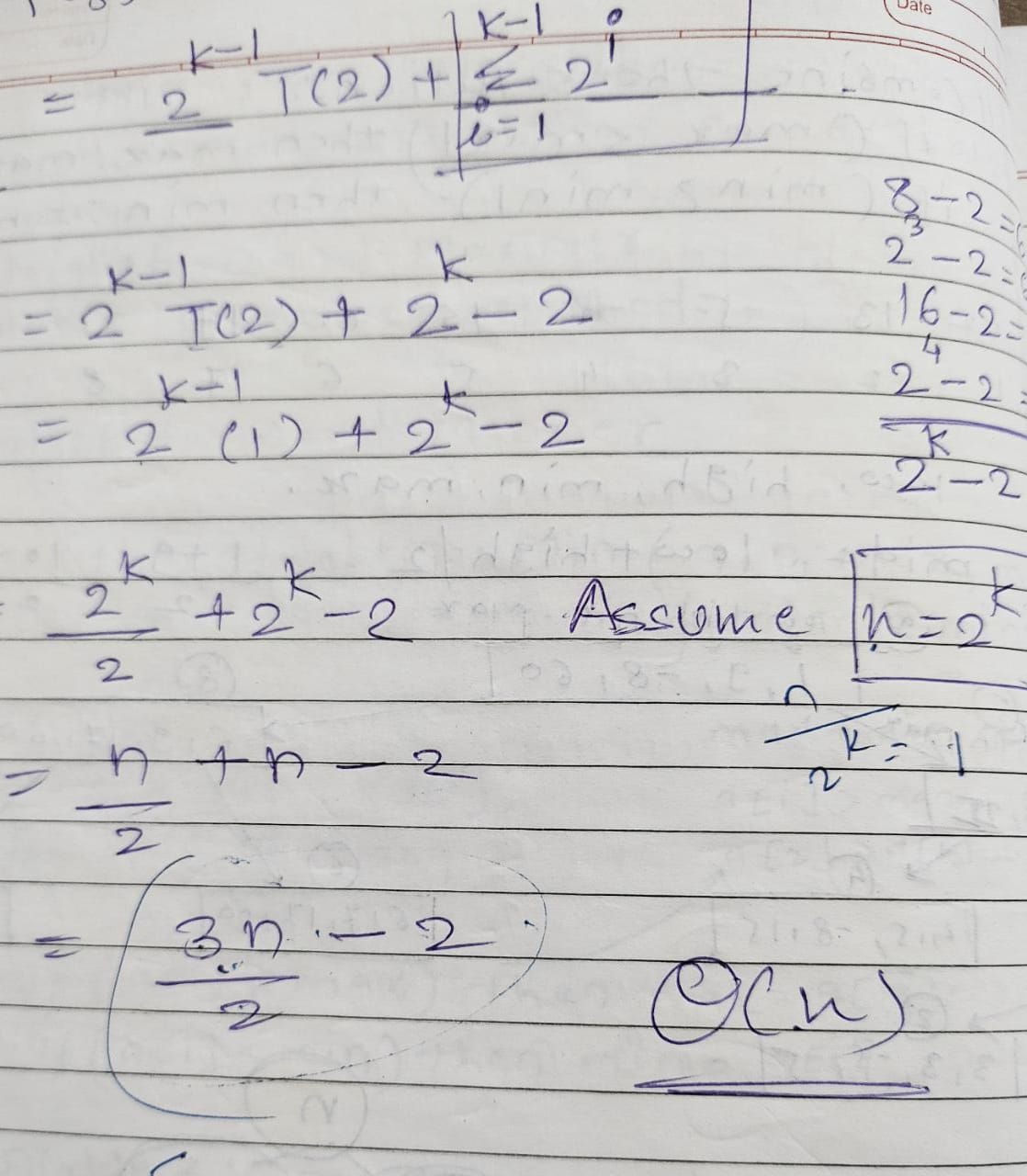
**Q.1 a)Write the algorithm for the min max problem using the divide and conquer approach. Show that its time complexity is O(3n/2) (6M)**

**Algorithm and Explanation of Min Max 3M**

**Time Complexity by Recurrence Relation 3M**

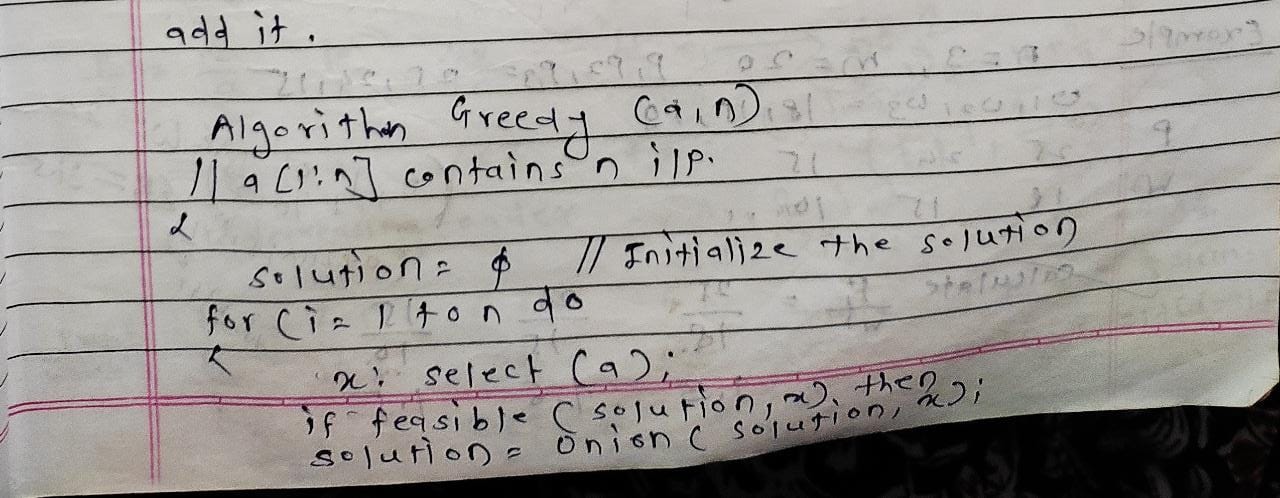
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**Q.1 b2) Explain the Greedy approach and its abstraction**

**The general Method and it’s Working 1M**

**Algorithm 2M**

****

**Q.1 C) Explain graph coloring problem with backtracking approach. Write its Algorithm (7M)**

**Definition 1M**

An undirected graph is given. There is also provided m colors. The problem is to find if it is possible to assign nodes with m different colors, such that no two adjacent vertices of the graph are of the same colors.

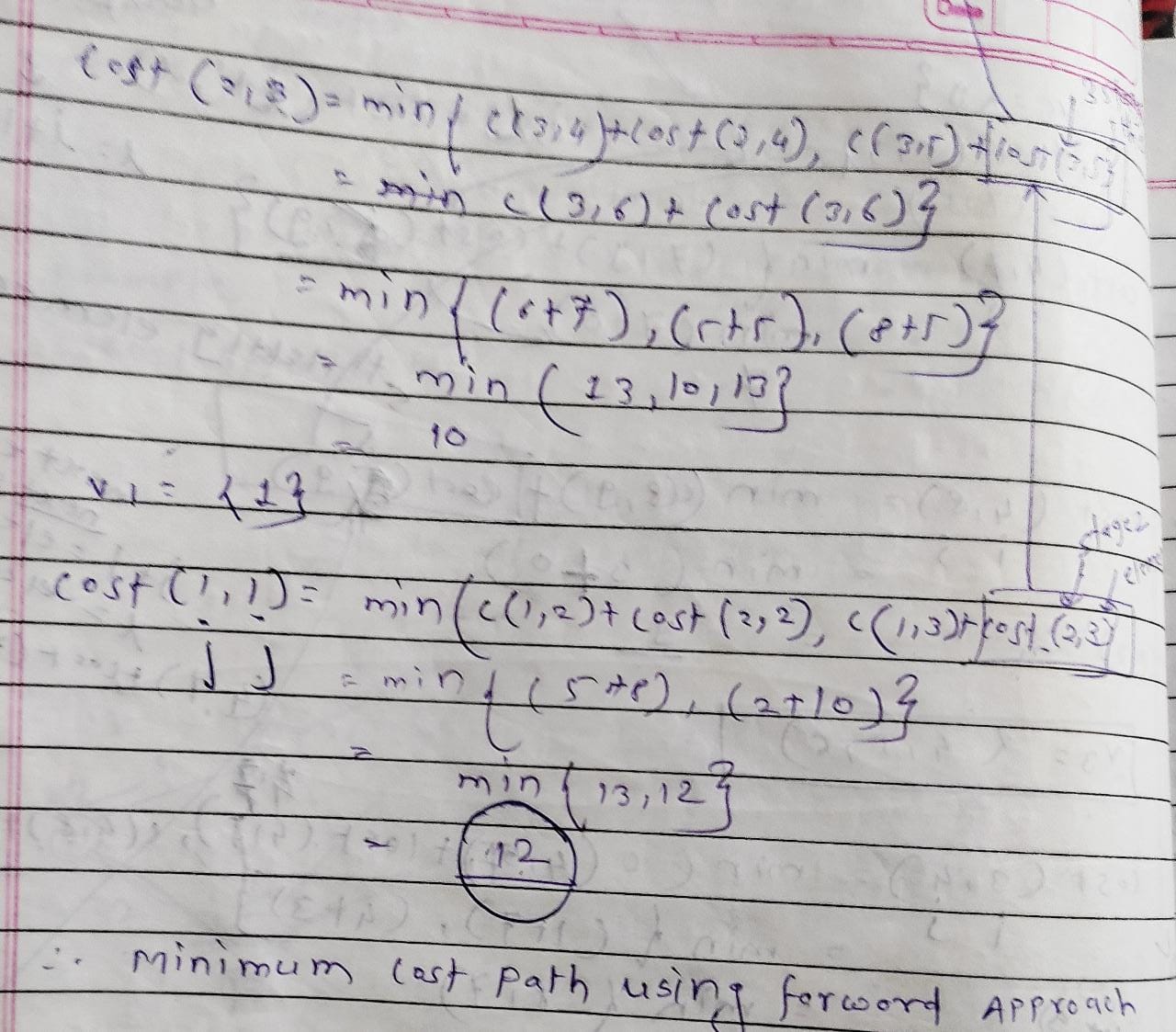
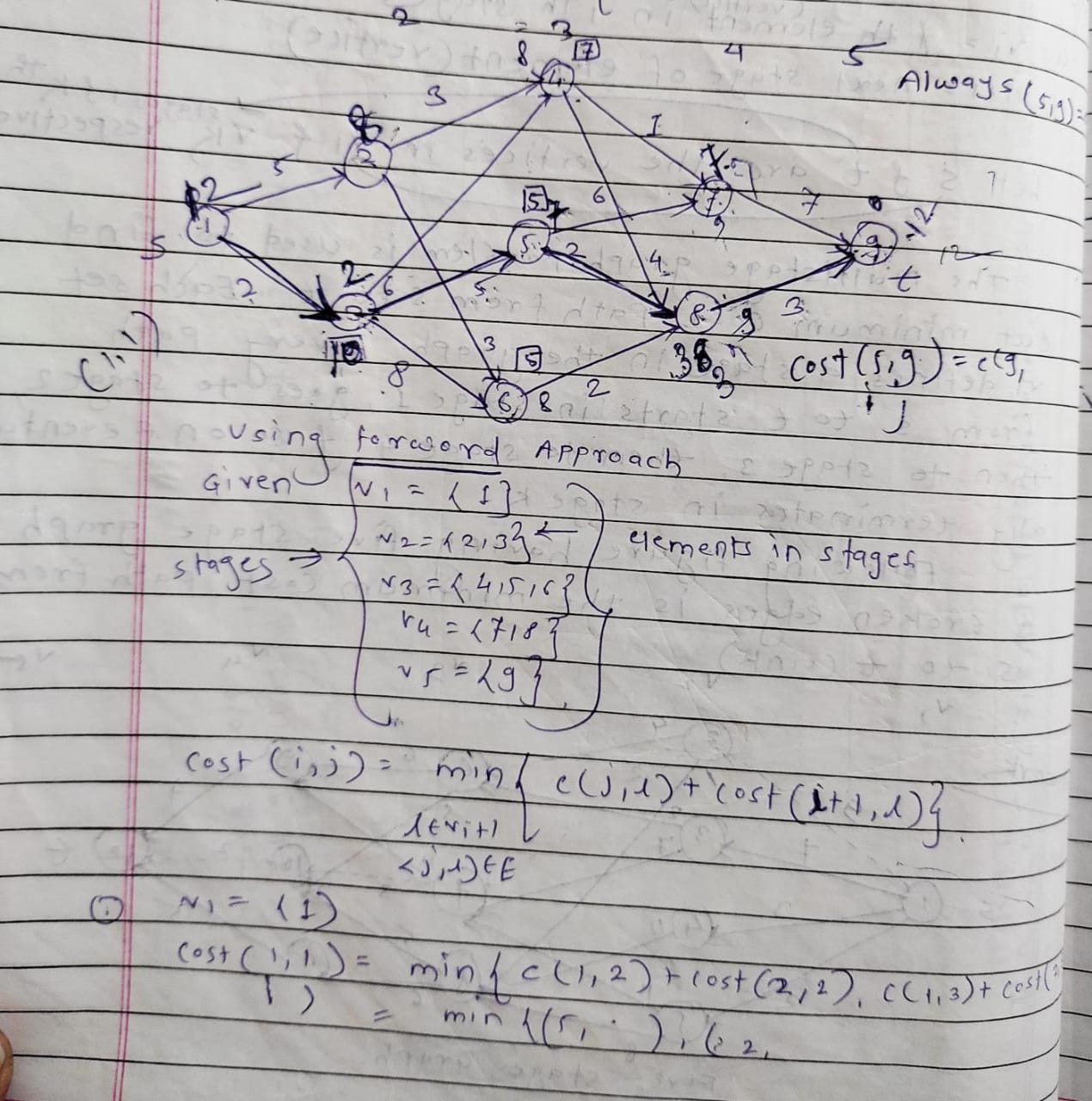
**Explaination with example 3M**

Generate all possible configurations of colors. Since each node can be coloured using any of the m available colours, the total number of colour configurations possible are m^V.   
After generating a configuration of colour, check if the adjacent vertices have the same colour or not. If the conditions are met, print the combination and break the loop.

**Algorithm:  3M**

1. Create a recursive function that takes current index, number of vertices and output color array.
2. If the current index is equal to number of vertices. Check if the output color configuration is safe, i.e check if the adjacent vertices do not have same color. If the conditions are met, print the configuration and break.
3. Assign a color to a vertex (1 to m).
4. For every assigned color recursively call the function with next index and number of vertices

**Q.2 a)**

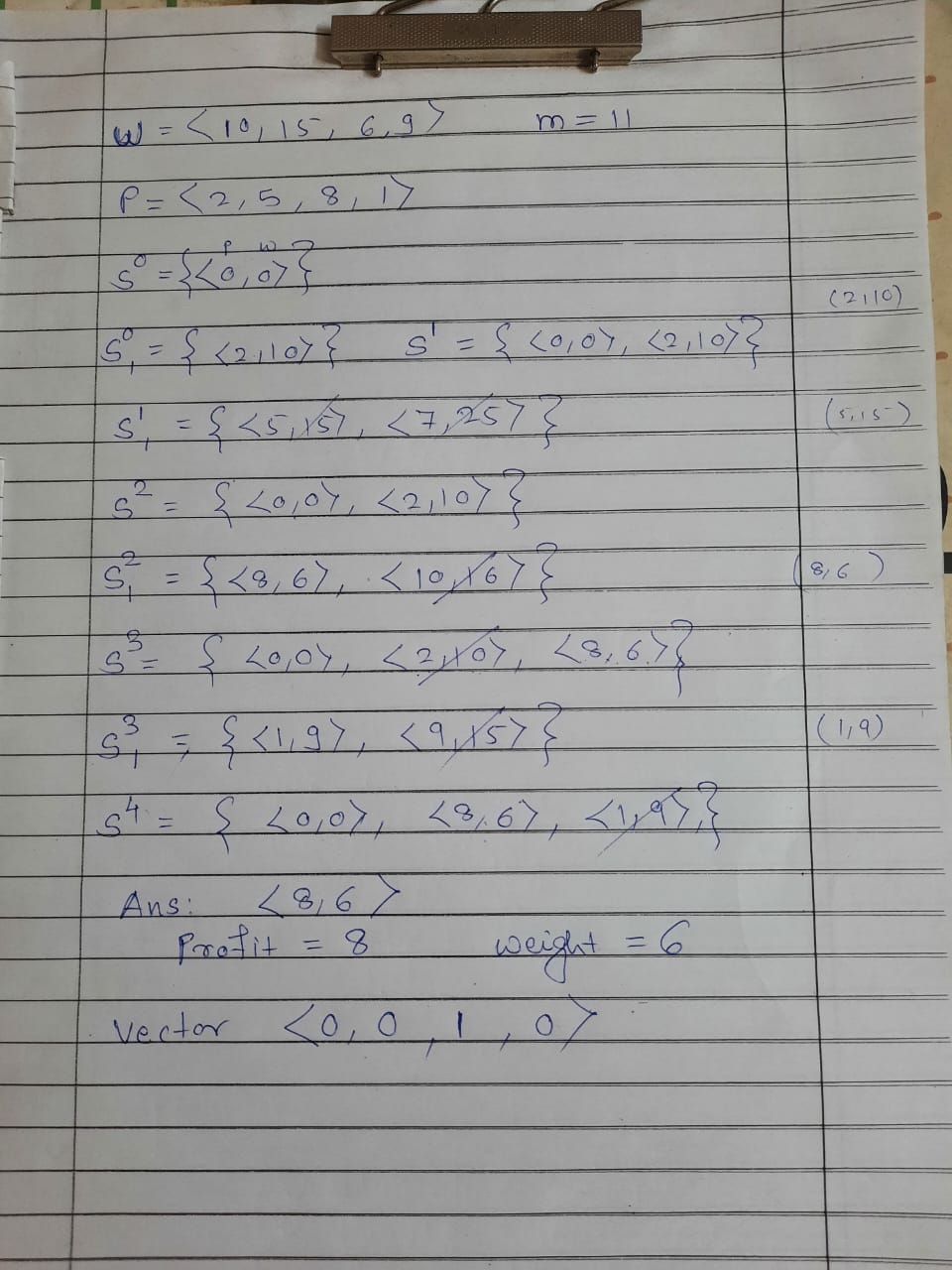


**Q.2 b) Describe traversal technique of graph with algorithm (6M)**

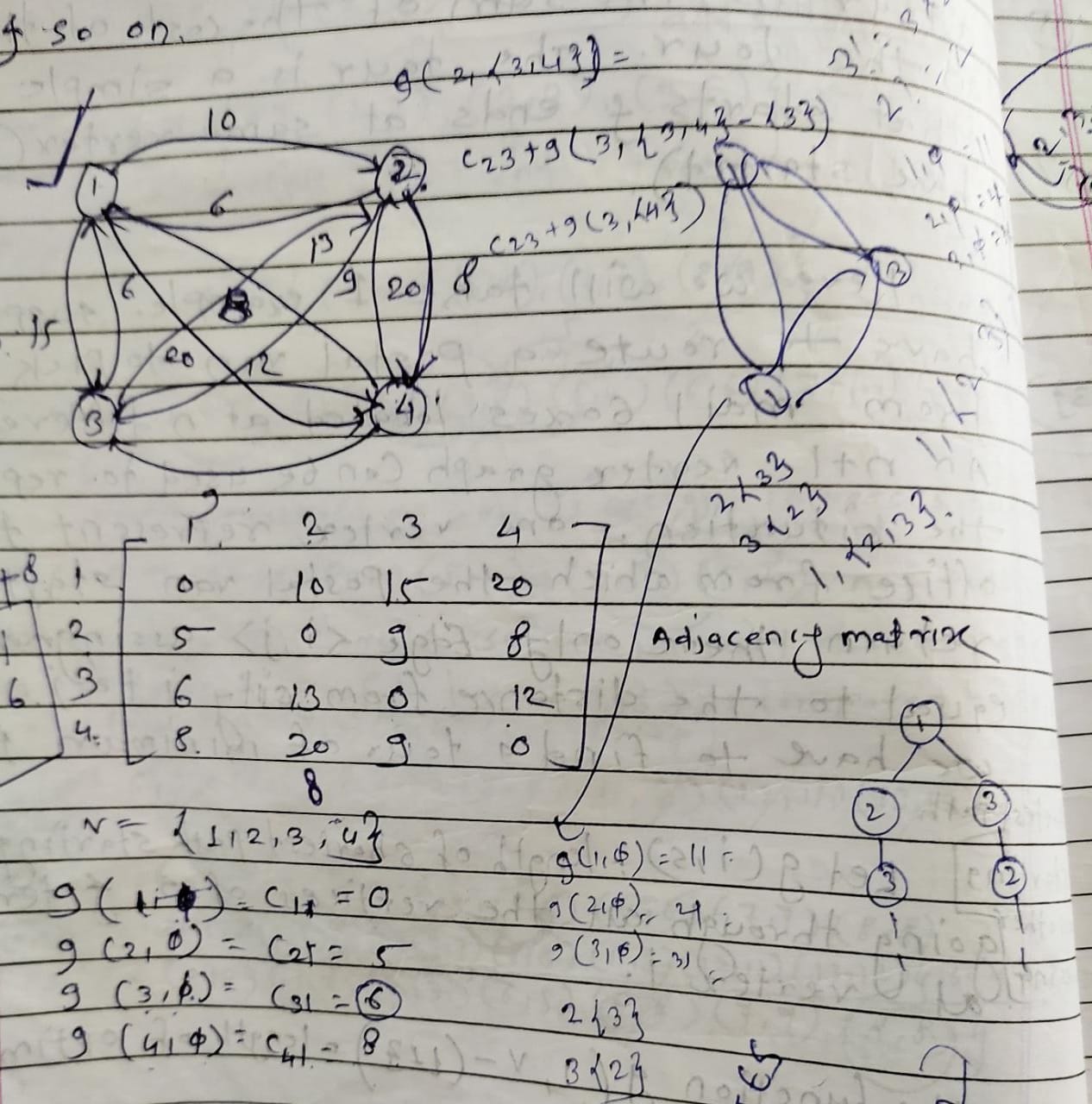
Explanation of Breadth First Search technique(Uses Queue data structure) with example and it’s Algorithm **3M**

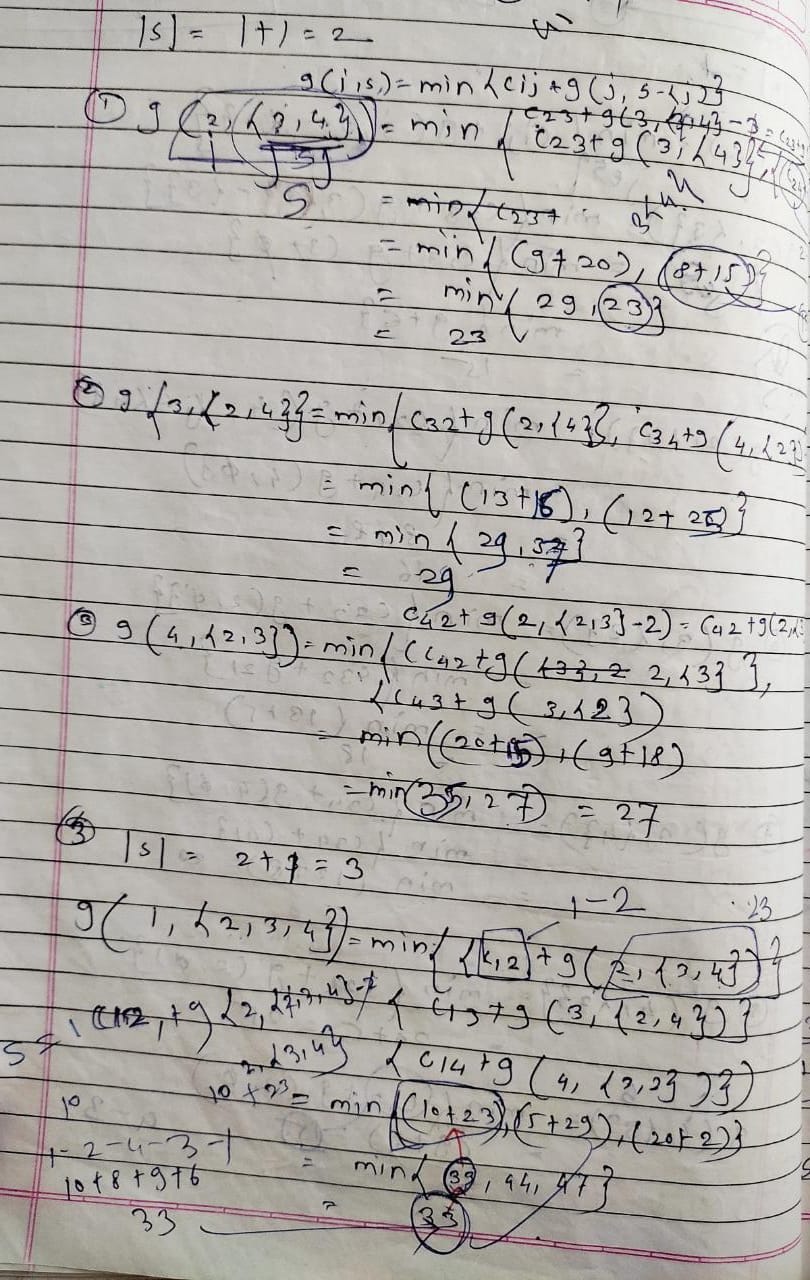
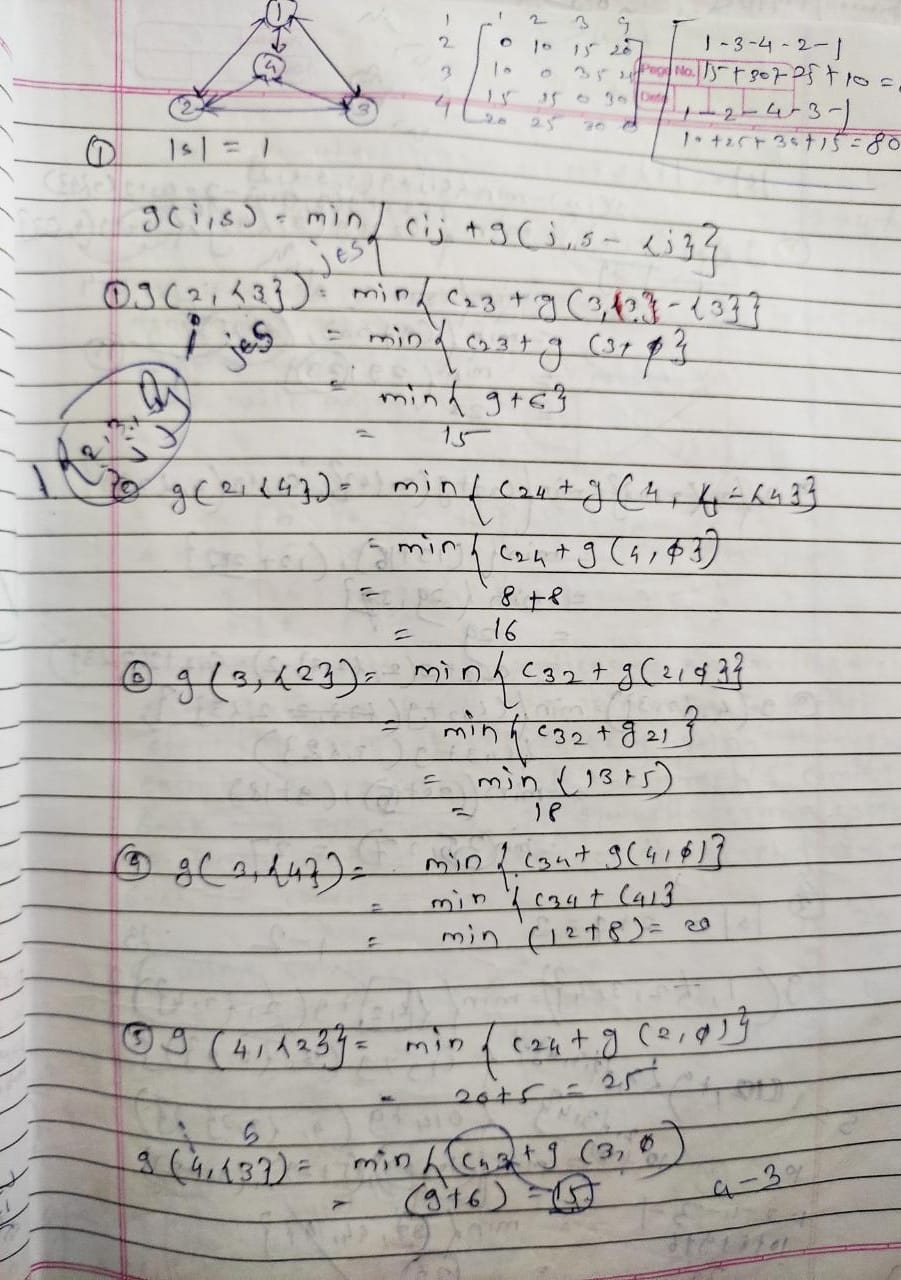
Explanation of Depth First Search technique(Uses Stack data structure) with example and it’s Algorithm **3M**

Q.3 a)



**Q.3b)**

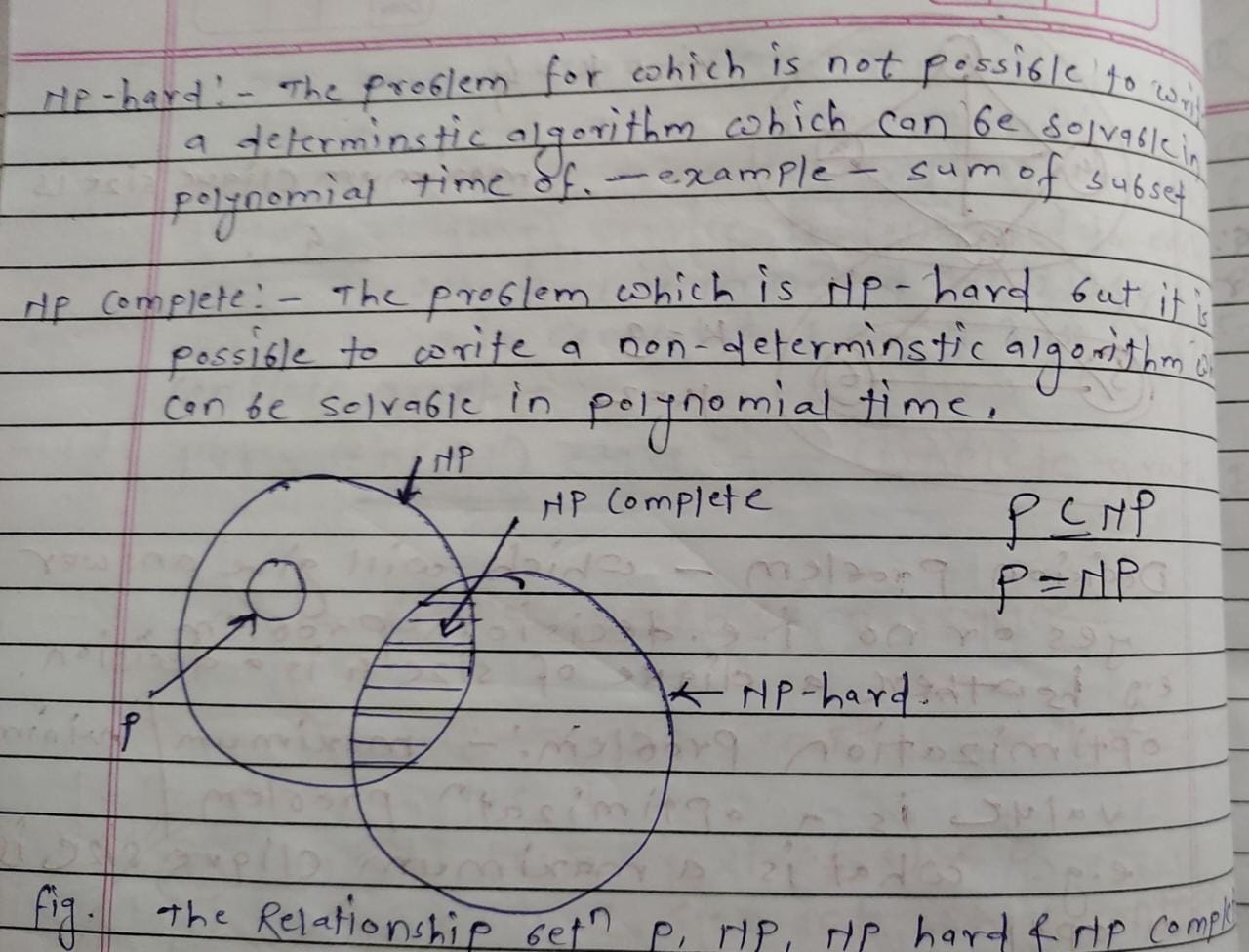




**Q.4.a) Define P and NP Problem. Explain relationship between P,NP,NP Complete and NP hard problems with neat diagram (5M)**

Definition of P,NP,NP hard, NP Complete **3M**

Relationship diagram between P,NP,NP hard, NP Complete **2M**



**Q.4 b) Explain Clique decision problem and show that its NP Hard problem. (5M)**

Definition of Clique decision problem. Explanation of CDP with example. **2M**

Procedure to prove CDP is NP hard by taking example of Satisfiability problem as a base problem and convert it into graph. **3M**

**Q.4 C) Explain AND/OR graph decision problem (5M)**

**Definition of AND/OR Graph 2M**

**AND/OR graph** A form of [graph](https://www.encyclopedia.com/science-and-technology/mathematics/mathematics/graph#1O11graph) or [tree](https://www.encyclopedia.com/plants-and-animals/botany/botany-general/tree#1O11tree) used in problem solving and problem decomposition. The nodes of the graph represent states or goals and their successors are labeled as either AND or OR branches. The AND successors are subgoals that must all be achieved to satisfy the parent goal, while OR branches indicate alternative subgoals, any one of which could satisfy the parent goal.

**Example of AND/OR Graph and Explanation 1M**

**AND/OR Graph Algorithm 2M**