Assignment 4

Q1) Fill in the blanks

a) A node is said to be promising if it has a possibility of reaching a complete solution.

b) Backtracking enumerates a list of promising nodes that could be computed to give the possible solutions of a given problem.

c) The problem cosist of 15 numbered (0-15) tiles on a square box with 16 tiles.

Q2) Choose Correct Options

a) The problem of finding a subset of positive integers whose sum is equal to a given positive integer is called as?

Ans: b) subset sum problem

b) The problem of placing n queens in a chess board such that no two queens attack each other is called as? choosing a random element as pivot

Ans: a) n-queen problem.

c) Branch & bound is a a) problem solving technique

d) What is Rabin & Karp Algorithm?

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Ans: b) Shortest path algorithm

c) What is the worst case time complexity of KMP algorithm for pattern searching (m = length of text, n = length of pattern)?

Ans: c) O(m)

Q3) State whether the following statements are true or false.

a) Rabin-Karp algorithm ~~with~~ can be used for discovering plagiarism in a sentence. False

b) Not more than 2 queens can occur in an n-queens problem. False

c) Given a set of cities & distance between every pair of cities, the problem is to find the shortest possible tour that visits every city exactly once & returns to the starting point. True.

Q4) Name the following or define or design the following.

a) What is backtracking in algorithms?

Ans: Backtracking is an algorithmic-technique for solving problems recursively by trying to build a solution incrementally, one piece at a time,

removing those solutions that fail to satisfy the constraints of the problem at any point of time.

b) What is branch and bound algorithm?

Ans: Branch and bound is an algorithm design paradigm which is generally used for solving combinatorial optimization problems.

c) What is exact string matching algorithm?

Ans: Exact string matching algorithms is to find one, several or all occurrences of a defined string (pattern) in a large string (text or sequences) such that each matching is perfect.

Q5) Answer the following questions in brief (20 to 30 words)

a) Explain N-queen problem algorithm.

Ans: N-queen is the problem of placing N chess queens on an NXN chessboard so that no two queens attack each other.

b) Explain Graph colouring algorithm.

Ans: • Colour first vertex with first colour.

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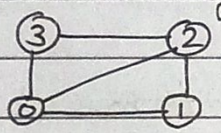
- Do following for remaining V-1 vertices.
Consider the currently picked vertex & colour it with the lowest colour that has not been used on any previously coloured vertices adjacent to it. If all previously used colours appear on vertices adjacent to v, assign a new colour to it.

c) Explain 15 Puzzle problem algorithm.

Ans: $c(x) = f(x) + h(x)$ where $f(x)$ is the length of the path from root to x (the number of moves so far) and $h(x)$ is the number of non-blank tiles not in their goal position.

Q6) Answer the following questions in brief. (50 to 70 words)

a) An integer m that denotes the maximum number of colours which can be used in graph colouring. Consider the input as shown in the image



: The above graph can be represented as follows:

```
graph [4][4] = {
                {0, 1, 1, 1},
                {1, 0, 1, 0},
                {1, 1, 0, 1},
                {1, 0, 1, 0},
              };
```

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Consider m=3

Output:

- Return array colour of size v that has numbers from 1 to m. Note that colour[i] represents the colour assigned to the ith vertex.
- Return false if the graph cannot be coloured with m colours.
- Solution:
- Naive Approach:
- The brute force approach would be to generate all possible combinations of colours.
- After generating a configuration, check if the adjacent vertices have the same colour or not. If the conditions are met, add the combination to the result & break the loop.
- ∴ each node can be coloured by using any of the m colours, the total number of possible colour configurations are m^v. The complexity is exponential which is very huge.

Q7) Think and Answer

a) What is Knuth Morris Pratt Method of Pattern Matching? Give examples.

Ans: Given a text txt[0...n-1] and a pattern pat[0...m-1], write ~~an algorithm~~ function search(char pat[], char txt[]) that prints all occurrences of pat[] in txt[]. You may assume that n > m.

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- ~~Consider m=3~~ Example:

Input: txt[] = "THIS IS A TEST TEXT"
pat[] = "TEST"
Output: Pattern found at index 10.

Q8) My Ideas

a) Explain ~~use~~ the Traveling Salesman Problem using Branch & Bound.

Ans: Traveling Salesman Problem using Branch and Bound given a set of cities & distance between every pair of cities, the problem is to find the shortest possible tour that visits every city exactly once & returns to the starting point.

b) Explain Naïve string matching algorithm with example.

Ans: The naive algorithm finds all valid shifts using a loop that checks the condition P[1..m] = T[s+1 ... s+m] for each of the n-m+1 possible values of s. NAIVE-STRING-MATCHER (T, P)

```
1 n length[T]
2 m length[P]
3 for s 0 to n-m
4   do if P[1...m] = T[s+1...s+m]
5     then print "Pattern occurs with shift" s.
```

The naive string-matching process can be interpreted graphically.