One Compulsory mark Questions

What is an algorithm?

Ans: An algorithm is a sequence of unambiguous instructions for solving a problem, i.e., for obtaining a required
output for any legitimate input in finite amount of time.
An algorithm is step by step procedure to solve a problem.

What is pseudocode?

A pseudocode is a mixture of a natural language and programming language constructs to specify an algorithm. A pseudocode is more precisethan a natural language and its usage often yields more concise algorithm descriptions.

Time complexity of an algorithm quantifies the amount of time taken by an algorithm to run as a function of the length of the input.

Space complexity of an algorithm quantifies the amount of space or memory taken by an algorithm to run as a function of the length of the input.

Time complexities of merge sort and quick sort

What is worst-case efficiency?

The worst -case efficiency of an algorithm is its efficiency
for the worst-case input of size n, which is an input or inputs of size n for which the algorithm runs the longest among all possible inputs of that size.

What is best -case efficiency?

The best -case efficiency of an algorithm is its efficiency for the best-case input of size n, which is an input or inputs for which the algorithm runs the fastest among all possible inputs of that size.

What is average case efficiency?

The average case efficiency of an algorithm is its efficiency for an average case input of size n. It provides information about an algorithm behavior on a ―typical‖ or ―random‖ input.

What is amortized efficiency?
In some situations a single operation can be expensive, but the total time for the entire sequence of n such operations is always significantly better that the worst case efficiency of that single operation multiplied by n. this is called amortized efficiency.

Define O-notation?
A function t(n) is said to be in O(g(n)), denoted by t(n)
εO(g(n)), if t(n) is bounded above by some constant multiple of g(n) for all large n, i.e., if there exists some positive constant c and some non-negative integer n0 such that
T (n)<=cg (n) for all >=n0

Define Ω-notation?
A function t(n) is said to be in Ω (g(n)), denoted by t(n) εΩ
(g(n)), if t(n) is bounded below by some constant multiple of g(n) for all large n, i.e., if there exists some positive constant c and some non-negative integer n0 such that

T (n)>=cg (n) for all n >=n0

Define θ-notation?
A function t(n) is said to be in θ(g(n)), denoted by t(n)εθ(g(n)), if t(n) is bounded both above & below by some constant multiple of g(n) for all large n,i.e., if there exists some positive constants c1 & c2 and some nonnegative integer n0 such that

c2g (n) <= t (n) <=c1g (n) for all n >=n0

Divide and Conquer Method
A divide and conquer algorithm works by recursively breaking down a problem into two or more sub-problems of the same or related type, until these become simple enough to be solved directly. The solutions to the sub-problems are then combined to give a solution to the original problem.

Define principle of optimality.
It states that an optimal sequence of decisions has the property that whenever the initial stage or decisions must constitute an optimal sequence with regard to stage resulting from the first decision.

Write the difference between the Greedy method and Dynamic programming.

•Greedy method
1.Only one sequence of decision is generated.
2.It does not guarantee to give an optimal solution always.
•Dynamic programming
1.Many number of decisions are generated.
2.It definitely gives an optimal solution always.

What is greedy method?

Greedy method is the most important design technique, which makes a choice that looks best at that moment. A given‗n‘ inputs are required us to obtain a subset that satisfies some constraints that is the feasible solution. A greedy method suggests that one can device an algorithm that works in stages considering one input at a time.

Define Backtracking

Backtracking is used to solve problems with tree structures. Even problems seemingly remote to trees such as a walking a maze are actually trees when the decision \'back-left-straight-right \
' is considered a node in a tree.The principle idea is to construct solutions one component at a time and evaluate such partially constructed candidates.

Define Branch and Bound?

A counter-part of the backtracking search algorithm which, in the absence of a cost criteria, the algorithm traverses a spanning tree of the solution space using the breadth-first approach. That is, a queue is used, and the nodes are processed in first-in-first-out order.

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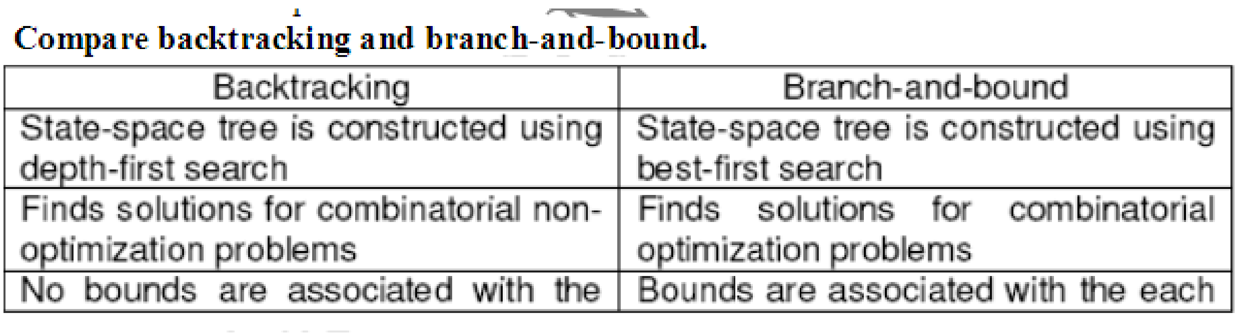
What is a state space tree?

The processing of backtracking is implemented by constructing a tree of choices being made. This is called the state-space tree. Its root representsa initial state before the search for a solution begins. The nodes of the first level in the tree represent the choices made for the first component of the solution, the nodes in the second level represent the choices for the second component and so on.



Compare backtracking and branch-and-bound.

Backtracking	Branch-and-bound
State-space tree is constructed using depth-first search	State-space tree is constructed using best-first search
Finds solutions for combinatorial non-optimization problems	Finds solutions for combinatorial optimization problems
No bounds are associated with the	Bounds are associated with the each

Biconnected component:

In graph theory, a *biconnected component* (also known as a block or 2-connected *component*) is a maximal *biconnected* subgraph. Any connected graph decomposes into a tree of *biconnected components* called the block-cut tree of the graph.

Spanning tree

In the mathematical field of graph theory, a spanning tree T of an undirected graph G is a subgraph that is a tree which includes all of the vertices of G, with minimum possible number of edges.

Articulation Point

A vertex in an undirected connected graph is an articulation point (or cut vertex) iff removing it (and edges through it) disconnects the graph

What is meant by nondeterministic algorithm?

A nondeterministic algorithm is a two stage procedure that takes as its input an instance I of a decision problem. Algorithm has the property that the result of every operation whose outcome are not uniquely defined.

Define NP-Complete

An NP-Complete problem is a problem in NP that is as difficult as any other the problem in this class because any other problem in NP can be reduced to it in Polynomial time.

Define P

- The class P consists of those problems that are solvable in polynomial time.

- More specifically, they are problems that can be solved in time O(n^k) for some constant k, where n is the size of the input to the problem
- The key is that n is the **size of input**

Define NP

- **NP is not the same as non-polynomial complexity/running time. NP does not stand for not polynomial.**
- **NP = Non-Deterministic polynomial time**
- NP means verifiable in polynomial time
- Verifiable?
  - If we are somehow given a ‘certificate’ of a solution we can verify the legitimacy in polynomial time

Np-hard

NP-hardness (non-deterministic polynomial-time hard), in computational complexity theory, is the defining property of a class of problems that are, informally, "at least as hard as the hardest problems in NP".