University of Sargodha

BS 4th Term Examination 2018

Subject: Computer Science **Paper: Design & Analysis of Algorithm (CS: 3143)**

****

Q1. Write short answers of the following.

1. Difference between algorithm and pseudo code?

An **algorithm** is a step by step procedure to solve a problem. A procedure is a finite sequence of instructions, where each is carried out in a finite amount of time.

Pseudocode is an informal way of writing a program. It is not exactly a computer program. It represents the algorithm of the program in natural language and mathematical notations. Usually, there is no particular code syntax to write a pseudocode. Therefore, there is no strict syntax as a usual programming language. It uses simple English language.

An algorithm is an arrangement of steps to solve a problem. A pseudo-code uses natural language or compact mathematical notation to write algorithms. The main difference between algorithm and pseudocode is that an algorithm is a step by step procedure to solve a given problem while a pseudocode is a method of writing an algorithm.

2. Explain properties of algorithm?

- **Finiteness**: An algorithm must always terminate after a finite number of steps.
- **Definiteness**: Each step of an algorithm must be precisely defined.
- **Input**: An algorithm has zero or more inputs.
- **Output**: An algorithm has one or more outputs.
- **Effectiveness**: An algorithm is also generally expected to be effective, in the sense that its operations must all be sufficiently basic that they can in principle be done exactly and in a finite length of time by someone using pencil and paper.

3. What do you mean by performance analysis?

Performance analysis of an algorithm is the process of calculating space and time required by that algorithm. Performance analysis of an algorithm depends upon two factors i.e. amount of memory used and amount of compute time consumed on any CPU. Formally they are notified as complexities in terms of:

- Space Complexity.
- Time Complexity.

4. Difference between prims and Kruskal spanning tree?

- ✓ Prim's algorithm initializes with a node, whereas Kruskal's algorithm initiates with an edge.
- ✓ Prim's algorithms span from one node to another while Kruskal's algorithm select the edges in a way that the position of the edge is not based on the last step.
- ✓ In prim's algorithm, graph must be a connected graph while the Kruskal's can function on disconnected graphs too.
- ✓ Prim's algorithm has a time complexity of O(V2), and Kruskal's time complexity is O(logV).

5. What is meant by divide and conquer approach?

A typical Divide and Conquer algorithm solve a problem using following three steps.

1. **Divide**: Break the given problem into subproblems of same type.
2. **Conquer**: Recursively solve these subproblems
3. **Combine**: Appropriately combine the answers

6. **Define any three asymptotic notations?**

Big Oh Notation: A function t(n) is said to be in O(g(n)), denoted t(n) ∈ O(g(n)), if t(n) is bounded above by some constant multiple of g(n) for all large n, i.e., if there exist some positive constant c and some nonnegative integer n0 such that

$$t(n) \leq cg(n) \text{ for all } n \geq n0.$$

Big Theta Notation: A function t(n) is said to be in Θ (g(n)), denoted t(n) ∈ Θ (g(n)), if t(n) is bounded both above and below by some positive constant multiples of g(n) for all large n, i.e., if there exist some positive constants c1 and c2 and some nonnegative integer n0 such that

$$C_2\, g(n) \leq t(n) \leq C_1\, g(n) \text{ for all } n \geq n0.$$

Big Omega Notation: A function t(n) is said to be in Ω(g(n)), denoted t(n) ∈ Ω g(n)), if t(n) is bounded below by some positive constant multiple of g(n) for all large n, i.e., if there exist some positive constant c and some nonnegative integer n0 such that

$$t(n) \geq cg(n) \text{ for all } n \geq n_0$$

7. **diff b/w dynamic programing and greedy method?**

A **Greedy algorithm** is an algorithmic paradigm that builds up a solution piece by piece, always choosing the next piece that offers the most obvious and immediate benefit. So, the problems where choosing locally optimal also leads to a global solution are best fit for Greedy.

Dynamic programming is mainly an optimization over plain recursion. Wherever we see a recursive solution that has repeated calls for the same inputs, we can optimize it using Dynamic Programming. The idea is to simply store the results of subproblems so that we do not have to re-compute them when needed later. This simple optimization reduces time complexities from exponential to polynomial.

8. **Define merge and quick sort?**

Quick sort is an internal algorithm which is based on divide and conquer strategy. In this:

- The array of elements is divided into parts repeatedly until it is not possible to divide it further.
- It is also known as "partition exchange sort".
- It uses a key element (pivot) for partitioning the elements.
- One left partition contains all those elements that are smaller than the pivot and one right partition contains all those elements which are greater than the key element

Merge sort is an external algorithm and based on divide and conquer strategy. In this:

- The elements are split into two sub-arrays (n/2) again and again until only one element is left.
- Merge sort uses additional storage for sorting the auxiliary array.
- Merge sort uses three arrays where two are used for storing each half, and the third external one is used to store the final sorted list by merging other two and each array is then sorted recursively.
- At last, the all sub arrays are merged to make it 'n' element size of the array.

9. **What is red black tree?**

A red–black tree is a kind of self-balancing binary search tree in computer science. Each node of the binary tree has an extra bit, and that bit is often interpreted as the colour (red or black) of the node. These colour bits are used to ensure the tree remains approximately balanced during insertions and deletions.

10. **Define radix sort?**

Radix sort is a sorting technique that sorts the elements by first grouping the individual digits of same place value. Then, sort the elements according to their increasing/decreasing order. For the radix sort that uses counting sort as an intermediate stable sort, the time complexity is O(d(n+k)).

11. Define LCS (Longest Common Subsequence)?

If a set of sequences are given, the longest common subsequence problem is to find a common subsequence of all the sequences that is of maximal length.

The longest common subsequence problem is a classic computer science problem, the basis of data comparison programs such as the diff-utility, and has applications in bioinformatics. It is also widely used by revision control systems, such as SVN and Git, for reconciling multiple changes made to a revision-controlled collection of files.

12. Difference between LIFO and FIFO principle?

LIFO is an abbreviation for last in, first out. It is a method for handling data structures where the first element is processed last and the last element is processed first.

FIFO is an abbreviation for first in, first out. It is a method for handling data structures where the first element is processed first and the newest element is processed last.

13. Define recursion?

Recursion is a method of solving problems that involves breaking a problem down into smaller and smaller subproblems until you get to a small enough problem that it can be solved trivially. Usually recursion involves a function calling itself. While it may not seem like much on the surface, recursion allows us to write elegant solutions to problems that may otherwise be very difficult to program.

The process in which a function calls itself directly or indirectly is called recursion and the corresponding function is called as recursive function.

14. What is meant by correctness of algorithm?

correctness of an algorithm is asserted when it is said that the algorithm is correct with respect to a specification. Functional correctness refers to the input-output behavior of the algorithm (i.e., for each input it produces the expected output).

15. Create a binary tree of following alphabets "pakistan"?

TSHAHAB

Visit
https://tshahab.blogspot.com
for more.