Data Structures and Algorithms (17ECSC204)
Minor 02 – Just like that

Semester: III – D   29 October 2018   **Take Home Test**

The Smelly Paper
"The ball is in your court and so it shall remain"

Question 01
"Keep Listing, Ever Lasting,
Time Wasting, Patience Testing"

a.   **The Unheard Tree Tales**

(04)   i. Let T1 be a BST and T2 be a 2-3 tree where they both are constructed for the same list of keys inserted in the corresponding trees in the same order. Searching for the same key in T2 ALWAYS takes fewer or the same number of key comparisons as searching in T1. True or False?

ii. A binary tree is constructed given 5 nodes going from one level to another, inserting nodes from left to right. What minimum number of more nodes are required to make it a Complete Binary Tree?

iii. Assuming there is more than one node in the tree, when can a binary tree print inorder, preorder and postorder traversal with the same result?

iv. Write the post order traversal for the tree on the right.

**[Into the forest you go, to lose your mind and soul!]**
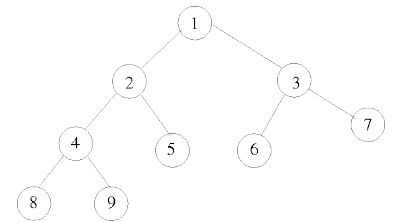
b.   **The Government Question**

(06)   Present your own sorting technique. It could just be a minor change to existing ones. If you could not think of any, write any sorting algorithm you know of. Six marks, easy-peasy!

[How sorted are you?]

c.   **Shortest Path Chronicles**

(10)   Given below is a G(V, E). Find the shortest path from vertex number 4 to every other vertices. Pick an appropriate algorithm to achieve the task. You are supposed to show all the iterations in detail using the appropriate data structures.
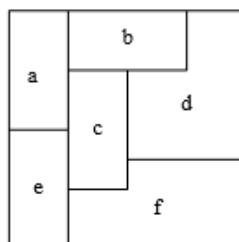
[The shortest way is by doing the required thing]
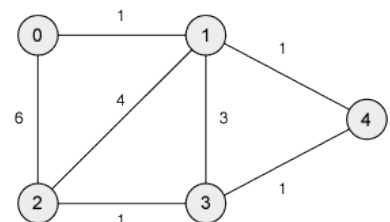
Question 02
"What you know, that you write
I am not sure, if you are right"

a.   **Map Fights for Graph**

(04)   For the map given below, represent it as a (for a) graph problem.


[It's not a maze, still could be lost]

b. **The 42 Pictures**

(06) You are presented with 42 pictures kept one after the other. You need to identify the target picture by asking the questions that can be answered with yes or no and in as few questions as possible. Design an efficient algorithm for this problem and indicate the minimum number of questions that one needs to ask.

[A photography is good when you know where to stand!]

c. **The Nuts and Bolts**

(10) You are given a collection of N bolts of different widths and N corresponding nuts. You are allowed to try a nut and bolt together, from which you can determine whether the nut is larger than the bolt, smaller than the bolt, or matches the bolt exactly. However, there is no way to compare two nuts together or two bolts together. The problem is to match each bolt to its nut.
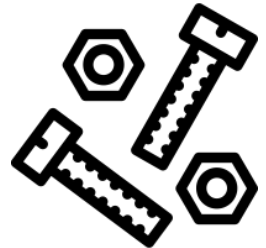
Design an algorithm for this problem with average-case efficiency in $\Theta(n\log n)$.
[That is going to test your nuts and bolts of sorting]

Question 03
"Sometimes more works better,
Sometimes better works more"

a. **The Efficiencies, Counts and Orders of Growth**

(04) Write a note on algorithm analysis framework. Keep it like an engineer's answer. To the point, sharp and precise.
[You should know what you are talking about]

b. **The Text and Pattern War**

(06) There is a text which contains 1000 zeros. You are supposed to compare the pattern '00001' in the text.
i. How many comparisons will be made in the brute force string match?
ii. Construct the prefix table π for the pattern used in KMP algorithm
iii. Construct the bad symbol shift table and good suffix shift table used in Boyer-Moore algorithm
[It's just the difference of 'F' between shift and shit]

c. **Deletions in a BST**

(10) Present the 5 cases of deletions of a node in a binary search tree by writing the appropriate code. The code has to be properly commented explaining each of the deletion cases. Necessary figures will do too.
[When in doubt, delete]

Yours Sincerely,
"Data Structures and Algorithms"

Note: Answer any 2 full questions.