UNIVERSITY OF COLOMBO, SRI LANKA

UNIVERSITY OF COLOMBO SCHOOL OF COMPUTING

DEGREE OF BACHELOR OF INFORMATION TECHNOLOGY (EXTERNAL)

Academic Year 2013/2014 – 2nd Year Examination – Semester 4

IT4104: Programming II

Part 2: Structured Question Paper

19th July, 2014
(ONE HOUR)

To be completed by the candidate

BIT Examination Index No: _____

Important Instructions:

- The duration of the paper is **1 (one) hour**.
- The medium of instruction and questions is English.
- This paper has **2 questions** and **10 pages**.
- **Answer all questions.** All questions carry equal marks.
- **Write your answers** in English using the space provided **in this question paper**.
- Do not tear off any part of this answer book.
- Under no circumstances may this book, used or unused, be removed from the examination hall by a candidate.
- Note that questions appear on both sides of the paper.
  If a page is not printed, please inform the supervisor immediately.

Questions Answered

Indicate by a cross (×), (e.g. [X]) the numbers of the questions answered.

	Question numbers		
To be completed by the candidate by marking a cross (×).	**1**	**2**	
To be completed by the examiners:			

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(1) (a) What are the basic features in the following data structures in relation to their basic operations insert, delete and retrieval data?

(i) Stacks
(ii) Queues
(iii)Priority queues

(3x2=6 Marks)

ANSWER IN THIS BOX

	Insert	Delete	Retrieve
Stacks	**Insertion is always restricted to the top of the stack.**	**Deletion is always restricted to the top element in the stack.**	**Retrieval is always restricted to the top element in the stack.**
Queues	**Insertion is restricted to the back end of the queue.**	**Deletion is restricted to the front end of the queue.**	**Retrieval is restricted to the front end of the queue.**
Priority queue	**Insertion is restricted to the back end of the priority queue.**	**Deletion is restricted to the front end of the queue.**	**Retrieval is restricted to the front end of the queue**

(b) In mathematics, a palindrome is a number that reads the same forwards and backwards. For example,727 and 8338

Given any set of numbers, you can use the following sample algorithm to find other palindromes.

Step 1:

Step 1.1 Start with any number.

Step 1.2 Call it as an ***original number***.

Step 1.3 Reverse the digit of the ***original number***

Step 2:

Step 2.1: Call the number whose digits are reversed as a ***new number***.

Step 2.2 Add the **new number** to your **original number.**

Step 2.3 Call the number found by adding the ***new number*** to the ***original number*** as a ***test number***

Step 3:

Step 3.1 If the **test number** is a palindrome, you are successful.

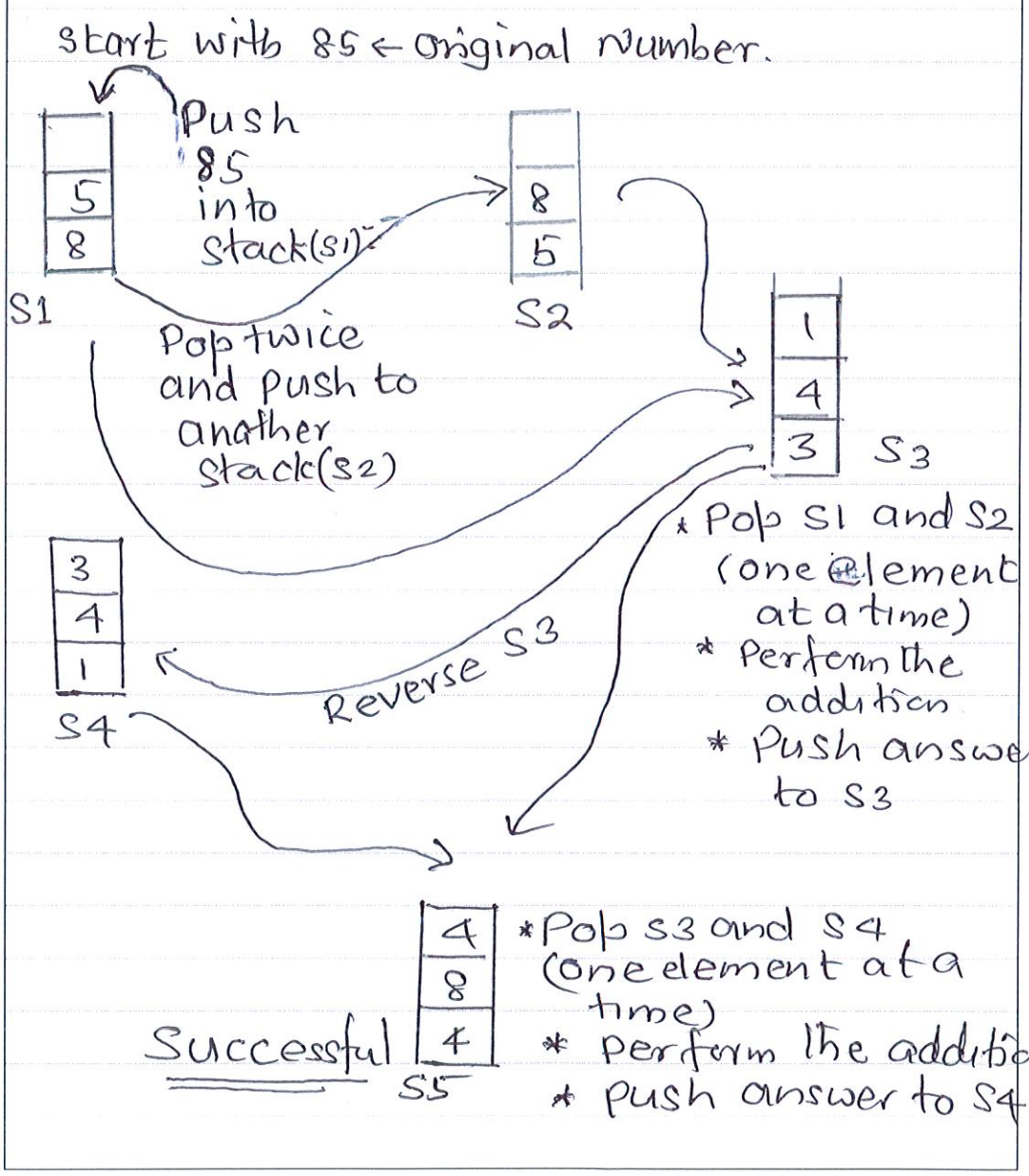
Step 3.2 If you are not successful, use your **test number** as your original number and go to step 1 to repeat the above 3 steps.

Example : 85
Reversing 85 gives 58
Adding 85 and 58 gives 143
Reversing 143 gives 341
Adding 143 and 341 gives 484 and well done! The answer is a palindrome.

Describe, how the above algorithm is implemented using a stack. You should illustrate your answer with suitable diagram(s).

(7 Marks)

ANSWER IN THIS BOX



(c)

(i) In a priority queue, a newly inserted element goes to the appropriate position according to its priority. Heap sort algorithm is based on the priority queue concept and it consists of two stages.

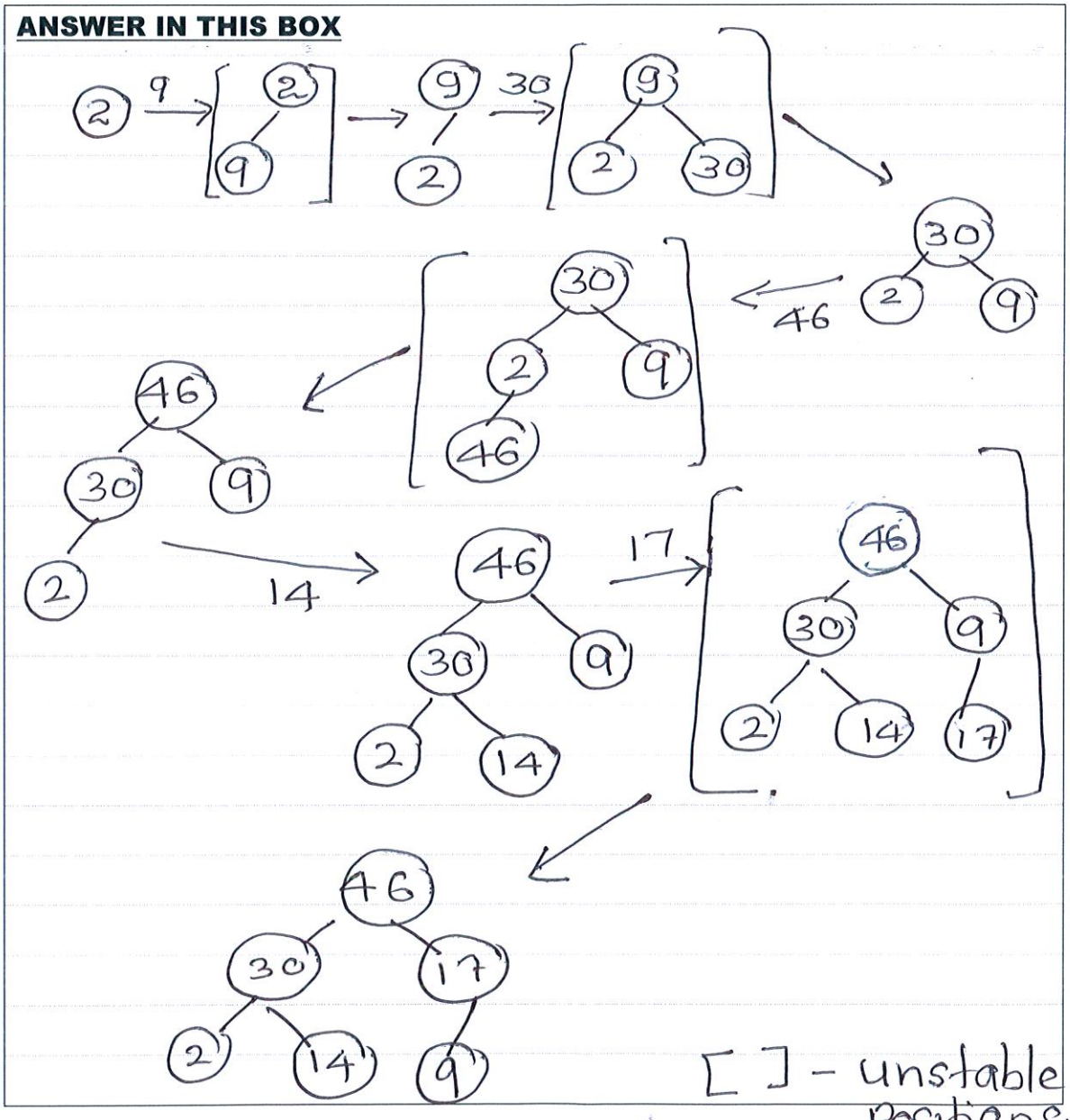
- Creating a heap
- Sorting the heap

If one wants to create the maximum heap using the following set of integer values, what would be the final situation of the array? Illustrate your answer with all the intermediate steps.

Integer data set is : {2,9,30,46,14,17}

(6Marks)

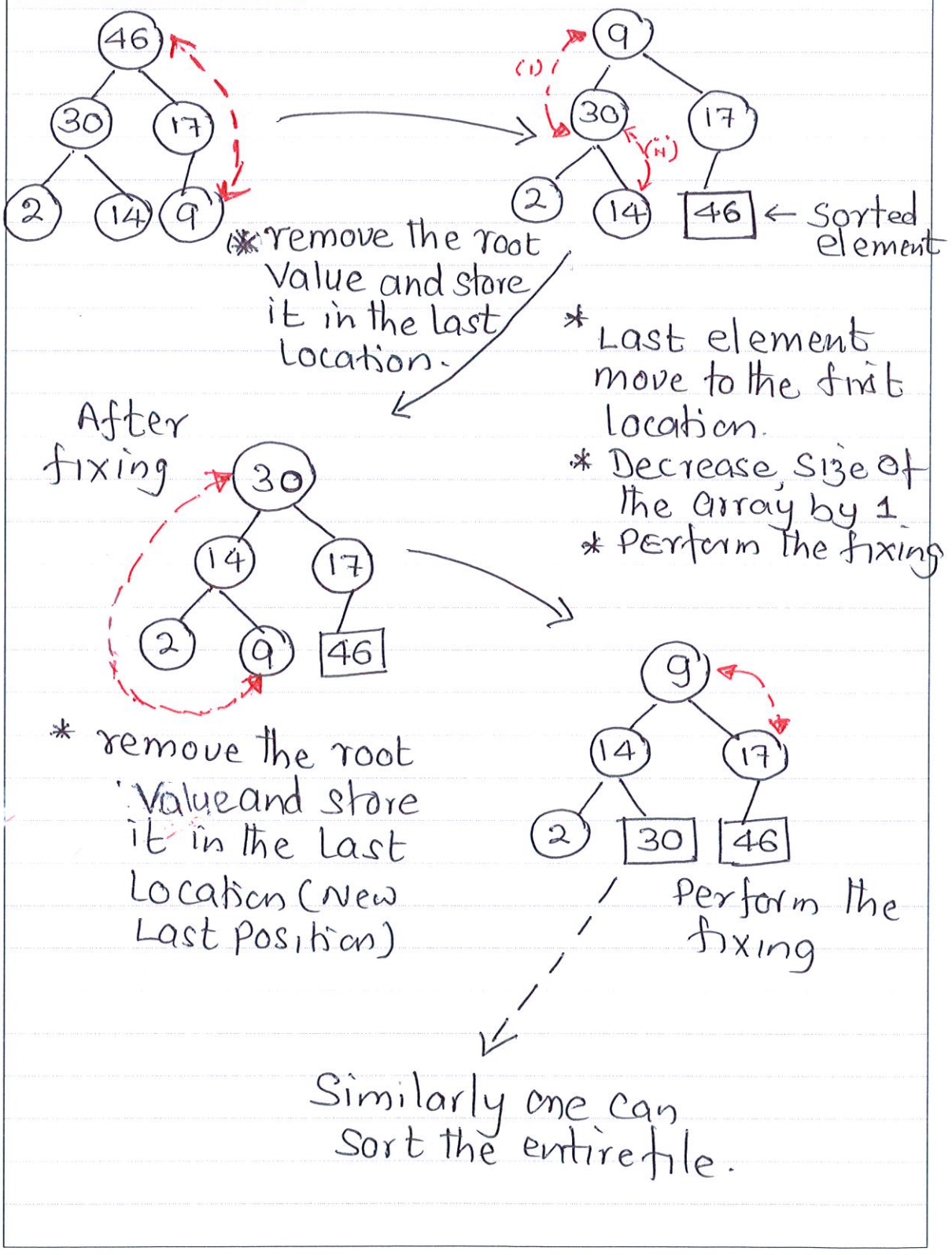
ANSWER IN THIS BOX



(ii) Discuss, how to sort the values of the heap created in part (c) (i) above using the same array. Your answer should be limited to one or two steps of the sorting process.

(6 Marks)

ANSWER IN THIS BOX



(2)

(a) Discuss the main difference between the Binary Search trees and AVL trees?

(4 Marks)

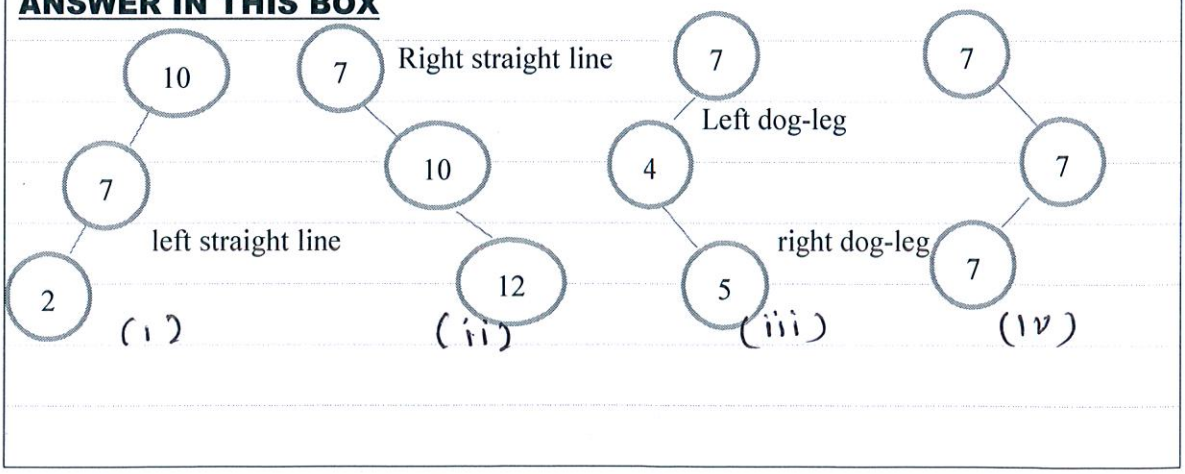
ANSWER IN THIS BOX

Binary search trees and AVL trees are special kinds of binary trees, but in binary search trees ,root value is heigher with respect to all the nodes in the left sub tree and root value is smaller with respect to the all the nodes in the right subtree. In AVL trees, all the conditions in Binary search tree are valid. In addition to that, an AVL tree maintains the balance factor. If balance factor is -1,0 and +1, it is an AVL tree (last fact is sufficent for the answer)

(b) What are the four (04) possibilities of AVL property violation?
You should give one example for each

(4 Marks)

ANSWER IN THIS BOX



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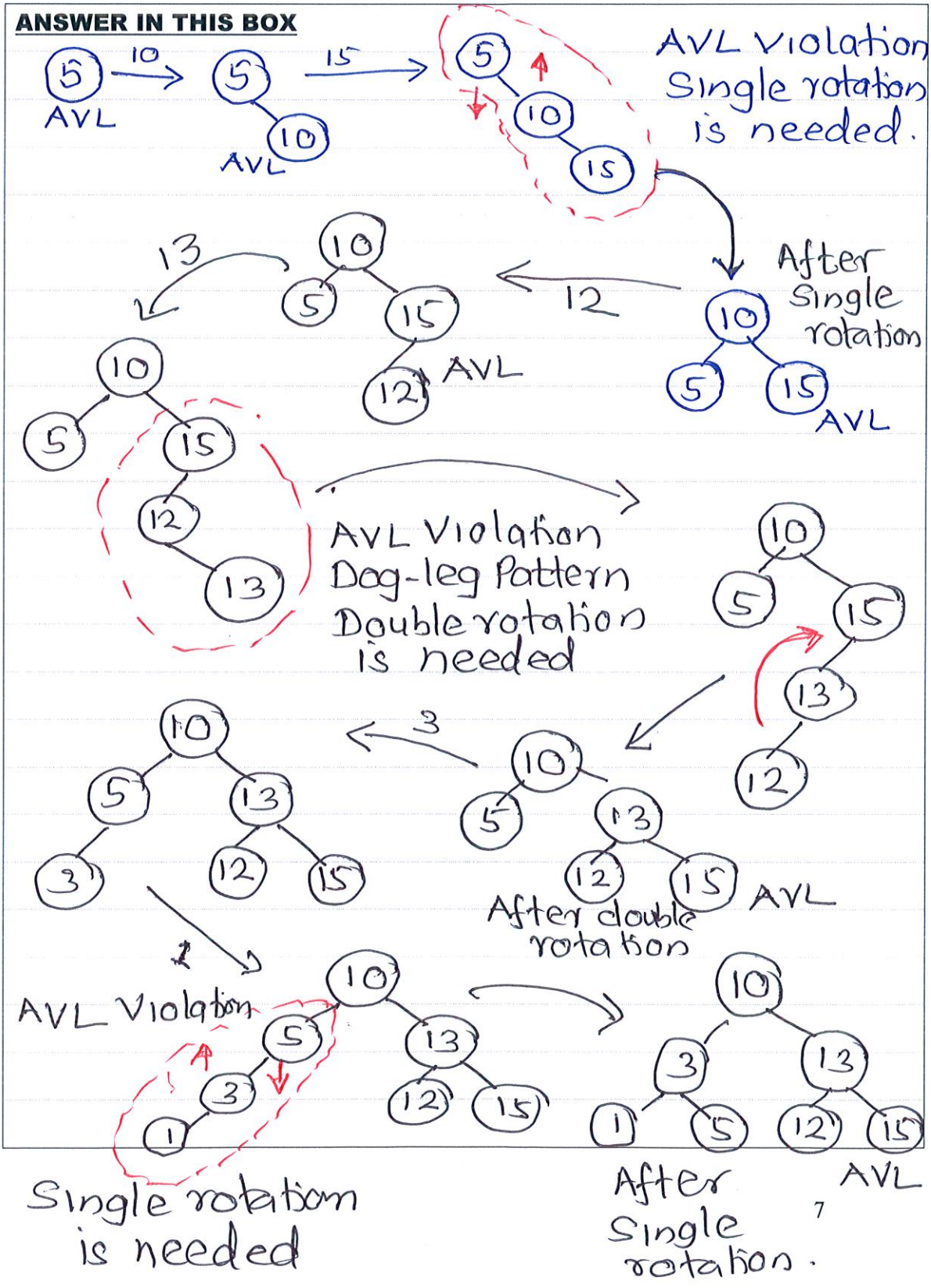
(c) Create the AVL tree using the following the data set.
{ 5,10,15,12,13,3,1}
In the process of creating the above tree, how can you fix any AVL property violations?
Your answer should be clearly illustrated with suitable diagrams with single and double rotations involving the fixing process, if any.

(8 Marks)

ANSWER IN THIS BOX



(d)What are the three categories of deleting nodes from a binary search tree?

(3 Marks)

ANSWER IN THIS BOX

(1) The node to be deleted has no sons. (deleting a leaf node).

(2) The node to be deleted has only one sub-tree.

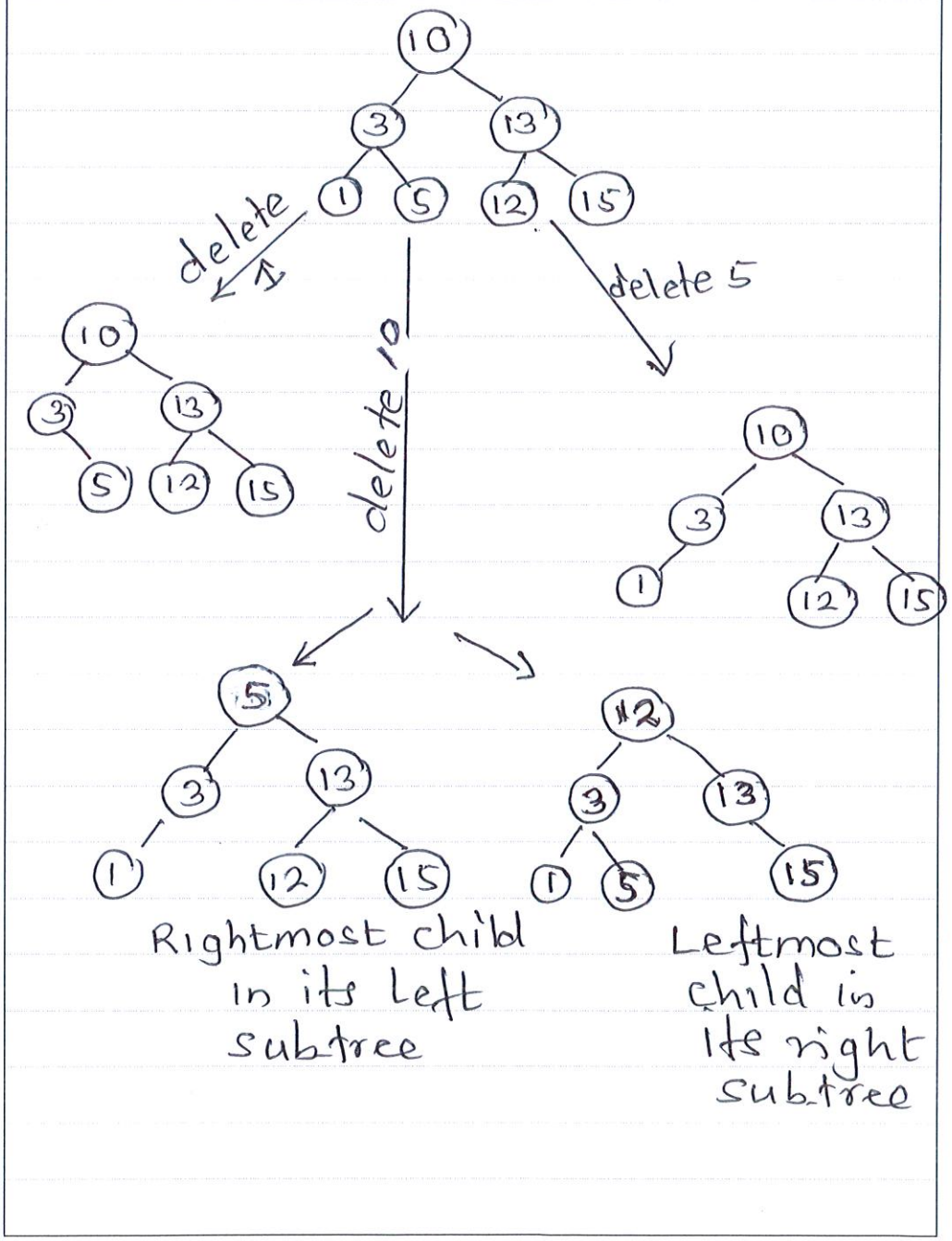
(3) The node to be deleted has two sub-trees.

(e) If one assumes the output of the above part(c) as a Binary Search Tree, describe a step by step sequence of deleting the following values from the tree created in part (c) above. Note: you should use the initial tree created in part (c) to perform the following deletions.

(i) 1
(ii) 5
(iii) 10

(6 Marks)

ANSWER IN THIS BOX



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