College Of Engineering Pune

END-SEM EXAM

(CT(HO) - 17001) Advanced Data Structures (ADS)

T.Y.B.Tech.(Computer Engineering - Honors)

Year: 2017 Semester: I Date: 03/12/2017

Duration: 3 hrs Max. Marks: 60

Instructions to candidates:

1. Answer all questions.
2. Figures to the right indicate full marks.

Marks

Q.1 (a) A stack is implemented using array. If the stack is full when 'Push' is called, the stack contents are copied into a new array of bigger size and then 'Push' is carried out. Assume both, 'Push' and 'Pop', take constant amount of time and initial size of array is 1. Find the amortized complexity of a sequence of n operations in each of the following scenario: 6

(i) When a new array is to be used, its size is taken as (size of old array + 1)

(ii) When a new array is to be used, its size is taken as (size of old array X 2)

(b) Encode the string "ABRACADABRA" using 4

(i) Fixed length code (ii) Variable length code using Huffman tree

Compare the size of encoded string in each case with the actual string size assuming one byte is required to represent one ASCII character.

Q.2 (a) A Total Correspondence structure is drawn partially as shown below in Fig-1. 6

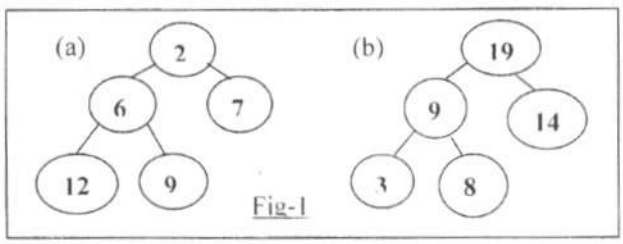

Fig-1

i) Show pointers between (a) and (b) so that they together represent a Total Correspondence structure.

ii) Show how the structure would change if 4 and 20 are inserted into it one after other.

(b) Let A[1..n, 1..n] be a nXn array of integers. Assume the array is stored in row-major form and there is a single cache line that can hold n integers. Write pseudo-code to find sum of elements of both the diagonals that will require minimum number of cache misses. How many cache misses will take place in the execution of your program? 4

Q.3 (a) Pseudo-code for melding two leftist trees with roots A and B is given below. Fill in the blanks in the pseudo-code: 6

```
Meld (A, B)
    if A = NULL return B;
    ----------------------; //to be filled

    if key(B) < Key(A)
        swap A, B;

    right(A) = Meld(-------, B); // to be filled

    if (dist(right(A)) > dist(left(A)))
        swap ----------------; // to be filled

    if right(A) = NULL
        dist(A) = 0;
    else
        ----------------------; // to be filled
    return A;
```

(b) Consider the Interval heap shown below (Fig-2): 4

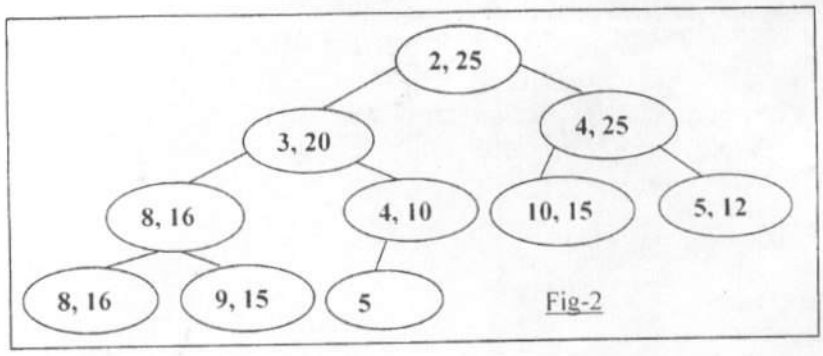

Fig-2

Report points outside the interval [4, 30] using complementary range search.

Q.4 (a) Let a Binomial heap is created by inserting elements (7, 2, 4, 17, 1, 11, 6, 8, 15, 10, 20) Show the changes in the Binomial heap, in step by step manner, after a RemoveMin operation is performed. 6

(b) Consider the Min Pairing heap shown below (Fig-3): 4

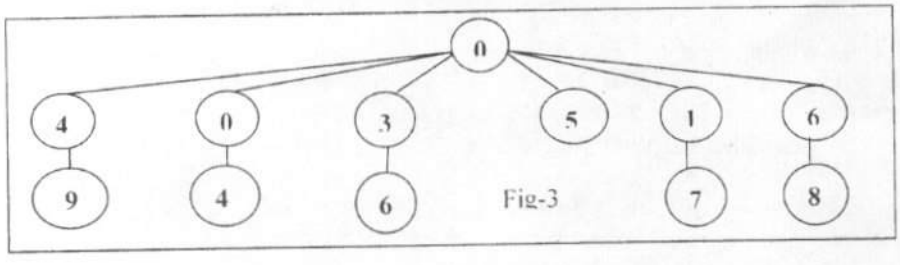

Fig-3

Show in step-by-step manner how the heap will change if min element is deleted and two-pass melding algorithm is used.

Q.5 (a) Find optimal binary search tree for a set of 5 keys with the following probabilities: 6

I	0	1	2	3	4	5
Pi	X	0.15	0.10	0.05	0.10	0.20
qi	0.05	0.10	0.05	0.05	0.05	0.10

(b) Consider the Fibonacci heap shown below (Fig-4) 4

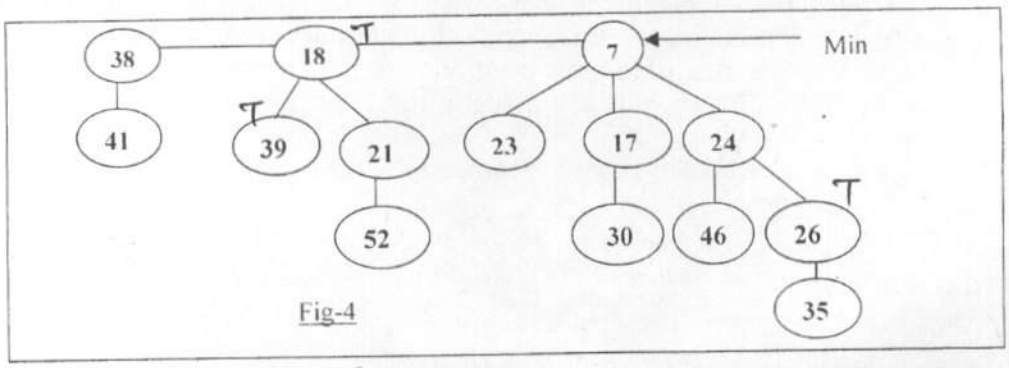

Fig-4

The nodes that have lost first child are shown with dark background. Show how the heap would change, in step-by-step manner, if following two 'DecreaseKey' operations are carried out one after the other:
(i) 46 is decreased by 31 (ii) 35 is decreased by 30

Q.6 (a) Show the AVL search trees that result after successively inserting the following values into an initially empty AVL tree: H, I, J, B, A, E, C, F, D, G, K, L 6

(b) Show the red-black trees that result after successively inserting the keys into an initially empty red-black tree: 41, 38, 31, 12, 19, 8 4

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