survival8

BITS WILP Data Structures and Algorithms Design Mid-Sem 2017-H1 (Regular)

BITS WILP Data Structures and Algorithms Design Mid-Sem 2017-H1 (Regular)

Birla Institue of Technology and Science, Pilani
Work Integrated Learning Programmes Division
Second Semester 2016-17
Mid Semester Test (EC-2 Regular)
Course No: SS ZG519
Course Title: Data Structures and Algorithms Design
Nature of exam: Closed book
Weightage: 35%
Duration: 2 hours
Date of exam: 25/Feb/2017 (AN)
No of pages: 2
No of questions: 5

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Birla Institute of Technology & Science, Pilani
Work-Integrated Learning Programmes Division
Second Semester 2016-2017

EC-2 Regular Mid-Semester Test

Course Title	:	Data Structures and Algorithms Design
Course No	:	SS ZG 519
Total	:	30 marks
Nature of Exam	:	Closed Book
Duration	:	2 hours
Date	:	25/02/2017 (AN)

No. of Pages = 2
No. of Questions = 5

Note:

1. Please follow all the Instructions to Candidates given on the cover page of the answer book.
2. All parts of a question should be answered consecutively. Each answer should start from a fresh page.
3. Assumptions made if any, should be stated clearly at the beginning of your answer.

1. Consider the following algorithm.

```
Algorithm
Input: Array consisting n integers
Output: Two dimensional n × n array B
for i = 1 to n
    for j = 1 to n
        B[i, j] → 0
    endfor
endfor
while (a ≠ b)
for i = 1 to n
    for j = i + 1 to n
        Add up array entries from A[i] to A[j] and store it in B[i, j]
    endfor
endfor
```

(a) What is the output the algorithm for the input $[2, 3, 4, 5]$? (2*Marks*)

(b) What is the running time of the algorithm? Justify your answer. (2*Marks*)

(c) Give a different algorithm to compute B (as in the above algorithm) with asymptotically better running time. (3*Marks*)

2. (a) Find C and n_0 to prove that $\log_2 n \in O(n^{1/4})$. (2*Marks*)

(b) Take the following functions and arrange them in ascending order of growth rate. That is, if function $g(n)$ immediately follows function $f(n)$ in your list, then it should be the case that $f(n)$ is $O(g(n))$.

$$2^{\sqrt{logn}} \quad 2^n \quad 2^{n/2} \quad n^{4/3}$$
$$n(logn)^3 \quad n^{logn} \quad 2^{n^2} \quad n!$$

(3*Marks*)

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...

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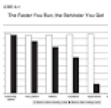

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Ashish Jain

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3. (a) Prove that a heap storing n keys has height $\lceil \log_2(n+1) \rceil$. (3*Marks*)
   (b) Illustrate heap sort by taking 7 distinct integers as input. (2*Marks*)

4. (a) The integers 1, 2, 3, 4 and 5 are to be inserted into an empty stack using the following sequence of push() operations:
   push(1) push(2) push(3) push(4) push(5)
   Assume that pop() removes an element from the stack and outputs the same. Which of the following output sequences can be generated by inserting suitable pop() operations into the above sequence of push() operations? Justify your answer.
   (A) 5 4 3 2 1
   (B) 1 2 3 4 5
   (C) 3 2 1 4 5
   (D) 5 4 1 2 3.
   (3*Marks*)
   (b) Write a pseudocode for inserting a node in a doubly linked list. (2*Marks*)

5. (a) Prove or disprove: delete operation in binary search tree is commutative. That is deleting x and y leaves the same tree as removing y and then x. (2*Marks*)
   (b) Construct a binary search tree such that its preorder traversal is 12, 7, 3, 9, 42, 52. (3*Marks*)
   (c) Insert items with the following keys (in the given order) into an initially empty binary search tree: 30, 40, 24, 58, 28, 26, 11, 13. Draw the tree after each insertion. (3*Marks*)

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