

哈尔滨工业大学深圳研究生院
2012 年 秋 季学期期末考试试卷

HIT Shenzhen Graduate School Examination Paper

Course Name: _____ Lecturer: _____

Question	One	Two	Three	Four	Five	Six	Seven	Eight	Nine	Ten	Total
Mark											

General directions:

This exam is **closed book**. You may not use the text book, your notes, computer, or any other materials during the exam.

No credit will be given for questions left unanswered, so you should be sure to answer all questions, even if you are only taking your best guess.

Write your answer to each question or problem in the paper provided. If necessary, extra sheets will be provided. Make sure your name is written on all of these pages.

Please be sure to write neatly and answer all questions unambiguously.

This exam has a total of 100 points, and you have 120 minutes.

Single choice [10 points]

1、Which case is most commonly used to evaluate the running time of one algorithm. ()

- (A) Worst case (B) Average case
(C) Best case (D) Ideal case.

2、Which method is not used to resolve a recurrence. ()

- (A) Substitution method (B) Recursion tree method
(C) Master method (D) Linear programming method.

3、An order-statistic tree is an augmented red-black tree. In addition to its usual fields, each node x has a field $size[x]$, which is the number of nodes in the subtree rooted at x . For an order-statistic tree with n nodes, the time for insertion, deletion and maintenance of the *size* field are ()

- (A) $O(\lg n)$ $O(\lg n)$ $O(\lg n)$
(B) $O(\lg n)$ $O(\lg n)$ $O(n \lg n)$
(C) $O(\lg n)$ $O(\lg n)$ $O(1)$
(D) $O(\lg n)$ $O(n \lg n)$ $O(n)$

Student Name:

Student ID:

Major:

答题内容写在边线外视为无效

4、 Computing a discrete Fourier transform (DFT) of N points takes ____ arithmetical operations, while computing a fast Fourier transform (FFT) of N points takes ____ arithmetical operations. ()

(A) $O(n^2)$ $O(n^2)$ (B) $O(n \lg n)$ $O(\lg n)$

(C) $O(\lg n)$ $O(n^2)$ (D) $O(n^2)$ $O(n \lg n)$

5、 In a hash table in which collisions are resolved by chaining, a successful search takes time ____, under the assumption of simple uniform hashing. The load factor of this hash table is α . ()

(A) $\theta(1)$ (B) $\theta(\alpha)$ (C) $\theta(1 + \alpha)$ (D) $\theta(\alpha^2)$

[31 points]

6、 Using figure to illustrate the operation of COUNTING-SORT on the array

$A = \langle 6, 0, 2, 0, 1, 3, 4, 6, 1, 3, 2 \rangle$.

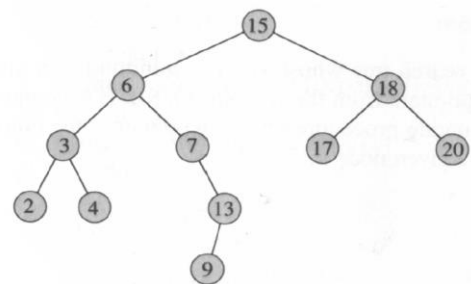
$C = \langle 2, 2, 2, 2, 1, 0, 2 \rangle$

$C' = \langle 2, 4, 6, 8, 9, 9, 11 \rangle$

$B = \langle 0, 0, 1, 1, 2, 2, 3, 3, 4, 6, 6 \rangle$

7、 Using figure to illustrate the operation of RADIX-SORT on the following list of English words: COW, DOG, SEA, RUG, ROW, MOB, BOX, TAB. [8 points]

8、 Please write inorder, preorder and postorder tree walks of the following binary search tree. [9 points]



9、 Please write down the elements of dynamic programming. [6 points]

[59 points]

10、 Using a recursion tree to give an asymptotically tight solution to the recurrence $T(n) = T(n/3) + T(2n/3) + cn$. [9 points]

11、 A red-black tree is a binary search tree with one extra bit of storage per node: its color, which can be either RED or BLACK, and the red-black is a nearly balanced tree. [10 points]

1) Please write down the red-black properties. [5 points]

2) Please prove the lemma: A red-black tree with n internal nodes has height at most $2\lg(n + 1)$? [5 points]

12、 Please give an optimal Huffman code for the following set of frequencies. [10 points]

	a	b	c	d	e	f
Frequency	5	9	16	12	13	45

13、 Converting the following linear program into standard form:

Minimize $2x_1 + 7x_2$

Subject to $x_1 = 7$

$$3x_1 + x_2 \geq 24$$

$$x_2 \geq 0$$

$$x_3 \leq 0$$

$$x_1, x_2 \geq 0$$
[illegible]