

國立高雄大學 109 學年度研究所碩士班招生考試試題

科目：資料結構

系所：資訊工程學系

是否使用計算機：否

考試時間：100 分鐘

本科原始成績：100 分

1. Given a vector of n integers, consider the problem of sorting it in increasing order. What is the cost of the insertion sort algorithm in terms of n in the worst case? (5%)

- (a) $\Theta(n)$
- (b) $\Theta(n^2)$
- (c) $\Theta(n^3)$
- (d) $\Theta(n^n)$

2. Given a vector of n integers, consider the problem of sorting it in increasing order. What is the cost of the insertion sort algorithm in terms of n in the best case? (5%)

- (a) $\Theta(n^n)$
- (b) $\Theta(n^2)$
- (c) $\Theta(\log n)$
- (d) $\Theta(n)$

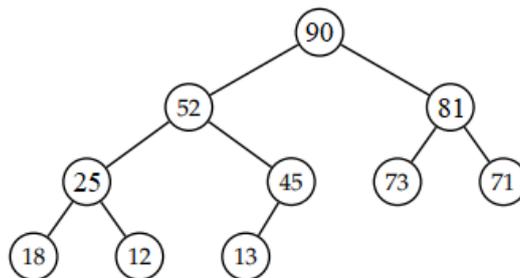
3. Show that $n! = \mathbf{O}(n^n)$ by applying the definition (not using limits). (10%)

4. A palindrome is a string that can be read backwards, and forwards with the same result. For instance, the following string is a palindrome

abbbdacadbbba

Write an algorithm in pseudocode using a stack to test if a string is a palindrome. (20%)

5. For the max-heap below, draw the resultant max-heap from adding 65 and deleting the maximum element (in this order). Show the detailed steps. (20%)



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6. (a) For the following data sequence:

5, 9, 3, 15, 2, 17

Show how to generate the binary search tree. (10%)

(b) Using the binary search tree constructed from (a), show the detailed steps about how to find which integer is closest to 8. (Hint: you may use any meaningful distance metric for computing the distance between two values.) (10%)

(c) The question in (b) is for finding the nearest neighbor of a given 1-dimensional instance. Now suppose you are given the following six 2-dimensional instances:

(5, 7), (9, 4), (3, 6), (15, 2), (2, 5), (17, 8)

Show how to generate the *k-d tree* (*k*-dimensional tree), where $k = 2$. (10%)

(d) Show how to use the *k-d tree* from (c) to find the nearest neighbor of (14,3). (Hint: you may use Euclidean distance for computing the distance between any pair of 2-dimensional instances.) (10%)