

# 國立台灣海洋大學資訊工程學系博士班

## 100 學年度第一學期博士班資格考命題卷

科目：演算法

日期：2012/01/11

1. Please briefly describe the following standard terms and techniques which are commonly used in algorithm designs. (20%)
  - (a) Max-Heap
  - (b) Optimal Substructure
  - (c) Dynamic Programming
  - (d) Prune and Search
2. Suppose we assign  $n$  persons to  $n$  jobs. Let  $C_{ij}$  be the cost of assigning the  $i$ th person to the  $j$ th job. Use a greedy approach to write an algorithm that finds an assignment that minimizes the total cost of assigning all  $n$  persons to all  $n$  jobs. Analyze your algorithm and show the results using order notation. (15%)
3. Please describe briefly the following sorting algorithms along with their time complexities. Which of them are *stable* sorting algorithms? Which of them are *in-place* sorting algorithms? (15%)
  - (a) Counting sort
  - (b) Merge sort
  - (c) Insertion sort
4. Let  $S$  and  $T$  be two arrays of  $n$  numbers that are already in nondecreasing order. Write an algorithm that finds the median of all  $2n$  numbers whose time complexity is  $\Theta(\lg n)$  (15%)
5. Given an array  $S$  containing  $n$  keys, the *selection problem* is to find the  $i$ th smallest key in  $S$  with  $1 \leq i \leq n$ . Show that the selection problem can be solved in  $O(n)$  time. (15%)
6. Design an algorithm to find both the minimum and the maximum of a set of  $n$  elements with  $3\lfloor n/2 \rfloor$  comparisons in the worse case. (10%)

7. Find the maximum value of  $s-t$  flow by Ford-Fulkerson Algorithm. Show the state of each phase. (10%)

