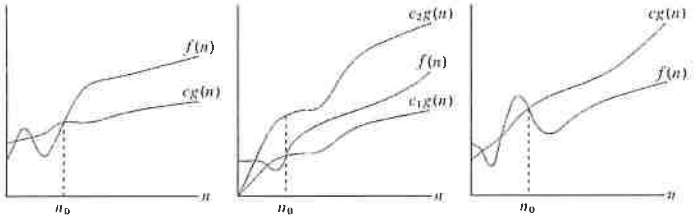
考 試 時 間	月 日上午 下午第 節 （星期 ）晚間	份 數		任 課 教 師	

國立臺灣科技大學 108學年度第 1 學期 博七班 資格考 考試命題用紙 系班別： 第 1 頁共 2 頁

考試科目：Algorithms

□研究所
□大學部
□工程在職進修

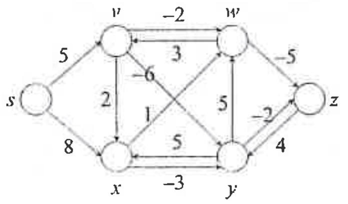
1. Please select the appropriate notation for the following figures: (15%)
(1) $f(n) = \Theta(g(n))$ (2) $g(n) = \Theta(f(n))$ (3) $f(n) = O(g(n))$ (4) $g(n) = O(f(n))$
(5) $f(n) = \Omega(g(n))$ (6) $g(n) = \Omega(f(n))$ (7) $f(n) = o(g(n))$ (9) $g(n) = o(f(n))$
(9) $f(n) = \omega(g(n))$ (10) $g(n) = \omega(f(n))$



(a) ________ (b) ________ (c) ________

2. Show that the solution of $T(n) = T(n-1) + n$ is $O(n^2)$. (10%)

3. (a) Given a directed graph with negative-weight edges as below, please find shortest paths from s to all other vertices. **Note: Please fill in each circle with the value of its shortest path from s and highlight edges to indicate predecessor values.** (10%)



(b) What kind of the algorithm shall you use to solve the problem? (5%)
(1) Bellman-Ford algorithm (2) Dijkstra's algorithm (3) Kruskal's algorithm (4) Prim's algorithm

4. Huffman's greedy algorithm uses a table giving how often each character occurs (i.e., its frequency) to build up an optimal way of representing each character as a binary string. Given the frequency of each character as follows:

a:22 b:12 c:5 d:18 e:11 f:24 g:8

Please construct the corresponding optimal Huffman code. (10%)

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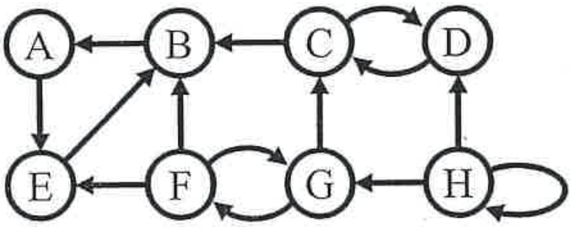
5. For an ordered number sequence: 20, 45, 30, 50, 100, 70, 40, 10, 60, 55
   (a) Please build an AVL tree by using the ordered number sequence. (5%)
   (b) Please write down all the steps when using quick sort algorithm to sort the given number sequence. (5%)
   (c) Please write down a pseudo code for the randomized quick sort algorithm. (10%)
   (d) What are the worst-case run times for classic quick sort and randomized quick sort algorithms, respectively? (5%)

6. Given a directed graph, please use DFS to find its strongly connected components. (10%)



7. Insertion sort, bubble sort, merge sort, heap sort, and radix sort are popular sorting algorithms. Please complete the following table. (15%)

	Comparison Sort? (Y/N)	Worst-case Running Time	Stable Sort? (Y/N)
Insertion Sort			
Bubble Sort			
Merge Sort			
Heap Sort			
Radix Sort			

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