類組：電機類　科目：資料結構(3002)　※請在答案卷內作答

一 (10%) Draw a detailed picture to show the steps to delete a node in the middle of a doubly linked list.

二 (10%) A *palindrome* is a sentence that can be read the same way in either direction. For example, "Able was I ere I saw Elba" is a palindrome. Please design an algorithm using a stack and a queue to check if a given sentence is a palindrome.

三 (10%) For secure hash functions.

(一) (2%) Define one-way property.

(二) (2%) Define weak collision resistance.

(三) (2%) Define strong collision resistance.

(四) (4%) Does the hash function $h(k) = k \% 17$ satisfy the one-way property, weak collision resistance, or strong collision resistance?

四 (10%) For sorting.

(一) (3%) Which of the bubble sort, quick sort, merge sort, heap sort, insertion sort, and selection sort are stable?

(二) (7%) What is the worst-case computing time of any sorting algorithm that sorts only by comparison? Prove your answer.

五 (10%)

(一) (2%) Define a max heap tree.

(二) (2%) Develop an algorithm in C/C++ to insert integers into a max heap tree. (Note, please use an array to implement the heap tree.)

(三) (2%) What does your max heap tree look like after inserting the following numbers {48, 2, 9, 67}?

(四) (2%) Continually, what does your max heap tree look like after inserting the following numbers { 59, 62, 18, 27}?

(五) (2%) Continually, what does your max heap tree look like after two deletions? (2%)

六 (10%)

(一) (6%) Write *inorder*(), *preorder*(), and *postorder*() functions for a given binary tree $T$. (Input: a binary tree $T$; output: the ordered sequence of nodes.)

(二) (4%) If the outputs of a tree, says $P$, are

*inorder*($P$) = *BCEAFGD*, and

*preorder*($P$) = *FCBAEDG*,

please draw the binary tree $P$ and give the output of *postorder*($P$).



七 (10%)

(一) (2%) Define a binary search tree.

(二) (4%) Write a program to start with an initially empty binary search tree and make $n$ random insertions. In the binary search tree, node $y$ is placed in the left subtree of node $x$, if *key*[$y$] < *key*[$x$].

(三) (4%) Suppose that we have integer numbers between 1 and 1000 in the binary search tree and we want to search for the number 279. Then we visit the following sequence of nodes {107, 566, 523, $k$, 145, 156, 312, 279}. Please explain all possible range of $k$ in the sequence.

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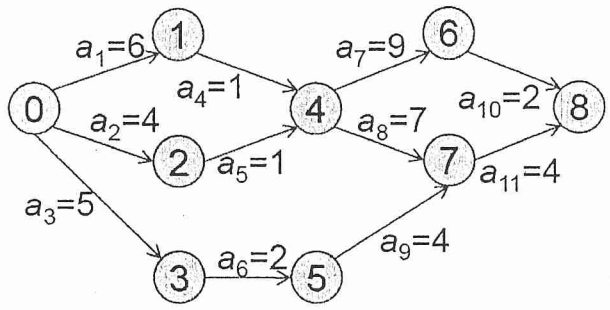
*k*, 145, 156, 312, 279}. Please explain all possible range of *k* in the sequence.

八 (10%) Let *G* be an undirected graph with 33 edges. *G* has 8 vertices of degree 4, 5 vertices of degree 3, 7 vertices of degree 2, and the rest of degree 1. How many vertices have degree 1? Show your steps.

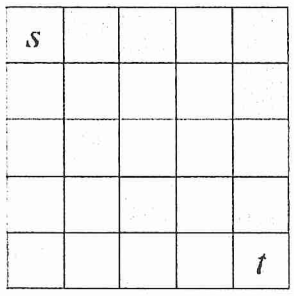
九 (10%) Given the following AOE (activity-on-edge) network.

(一) (5%) Write out the early, *e*(), and late, *l*(), start time for each activity ($a_1$–$a_{11}$). Use the forward-backward approach.

(二) (5%) Which activities are critical?




十 (10%) Consider the chessboard shown below. Note that some squares are shaded, denoting blockages. Any tour must not visit these shaded squares. We wish to determine a shortest path, if one exists, that starts at the square designated by *s* and after visiting the minimum number of squares, ends at the square designated by *t*. Formulate this problem on an appropriately defined graph. Give an efficient algorithm to solve this problem. What is the time complexity of your algorithm?



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