一　(10%) Briefly explain the following terms:

(一) Abstract data type

(二) Sparse matrix

(三) Circular queue

(四) Doubly linked list

二　(10%) Use the definition of Big-Oh to prove that $0.01n\log(n)-2000n+5$ is $O(n\log(n))$.

三　(10%) Convert an infix expression (A-B)/C-(D+E)/F-G to a postfix expression by using a stack. Your answer should include step-by-step status of input, stack, and output.

四　(10%) Let $A[1...u_1, 1...u_2, ..., 1...u_n]$ be an n-dimensional array. If s is the address for $A[1,1,...,1]$. What is the address for $A[i_1,i_2,...,i_n]$. Assume that the array elements are in row major order.

五　(10 %) The following figure shows an example of simulating a linked-list ($55 \to 23 \to 42 \to 10 \to 50 \to 5$) by a 2D array (first column stores data part and second column stores next part). Given a polynomial $f(x) = 10x^{100}y^4 + 20x^{10}y^2 + 4x$, show the function by using the representation of 4D array-based linked-list. Suppose the list starts from [2].

	data	next
[0]	5	-1
[1]	42	5
List start----→ [2]	55	4
[3]	50	0
[4]	23	1
[5]	10	3

六　(10%) Depict each step in Kruskal's and Prim's algorithms, respectively, to find the minimum-cost spanning tree of the following graph.
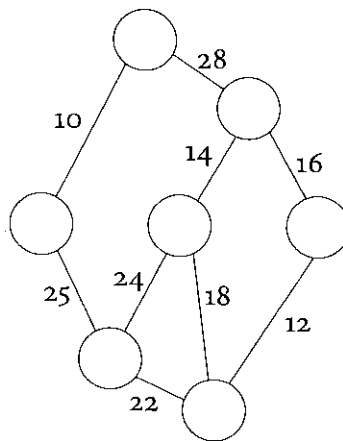
七　(10%) For Sorting,

(一) What does it means for a sorting algorithm to be "stable"?

(二) Why stable sorting is important?

(三) Which of quick sort, merge sort, heap sort, insertion sort, selection sort, and bubble sort is/are stable?
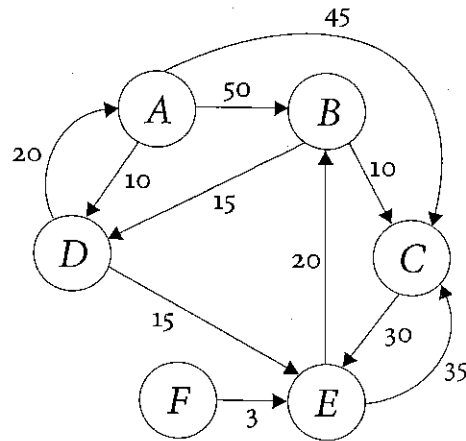
注意：背面有試題

八　(10%) For any nonempty binary tree, T, if n_0 is the number of leaf nodes and n_2 the number of nodes with two children. Prove that $n_0 = n_2 + 1$.

九　(10%) Please depict the change of a binary search tree after each of the following step.

(一) add 8　　　(二) add 11　　(三) add 3　　(四) add 1　　(五) add 9

(六) add 6　　　(七) delete 1　(八) delete 7　(九) delete 11　(十) delete 8

十　(10%) Find the shortest path from vertex A to all destinations.