1. Consider two-variable polynomials such as

$$f(x, y) = 4x^2 + 10xy + 2y^5.$$

   (a) (10%) You are asked to use arrays as the data structure to implement the addition operation of two polynomials. Discuss your implementation.

   (b) (10%) Discuss your implementation using linked lists as the data structure.

2. (10%) Convert the following infix expressions in Table 1 to postfix notations.

Infix
2+3*4
a*b+5
(1+2)*7
a*b/c
((a/(b-c+d))*(e-a)*c
a/b-c+d*e-a*c

Table 1: Infix expressions

3. (10%) Define the transformation of a forest into a single binary tree as follows: If $T_1, \ldots, T_n$ is a forest of trees, then the binary tree corresponding to this forest, denoted by $B(T_1, \ldots, T_n)$:

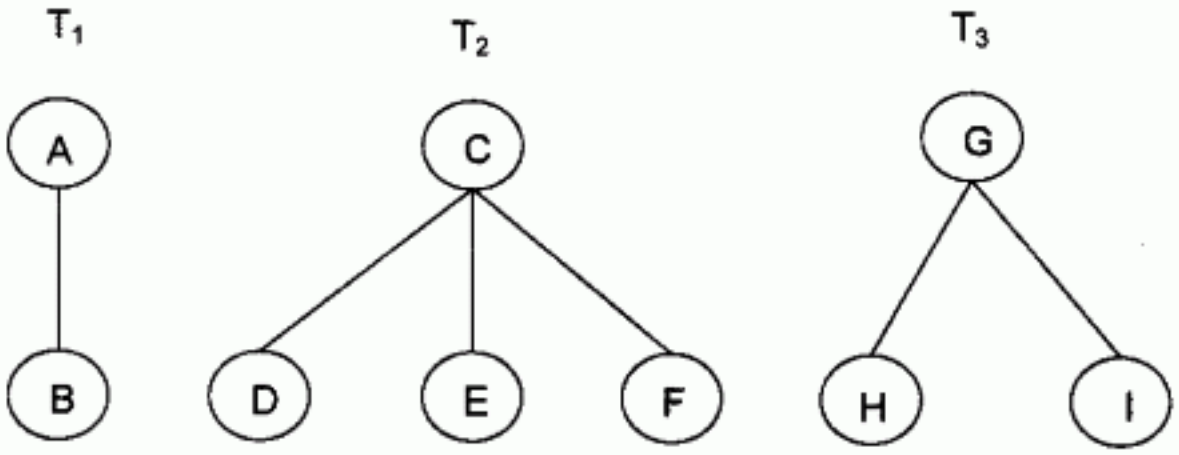
   (i) is empty if $n = 0$;

   (ii) has root equal to $root(T_1)$; has left subtree equal to $B(T_{11}, T_{12}, \ldots, T_{1m})$ where $T_{11}, \ldots, T_{1m}$ are the subtrees of $root(T_1)$; and has right subtree $B(T_2, \ldots, T_n)$.

   Thus, preorder and inorder traversals of the corresponding binary tree T of a forest F have a natural correspondence with traversals on F. Convert the following forest into a single binary tree according to the transformation described above. Show your answer in two steps:

   (a) Transform T_1, T_2, T_3 into their represented binary trees by *leftmost-child-next-right-sibling* relationship.

   (b) Construct the binary tree representation of the forest.



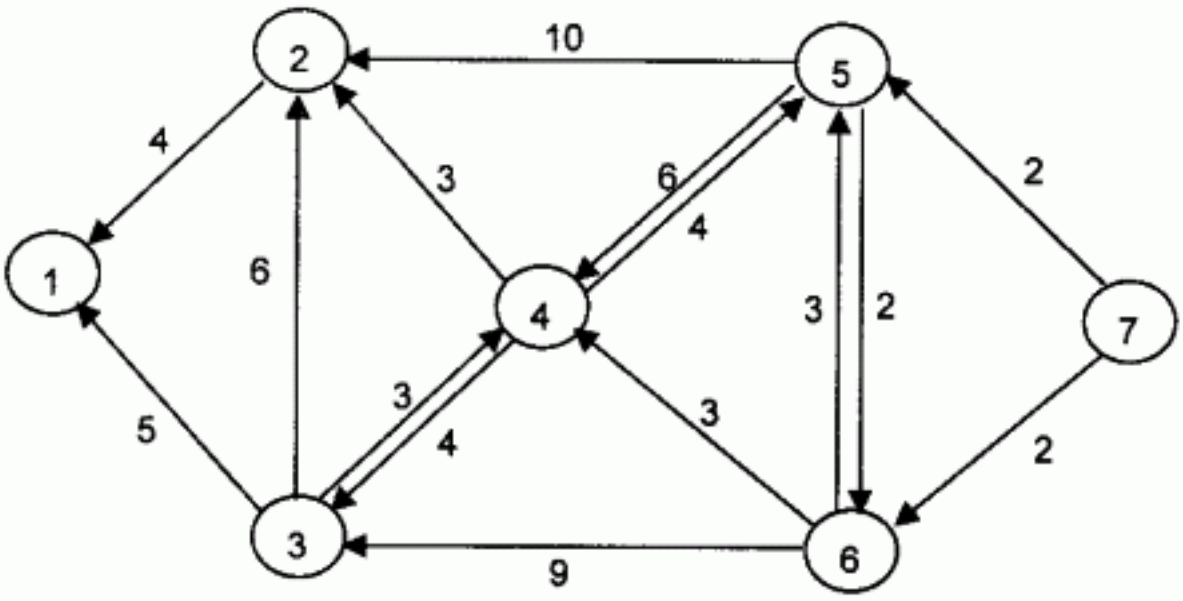
4. (10%) Write the status of the following file F at the end of each phase of the following algorithms:

   i. Insertion Sort

   ii. Quicksort

   $F = (12, 2, 16, 30, 8, 28, 4, 10, 20, 6, 18)$

5. (10%) Find the shortest path tree from every node to node 1 for the following graph by using the Bellman-Ford algorithm. (show clearly how each arc is selected after running the Bellman-Ford algorithm)



6. (10%) Compare the TCP and UDP protocols.

7. (10%) Compare two approaches to dealing with errors: (a) go back n (b) selected repeat.

8. (10%) Describe how the Address Resolution Protocol (ARP) works.

9. (10%) Draw a figure to show the relationship between the Internet protocol suite and the OSI seven-layer model.