

- (15 points) Show the number  $-5$  by 8-bit binary codes using the two-complement representation. Also give an example to explain the problem of overflow.
- (15 points) Give the full names of the following acronyms:  
 CPU, RAM, WWW, URL, http.
- (20 points) Convert the following infix expression into a postfix expression:  
 $(2 + 3 * 5) * (8 - 3 - 2) * 5 + 3$ .  
 Also briefly describe how to evaluate postfix expressions.
- (15 points) Let  $A$  be an adjacent matrix for a simple graph  $G = (V, E)$ , where  $V = \{1, 2, \dots, n\}$ , and  $A[i, j] = 1$  if node  $i$  and node  $j$  are adjacent, where  $1 \leq i \neq j \leq n$ . Otherwise,  $A[i, j] = 0$ . Describe briefly how to determine whether or not given any two distinct nodes  $i$  and  $j$  there is a path connecting these two nodes. And find a shortest path if they are connected. Give necessary data structures in order to get credits.
- (15 points) Given a C programming data structure as the following,
 

```

            struct node
            {
                int value;
                struct node *left, *right;
            }
            
```

 design a recursive C function (or a recursive function in some other programming languages) to find the total number of leaves of a binary tree. The heading of the definition of the function is as follows:  
`int total_leaves(struct node *np).`  
 The call `total_leaves( rootnode )` by passing the root `rootnode` of a tree will return the total number of leaves of the tree.
- (a)(10 points) Given a bipartite graph  $G = (V_1 \cup V_2, E)$ , where  $V_1$  and  $V_2$  are disjoint, show that the difference between the number of nodes of  $V_1$  and  $V_2$  is less than 2 if there is a Hamilton path in  $G$ .  
 (b)(10 points) Given a graph as follows, is there any Hamilton path in the graph? If there is one, then show it. Otherwise, explain why.

