1. What does the following program print?　(10%)

```c
#include <stdio.h>
#include <math.h>
int main(void) {
   int a=10, b=20;
   (a>=b) ? printf("%3d", ((a+b)+abs(a-b))/2) : printf("%3d", ((a+b)-abs(a-b))/2);
   return 0;
}
```

2. What does the following program print?　(10%)

```c
#include <stdio.h>
void gcd(int, int);
int main(void) {
    gcd(201,144);
    return 0;
}

void gcd(int a, int b){
    printf("%4d", a);
    if (a%b==0)
      return  a;
    else
      gcd(b, a%b);
}
```

3. What does the following program print?　(10%)

```c
#include <stdio.h>
int main(void) {
   int i, j, a[5][3];
   for (i=0; i<5; i++){
      for (j=0; j<3; j++){
         a[j][i]=j*5+i;
         printf("%4d", a[j][i]);
      }
      printf("\n");
   }
   return 0;
}
```

4. What does the following program print? (10%)

```c
#include <stdio.h>
int main(void) {
    int a=10000;
    do {
        if ((a%3==2) && (a%5==1) && (a%7==3)) {
            printf("%5d", a);
            break;
        }
        a--;
    } while (a>0);
    return 0;
}
```

5. What does the following program print?　(10%)

```c
#include <stdio.h>
int main(void) {
    int i=0, a[10]={3,5,6,1,4,7,2,9,8,0}, count=0;
    while (a[i+1]>a[i] && i<10){
        count++;
        i++;
    }
    printf("%2d", count);
    return 0;
}
```

6. The standard representation of a matrix is a two dimensional array. However for a sparse matrix as shown in the follows, this standard representation wastes memory space. Please describe what data structure is more suitable to represent a sparse matrix.　(10%)

$$\begin{bmatrix} 15 & 0 & 0 & 22 & 0 & -15 \\ 0 & 11 & 3 & 0 & 0 & 0 \\ 0 & 0 & 0 & -6 & 0 & 0 \\ 0 & 0 & 0 & 0 & 0 & 0 \\ 91 & 0 & 0 & 0 & 0 & 0 \\ 0 & 0 & 28 & 0 & 0 & 0 \end{bmatrix}$$
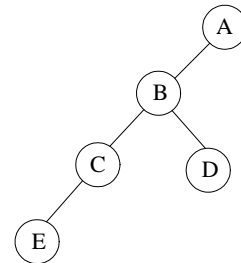
7. What does the following code do?　(5%)

　　ANS:

```
int *list;
list = (int*)malloc(sizeof(int)*size);
for ( i=0 ; i<size ; i++) {
      list[i] = i;
  }
```
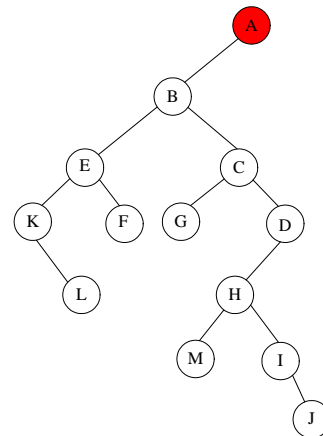
8. Please draw the internal memory representation of the following binary tree using a one-dimensional array;　(5%)

　　ANS:

9. Please transform the following tree into binary tree.　(5%)
　　ANS:

10. Suppose we have the preorder sequence ABCDEFGHI and the inorder sequence BCAEDGHFI of the same binary tree, please draw this binary tree.　(5%)
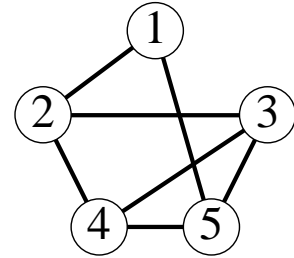
11. Given the following graph, please write its

    (a) Adjacency matrix;　(5%)

    (b) Adjacency lists;　(5%)

12. Find the minimum-cost spanning tree of the following graph by using Prim's algorithm. Assume we

    start from vertex B.　(10%)

    (Note: You have to draw the immediate steps or briefly explain your reason for (a), (b) and (c).
    Answers without explanation get only 2 points).

    ANS: