



1. (10%) Write a C/C++ function that reads in N integer quiz grades and computes the average and

standard deviation of the N scores. The standard deviation is defined as $\sqrt{\frac{1}{N} \sum_{i=1}^N (s_i - \bar{s})^2}$, where

\bar{s} is average of the N scores and s_i is the i -th score.

2. (10%) Consider the following type definition:

```
struct ShoeType
{
    char style;
    double price;
}
```

Given the function definition corresponding to the following function declarations:

(a) void readShoeRecord(ShoeType& newShoe);

// Fills newShoe with values read from the keyboard.

(b) ShoeType discount(ShoeType oldRecord);

// Returns a structure that is the same as its argument, but with the price reduced by 10%.

3. (5%) What is the output of the following program?

```
#include <iostream>
using namespace std;
void yuntech(int& x, int y, int& z);
int main ( )
{
    int a = 92, b=9 ,c=21;
    yuntech(a,b,c);
    cout<< a <<" " << b << " " << c <<endl;
    return 0;
}
void yuntech(int& x, int y, int& z)
{
    cout<< x <<" " << y << " " << z <<endl;
    x = x-3;
    y = y-3;
    z = z+5;
    cout<< x <<" " << y << " " << z <<endl;
}
```

4. (15%) Given the sequence: 6, 4, 3, 9, 2, 1, 8, 5, 7

(a) (3%) Construct a binary search tree for the sequence.

(b) (3%) Traverse the constructed binary search tree in inorder.

(c) (3%) Construct an AVL tree for the original sequence.



(d) (3%) Construct a heap tree (the root has the maximum key) for the original sequence.

(e) (3%) Construct a 2-3 tree for the original sequence.

5. (5%) What is the output of the following program?

```
#include <iostream>
using namespace std;
main()
{
    const int N=2, M=4;
    int i, j, a[N][M], *p, *q;
    p=&a[0][0];
    q=p+M;
    for (i=0; i<M; i++)
    {
        *(p+i)=N+i;
        *(q+i)=*(p+i)+i;
    }
    for (i=0; i<N; i++)
    {
        for (j=0; j<M; j++)
        {
            cout<< a[i][j]<<" ";
        }
        cout<<endl;
    }
}
```

6. (5%) What is the output of the following program?

```
#include <iostream>
using namespace std;
int csie (int n) {
    if (n<2)
        return 2;
    return csie(n-1)-csie(n-2);
}
main () {
    int i;
    for (i=0; i<7; i++)
        cout<< i << csie(i)<<endl;
}
```



7. (10 %) If the address of array elements $A(1,1)$ and $A(3, 3)$ are 2204 and 2244, what is the address of $A(4,4)$
8. (10 %) A byte of data with binary representation is 10011010. Please derive its hamming code.
9. (10 %) Please write the prefix and postfix notations of $A+B*(C-D)/E$
10. (10 %) Please implement the following function F with a multiplexer

$$F = A'B'C + A'BC + AB'C + ABC'$$
11. (10 %) Based on the Fig. 1, please write the search sequence with breadth-first search and depth-first search, respectively.

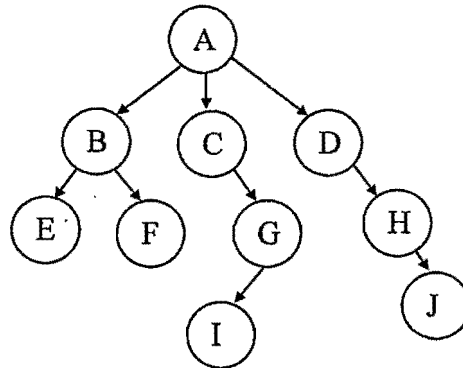


Fig.1