Department of Computer Science and Engineering
Southeast University
CSE161: Programming Language I

Assignment # 7

1. What are the outputs of the following program segments:

a)
```
int id[6],k;
for(k=0;k<=5;++k) id[k]=2*k;
id[2]=id[2]+id[3];
id[5]=id[5]-id[4];
for(k=0;k<=5;++k) printf("%d ",id[k]);
```

k	id[k]=2*k
0	id[0]=2*0=0
1	id[1]=2*1=2
2	id[2]=2*2=4
3	id[3]=2*3=6
4	id[4]=2*4=8
5	id[5]=2*5=10

id[2]=id[2]+id[3]=4+6=10
id[5]=id[5]-id[4]=10-8=2

Output: 0 2 10 6 8 2

b)
```
int M[5],k;
for(k=1;k<=4;++k) M[k]=10*k;
for(k=1;k<=4;++k) printf("%d ",M[k]);
```

k	M[k]=10*k
1	M[1]=10*1=10
2	M[2]=10*2=20
3	M[3]=10*3=30
4	M[4]=10*4=40

Output: 10 20 30 40

c)
```
int a[11],k;
for(k=1;k<=10;k+=2) {
  a[k]=3*k-2;
  a[k+1]=k*k-4;
}
for(k=2;k<=10;k+=3) a[k]=a[k+2]-a[k];
for(k=1;k<=10;++k) printf("%d ",a[k]);
```

k	a[k]=3*k-2	k+1	a[k+1]=k*k-4
1	a[1]=3*1-2=1	2	a[2]=1*1-4=-3
3	a[3]=3*3-2=7	4	a[4]=3*3-4=5
5	a[5]=3*5-2=13	6	a[6]=5*5-4=21
7	a[7]=3*7-2=19	8	a[8]=7*7-4=45
9	a[9]=3*9-2=25	10	a[10]=9*9-4=77

k	a[k]=a[k+2]-a[k]
2	a[2]= a[4]-a[2]=5-(-3)=8
5	a[5]= a[7]-a[5]=19-13=6
8	a[8]= a[10]-a[8]=77-45=32

Output: 1 8 7 5 6 21 19 32 25 77

d)
```
int x[7],k,j;
for(k=1;k<=6;k+=2) {
  x[k]=3*k;
  x[k+1]=k+2;
}
for(j=1;j<=6;j+=3) x[j]=x[j]+x[j+1];
for(k=1;k<=6;++k) printf("%d ",x[k]);
```

k	x[k]=3*k	k+1	x[k+1]=k+2
1	x[1]=3*1=3	2	x[2]= 1+2=3
3	x[3]=3*3=9	4	x[4]= 3+2=5
5	x[5]=3*5=15	6	x[6]= 5+2=7

j	x[j]=x[j]+x[j+1]
1	x[1]=x[1]+x[2]=3+3=6
4	x[4]=x[4]+x[5]=5+15=20

Output: 6 3 9 20 15 7

e)
```
int id[6],k;
for(k=0;k<=5;++k) id[k]=3*k;
id[1]=id[1]+id[2];
id[3]=id[3]-id[2];
id[5]=id[5]+ id[1]+id[3]-2*id[4];
for(k=0;k<=5;++k) printf("%d ",id[k]);
```

k	id[k]=3*k
0	id[0]=3*0=0
1	id[1]=3*1=3
2	id[2]=3*2=6
3	id[3]=3*3=9
4	id[4]=3*4=12
5	id[5]=3*5=15

id[1]=id[1]+id[2]=3+6=9
id[3]=id[3]-id[2]=9-6=3
id[5]=id[5]+ id[1]+id[3]-2*id[4]=15+9+3-24=3

Output: 0 9 6 3 12 3

2. If **sq** is a C array representing the matrix

$$\begin{bmatrix} 4 & 5 & 18 \\ 2 & 4 & 9 \\ 8 & 4 & 12 \end{bmatrix}$$

what is displayed by this program segment?

```
for(i=0;i<3;++i) printf("%8d",sq[i][i]);
```

```
int sq[3][3],i,j;
for(i=0;i<3;++i){ for(j=0;j<3;++j) scanf("%d",&sq[i][j]); }
```

sq[0][0]=4	sq[0][1]=5	sq[0][2]=18
sq[1][0]=2	sq[1][1]=4	sq[1][2]=9
sq[2][0]=8	sq[2][1]=4	sq[2][2]=12

Output: 4 4 12

3. A class of 15 students takes an exam on which scores range from 0 to 100. Write a C program which reads marks for all the students and finds:
a) the average score
b) the maximum score
c) the minimum score
d) the number of students who failed, i.e., scored below 40
e) the number of students with perfect papers, i.e. scored 100.

```
#include <stdio.h>

int main()
{
   int marks[15],i,sum=0,maxMark=-99,minMark=200,failed=0,perfect=0;
   float av;

  for(i=0;i<15;++i){
      scanf("%d",&marks[i]);
      sum=sum+marks[i];
      if(marks[i]>maxMark) maxMark=marks[i];
      if(marks[i]<minMark) minMark=marks[i];
      if(marks[i]<40)failed++;
      if(marks[i]==100) perfect++;
   }
   av=sum/15.0;
   printf("average score=%f\n maximum score=%d\n minimum score=%d\n",av,maxMark,minMark);
   printf("number of students who failed=%d\n number of students with perfect papers=%d",failed,perfect);

   return 0;
}
```

4. Write a C program to input elements in array and sort array elements in ascending order.

Example

Input:
Input size of array: 10
Input array elements: 20 2 10 6 52 31 0 45 79 40
Output:
Array sorted in ascending order: 0 2 6 10 20 31 40 45 52 79

5. Write a C program to input elements in array and sort array elements in descending order.

6. A is an m×n matrix and B is an m×n matrix too. Write a C program that adds these two matrices A and B to yield a new matrix D.

```
   A             B                D
 2   5  7      3  10   6         5  15  13
10   9  6      1   8   20       11  17  26
```

```
#include <stdio.h>
#define MAX_mSIZE 10    // Maximum row size
#define MAX_nSIZE 20    // Maximum column size

int main()
{
   int A[MAX_mSIZE][MAX_nSIZE],B[MAX_mSIZE][MAX_nSIZE],D[MAX_mSIZE][MAX_nSIZE],i,j,m,n;
   printf("Enter row size m: ");
   scanf("%d", &m);
   printf("Enter column size n: ");
   scanf("%d", &n);

   printf("Enter elements of matrix A:\n");
   for(i=0;i<m;i++){
          for(j=0;j<n;j++){
                  scanf("%d",&A[i][j]);
           }
   }
   printf("Enter elements of matrix B:\n");
   for(i=0;i<m;i++){
           for(j=0;j<n;j++){
                  scanf("%d",&B[i][j]);
            }
   }

   for(i=0;i<m;i++){
             for(j=0;j<n;j++){
                  D[i][j]=A[i][j]+B[i][j];
              }
   }
   printf("Matrix D:\n");
   for(i=0;i<m;i++){
              for(j=0;j<n;j++){
                  printf("%d ",D[i][j]);
              }
              printf("\n");
  }

   return 0;
}
```

7. Repeat Exercise 6 for matrix subtraction i.e., where D=A-B.

8. One student has sit for seven tests for a particular course. The final mark for that course is the average of six tests' marks (the lowest mark will be thrown out). Using two-dimensional array, input and output files, write a C program that calculates the final marks for 5 students who took that course. Develop a function for calculation and printing in the output file. Then write a C main program that reads the marks of all students and calls the developed function.

data.txt
3 1 7 10 10 9 5
10 7 2 6 5 4 7
8 3 9 7 6 2 4
6 8 9 5 2 9 8
7 10 4 3 9 10 6

out.txt
Student Average marks
1 7.33
2 6.50
3 6.17
4 7.50
5 7.67

```
#include <stdio.h>

int main()
{
   int marks[5][7],i,j,sum,minMark;
   float av;
   FILE *f1, *f2;
   f1= fopen("data.txt", "r");
   if (f1==0)
   { printf("error in opening file");

   return 0; }
   f2= fopen("out.txt", "w");

   fprintf(f2,"Student  Average marks\n ");

   for(i=0;i<5;i++){
      sum=0;
     minMark=200;
      for(j=0;j<7;j++){
         fscanf(f1,"%d",&marks[i][j]);

         sum=sum+marks[i][j];

         if(marks[i][j]<minMark) minMark=marks[i][j];
      }
      sum=sum-minMark;
      av=sum/6.0;

      fprintf(f2,"%d       %.2f\n ",i+1,av);
   }
   fclose(f1);
   fclose(f2);
```

```
    return 0;
}
```

Using Function

```
#include <stdio.h>

void cal(int marks[][7], FILE *f2)
{
    int i,j,sum,minMark;
    float av;
    fprintf(f2,"Student  Average marks\n ");

    for(i=0;i<5;i++){
        sum=0;
       minMark=200;
        for(j=0;j<7;j++){
            sum=sum+marks[i][j];

            if(marks[i][j]<minMark) minMark=marks[i][j];
        }
        sum=sum-minMark;
        av=sum/6.0;

        fprintf(f2,"%d       %.2f\n ",i+1,av);
    }

}

int main()
{
    int marks[5][7],i,j;

    FILE *f1, *f2;
    f1= fopen("data.txt", "r");
    if (f1==0)
    { printf("error in opening file");

    return 0; }
    f2= fopen("out.txt", "w");

    for(i=0;i<5;i++){
        for(j=0;j<7;j++){
            fscanf(f1,"%d",&marks[i][j]);
        }
    }
    cal(marks, f2);
    fclose(f1);
    fclose(f2);

    return 0;
}
```

9. A data file has n+1 lines. The first line contains the value of n and the following n lines contain the values for $x_1, x_2, x_3, \ldots, x_n$. Mean, variant and standard deviation for $x_1, x_2, x_3, \ldots, x_n$ can be defined as:-

$$m = mean = \frac{\sum_{i=1}^{n} x_i}{n}$$

$$variant = \frac{\sum_{i=1}^{n} x_i^2}{n} - m^2$$

$$standard\ deviation = \sqrt{variant}$$

Write a C program that reads data from the data file and then finds mean, variant and standard deviation for the data set.

data2.txt Output: Mean=7.50 variant=3.25 standard deviation=1.80

```
4
5
10
7
8
```

```
#include <stdio.h>
#include <math.h>

int main()
{
   int n,i, x[100];
   float sumX=0.0,sumX2=0.0, m, variant,stdDev;
   FILE *f1;
   f1= fopen("data2.txt", "r");
   if (f1==0)
   { printf("error in opening file");

   return 0; }
   fscanf(f1,"%d",&n);

   for(i=0;i<n;i++){
      fscanf(f1,"%d",&x[i]);
      sumX=sumX+x[i];
      sumX2=sumX2+x[i]*x[i];
   }

   m=sumX/n;
   variant = sumX2/n - m*m;
   stdDev=sqrt(variant);
   printf("Mean=%.2f variant=%.2f standard deviation=%.2f",m,variant,stdDev);

   fclose(f1);


   return 0;
}
```