Programming Basics (HW#2)

Data Structure

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Problem

Get 2 10 integer number series sorted in ascending order,

Print out the 20 numbers sorted in ascending order.

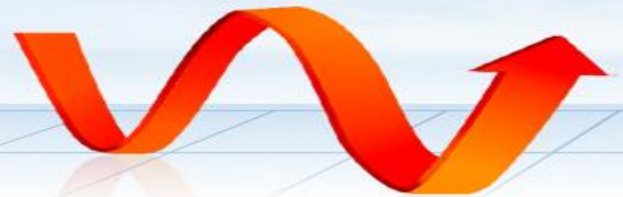
- Same numbers should be printed only once.

- You should check whether the input numbers are sorted in ascending order and the number of integers is 2 * 10 in total.

If not, you should print out the following error message and terminate your program,

"The input numbers are not in ascending order".

Or, "You should input 20 numbers in total"



Problem

- Execution

Input :
-1, 2, 6, 8, 19, 100, 120, 210, 211, 212
1, 3, 4, 9, 30, 50, 111, 211, 213, 215
Output :
-1, 1, 2, 3, 4, 6, 8, 9, 19, 30, 50, 100, 111, 120, 210, 211, 212, 213, 215

Input :
1, 2, 8, 6, 19, 100, 120, 210, 211, 212
1, 3, 4, 9, 30, 50, 111, 211, 213, 215
Output :
The input numbers are not in ascending order.

Input :
1, 2, 8, 6, 19, 100
1, 3, 4, 9, 30, 50, 111, 211, 213, 215
Output :
You should input 20 numbers in total.

Example – Problem Analysis (1)

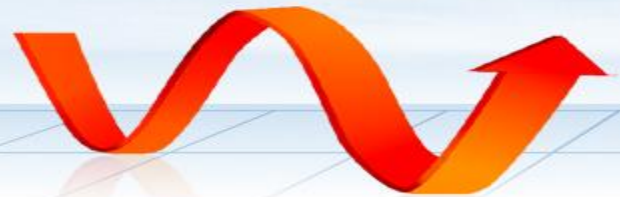
- Input : 2 * (10 numbers)
- Output : 20 numbers sorted in ascending order
- Requirements :
  - **Same numbers should be printed only once.**
  - **Check that the input numbers are sorted in ascending order.**
    - If not, print out an error message.
  - **Check that the number of integers is 2 * 10 in total.**
    - If not, print out an error message.

- What to do
  - **In/Out Design**
    - Keyboard in/Screen out
  - **Get the data from keyboard and store it, check the inputs**
    - Mixed input of integer and characters (‘,’ and ‘ ‘)
  - **Sort and print out the ordered numbers at screen**

- What to use
  - **Data/storage Design**
    - int *in[2]

Example – Problem Analysis (2)

- How to do
  - **Program structure**
    - Several functions ?
      - Extract and analyze input numbers
      - Sort 20 numbers in ascending order
      - Print out the sorted numbers
  - **Algorithm**
    - Get the input of 10 * 2 numbers
      - Get the various typed data entered
        - » **scanf, gets, getchar**
    - Extract 10 * 2 numbers
      - Check the numbers
      - Check the ascending order of the inputs
    - Sort and print out 20 numbers
      - Print integers
        - » **printf**



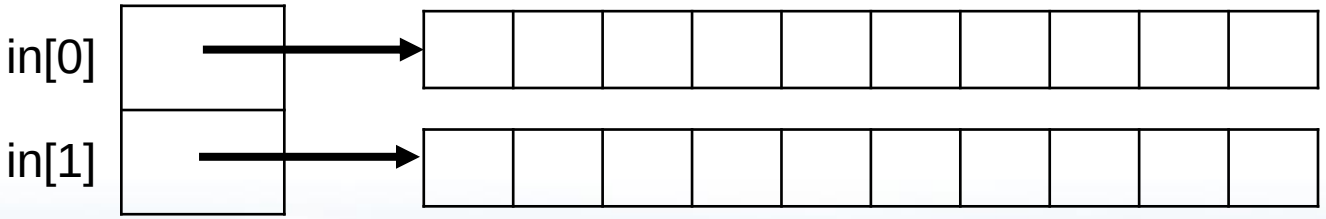
Example – Data/storage Design

char temp[100];

int status;

int *in[2];

- Get a string which contains 10 numbers mixed with ‘,’ and ‘ ‘
- NORMAL, NO_ASC, NO_TOTAL, NO_MEM
- *int[2]



Example – Program Flow (1)

```
char temp[100];
int input[10];
int status = NORMAL;

scanf(" %[^\n]s", temp);

for(token = strtok(temp, d), i=0;
    token != NULL && i < 10 ;
    token = strtok(NULL, d)){

            input[i++]=atoi(token);

            if(i>1 && input[i-2] > input[i-1]){
                status = NO_ASC;
              }
}

if(i != 10){
            status = NO_TOTAL;
}
```

- Get a string which contains 10 numbers mixed with ‘,’ and ‘ ‘
  - **Extract numbers from the string**
  - **Check that the input numbers are sorted in ascending order**
  - **Check that the number of integers is 2 * 10 in total**

Example – Program Flow (2)

```
int output[20];

for(i=0, j=0, k=0; i<10 && j<10 && k<20;){
        if( in[0][i] > in[1][j] )
            output[k++] = in[1][j++] ;
        else if(in[0][i] < in[1][j])
            output[k++] = in[0][i++];
        else{
            output[k++] = in[0][i++];
            j++;
        }
}

printf("Output : ");
for(i=0;i<k;i++){
        printf("%d", output[i]);
        if(i+1!=k)
            printf(", ");
}
```

- Sort the numbers in in[0][] and in[1][], and store them in output[]
  - **The same numbers are saved as one number**
- Print out output[]

Sample, ver. 1 (1/2)

```c
#include <stdio.h>
#include <string.h>
#include <stdlib.h>

#define MAX 10
#define T_MAX 20

#define NORMAL 0
#define NO_ASC 1
#define NO_TOTAL 2
#define NO_MEM 3

int *getin(int *);
void sort(int *in[]);
```

```c
int main()
{
    int *in[2], status=NORMAL;

    printf("Input 2*10 numbers :₩n");
    in[0]=getin(&status);
    if(status==NORMAL)
        in[1]=getin(&status);

    switch(status)
    {
        case NORMAL :
            sort(in);
            break;
        case NO_ASC :      // No Ascending Order
            printf("The input numbers are not in ascending order!₩n");
            break;
        case NO_TOTAL :    // Not 20 numbers
            printf("You should input 20 numbers in total.₩n");
            break;
        case NO_MEM :      // No memory assignment
            printf("No memory allocation.₩n");
            break;
    }

    return 0;
}
```

Sample, ver. 1 (2/2)

```
44  int *getin(int *status)
45  {
46      char temp[100];
47      int *input = NULL;
48      char d[2] =",";
49      char *token;
50      int i;
51
52      input = (int *)malloc(sizeof(int)*MAX);
53      if( input != NULL ){
54          scanf(" %[^\n]s", temp);
55
56          for(token = strtok(temp, d), i=0; token != NULL && i < MAX; token = strtok(NULL, d)){
57              input[i++]=atoi(token);
58
59              if(i>1 && input[i-2] > input[i-1]){
60                  *status = NO_ASC;
61                  free(input);
62                  return NULL;
63              }
64          }
65          if(i != MAX){
66              *status = NO_TOTAL;
67              free(input);
68              return NULL;
69          }
70      }
71      else
72          *status = NO_MEM;
73
74      return input;
75  }
```

```
77  void sort(int *in[])
78  {
79      int i, j, k;
80      int output[T_MAX];
81
82      for(i=0, j=0, k=0; i<MAX && j<MAX && k<T_MAX; ){
83          if( in[0][i] > in[1][j] )
84              output[k++] = in[1][j++] ;
85          else if(in[0][i] < in[1][j])
86              output[k++] = in[0][i++];
87          else{
88              output[k++] = in[0][i++];
89              j++;
90          }
91      }
92
93      if(i<MAX)
94          while(i<MAX && k<T_MAX)
95              output[k++] = in[0][i++];
96
97      if(j<MAX)
98          while(j<MAX && k<T_MAX)
99              output[k++] = in[1][j++];
100
101     printf("Output : ");
102     for(i=0;i<k;i++){
103         printf("%d", output[i]);
104         if(i+1!=k)
105             printf(", ");
106     }
107
108     free(in[0]);
109     free(in[1]);
110 }
```

Sample, ver. 2 (1/2)

```c
#include <stdio.h>
#include <string.h>
#include <stdlib.h>

#define MAX 10
#define T_MAX 20

#define NORMAL 0
#define NO_ASC 1
#define NO_TOTAL 2
#define NO_MEM 3

int **getin(int *);
void sort(int *in[]);
```

```c
int main()
{
    int **in, status=NORMAL;

    in=getin(&status);

    switch(status)
    {
        case NORMAL :
            sort(in);
            break;
        case NO_ASC :     // No Ascending Order
            printf("The input numbers are not in ascending order!₩n");
            break;
        case NO_TOTAL :   // Not 20 numbers
            printf("You should input 20 numbers in total.₩n");
            break;
        case NO_MEM :   // No memmory allocation
            printf("No memory allocation.₩n");
            break;
    }

    return 0;
}
```

Sample, ver. 2 (2/2)

```
41  int **getin(int *status)
42  {
43      char temp[100];
44      int **input = NULL;
45      char d[2] =",";
46      char *token;
47      int i, line=0;
48
49      input = (int **)malloc(sizeof(int *)*2);
50
51      if( input != NULL ){
52          printf("Input 2*10 numbers :₩n");
53
54          while(line<2){
55              if((input[line] = (int *)malloc(sizeof(int)*MAX))==NULL)
56              {
57                  *status = NO_MEM;
58                  return input;
59              }
60              scanf(" %[^₩n]s", temp);
61
62              for(token = strtok(temp, d), i=0; token != NULL && i < MAX; token = strtok(NULL, d)){
63                  input[line][i++]=atoi(token);
64
65                  if(i>1 && input[line][i-2] > input[line][i-1]){
66                      *status = NO_ASC;
67                      free(input[line]);
68                      free(input);
69                      return NULL;
70                  }
71              }
72              if(i != MAX){
73                  *status = NO_TOTAL;
74                  free(input[line]);
75                  free(input);
76                  return NULL;
77              }
78              line++;
79          }
80      }
81      else
82          *status = NO_MEM;
83
84      return input;
85  }
```

```
87  void sort(int *in[])
88  {
89      int i, j, k;
90      int output[T_MAX];
91
92      for(i=0, j=0, k=0; i<MAX && j<MAX && k<T_MAX; ){
93          if( in[0][i] > in[1][j] )
94              output[k++] = in[1][j++] ;
95          else if(in[0][i] < in[1][j])
96              output[k++] = in[0][i++];
97          else{
98              output[k++] = in[0][i++];
99              j++;
100         }
101     }
102
103     if(i<MAX)
104         while(i<MAX && k<T_MAX)
105             output[k++] = in[0][i++];
106
107     if(j<MAX)
108         while(j<MAX && k<T_MAX)
109             output[k++] = in[1][j++];
110
111     printf("Output : ");
112     for(i=0;i<k;i++){
113         printf("%d", output[i]);
114         if(i+1!=k)
115             printf(", ");
116     }
117
118     free(in[0]);
119     free(in[1]);
120     free(in);
121 }
```