King Fahd University of Petroleum and Minerals
Information and Computer Science Department
ICS 103: Computer Programming in C
Summer Semester 2009-2010 (Term-093)

Final Exam

Time: 120 minutes **Wednesday August 25, 2010**

Name:	KEY
ID#:	

PLEASE CIRCLE YOUR SECTION BELOW:

Section	01	02	03
Instructor	Mr. AHMAD IRFAN	Dr. FARAG AZZEDIN	Dr. AIMAN EL-MALEH
Time	SUMT 9:20-10:10am	SUMT 10:30-11:20am	SUMT 10:30-11:20am

Question #	Maximum Marks	Obtained Marks
1	36	
2	20	
3	20	
4	24	
Total	100	

Notes.
1. Make sure you have **TEN** pages including the cover page.
2. Closed book and notes
3. Write clearly, briefly and precisely
4. Cheating will result in ZERO grade

Good Luck

Question 1: (36 points)

Determine the output of each of the following programs:

```
#include <stdio.h>    // P1:      6 points
#include <string.h>

int main() {
 char s[]="seaqwwa901qwa0";

 for(int i=0; s[i]!='\0'; i++) {
   if (s[i]=='a')
      printf("%d\n", strlen(s)-i);
 }
 return 0;
}
```

```
12
8
2
```

```
#include <stdio.h> // P2:       6 points

int main() {
   int a[3][3],b[3][3];
   int i,j;

   for(i=0;i<3;i++) {
      for(j=0;j<3;j++)
         a[i][j]=i+j;
   }
   for(i=0;i<3;i++) {
      for(j=0;j<3;j++) {
          b[j][i] = a[i][j] + i;
          printf("%4d ",b[j][i]);
      }
      printf("\n");
   }
   return 0;
}
```

```
   0   1   2
   2   3   4
   4   5   6
```

```
#include <stdio.h> // P3:             6 points

int main() {
   int num = 120123456;

   while(num!=0){
       int rem = num%10;
       num = num/10;
       if (rem%2)continue;
       if(rem == 0)break;
       printf("%d\n", rem);
   }
   return 0;
}
```

6
4
2

```
#include <stdio.h> // P4:             6 points
#include <string.h>
#include <ctype.h>

int main() {
   char a[10],b[]="keq",c[]="jdr";
   int i,len;
   len=strlen(b);

   for(i=0;i<len;i++) {
      if(b[i] > c[i])
         a[i]=toupper(c[i]-1);
      else
         a[i]=toupper(c[i]+1);
   }
   a[i]='\0';
   puts(a);
   return 0;
}
```

ICS

```
#include <stdio.h>   // P5:       6 points
#include <string.h>

int main(void) {
   char str[4][80]={"ICS", "SWE", "SE",
"COE"};
   char tstr[80];
   int i, p=1, s;
   do{
     s = 0;
     for(i = 1; i <= 4-p; i++) {
        if (strcmp(str[i-1],str[i])<0){
            strcpy(tstr,str[i-1]);
            strcpy(str[i-1],str[i]);
            strcpy(str[i],tstr);
            s=1;
        }
     }
     p++;
     for (i=0; i<4; i++)
        puts(str[i]);
   } while (s && p <= 3);
   return 0;
}
```

```
SWE
SE
ICS
COE
SWE
SE
ICS
COE
```

```
#include <stdio.h>   // P6:       6 points
#include <string.h>
#include <ctype.h>

int main() {
  char str1[]={"ICS 103 is Interesting"};
  char *t;
  int count=0;
  t = strtok(str1, " ");
  while ( t != NULL ) {
     if (tolower(t[0])=='i'){
         puts(t);
         count++;
     }
     t = strtok(NULL, " ");
  }
  printf("%d\n", count);
  return 0;
}
```

```
ICS
is
Interesting
3
```

Question 2: (20 points)

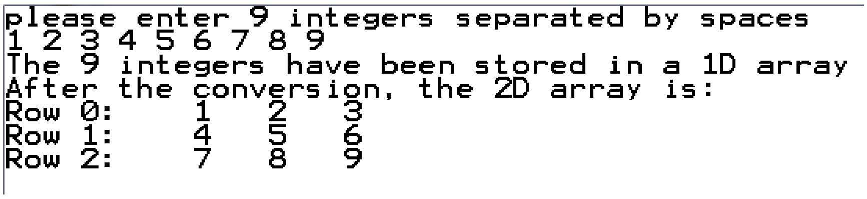
Write a complete C program that prompts a user to enter 64 integer numbers; the program stores them in a 1D array. Then, it converts the 1D array into an 8x8 2D array and prints the 2D array row-wise in the following format (as an example):

Row 0: 3 4 5 6 8 2 4 1
Row 1: 4 7 4 3 7 5 8 4
…
Row 7: 4 2 7 5 7 9 3 7

You must use loop to fill the arrays.

Your solution must use a function called **read_1D_array** to prompt the user to enter 64 integers and stores them in the ID array. You should also use a function called **convert** that takes the 1D array and converts it into an 8x8 2D array. The function **convert** will need arguments such as the input **1D_array** and the resulting **2D_array**. Finally, you should write a function called **print_2D_array** that takes the **2D_array** as an argument **and prints it to the screen.** Define the dimensions of the 1D and 2D arrays using define preprocessor directive.

Your program should produce the following output. This output is only for 9 integers as an example. Your program should work for 64 integers as specified above.



```
please enter 9 integers separated by spaces
1 2 3 4 5 6 7 8 9
The 9 integers have been stored in a 1D array
After the conversion, the 2D array is:
Row 0:     1   2   3
Row 1:     4   5   6
Row 2:     7   8   9
```

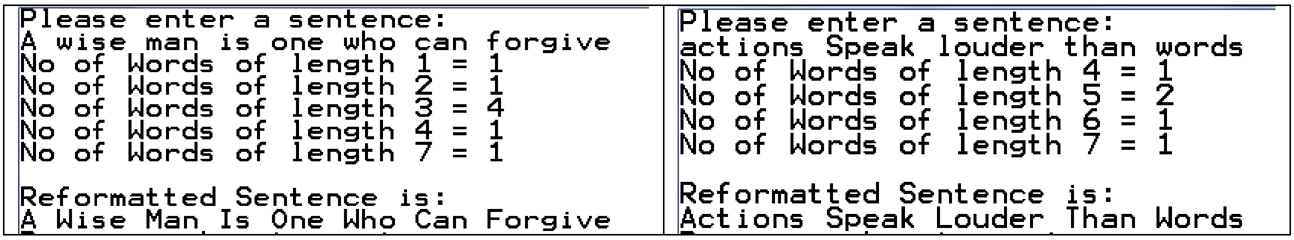
```c
#include <stdio.h>
#include <stdlib.h>

#define SIZE_1D 64
#define SIZE_2D 8

void read_1D_array(int nums_ID []);
void convert(int nums_1D [], int nums_2D[][SIZE_2D]);
void print_2D_array(int nums_2D[][SIZE_2D]);

int main(void) {
   int nums_1D[SIZE_1D], nums_2D[SIZE_2D][SIZE_2D];

    read_1D_array(nums_1D);
    convert(nums_1D,nums_2D);
    print_2D_array(nums_2D);

  return 0;

}

void read_1D_array (int nums_1D []) {
     int i;

     printf ("please enter %d integers separated by spaces\n", SIZE_1D);

     for (i = 0; i < SIZE_1D; ++i)
```

```
         scanf("%d", &nums_1D[i]);

     printf("The %d integers have been stored in a 1D array\n", SIZE_1D);
}

void convert ( int nums_1D [], int nums_2D [][SIZE_2D]) {
     int i, j, k = 0;

     for ( i = 0; i < SIZE_2D; i++ ) {
         for ( j = 0; j < SIZE_2D; j++ ) {
            nums_2D[i][j] = nums_1D[k];
            k++;
         }
     }
}

void print_2D_array (int nums_2D [][SIZE_2D]) {
     int i, j;

     printf("After the conversion, the 2D array is:\n");
     for ( i = 0; i < SIZE_2D; i++ ) {
         printf(“Row %d: “,i);
         for ( j = 0; j < SIZE_2D; j++ )
            printf("%4d",nums_2D[i][j]);
         printf("\n");
     }
}
```

Question 3: (20 points)

Write a C program that accepts a string from user and counts the number of one-letter words, two-letter words, three-letter words, etc, appearing in the text. Assume that there is no word greater than 10 letters. Then, your program prints the count of words whose count is not 0. Use an array to store the various words counts. Your program should then reformat and print the string such that every word starts with a capital letter.

Sample execution of the program is given below:



```
Please enter a sentence:
A wise man is one who can forgive
No of Words of length 1 = 1
No of Words of length 2 = 1
No of Words of length 3 = 4
No of Words of length 4 = 1
No of Words of length 7 = 1

Reformatted Sentence is:
A Wise Man Is One Who Can Forgive
```

```
Please enter a sentence:
actions Speak louder than words
No of Words of length 4 = 1
No of Words of length 5 = 2
No of Words of length 6 = 1
No of Words of length 7 = 1

Reformatted Sentence is:
Actions Speak Louder Than Words
```

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

int main() {
  char str[81], str2 [81];
  int size[10] = {0};

  puts("Please enter a sentence:");
  gets(str);

  char delims[] = " ";
  char *token;

  token = strtok( str, delims );

  while ( token != NULL ) {
        int len = strlen(token);
        size[len-1] = size[len-1] + 1;
        token[0] = toupper(token[0]);
        strcat(str2,token);
        strcat(str2," ");
        token = strtok( NULL, delims );
  }

  for(int i =0 ; i<10;i++)
     if (size[i]>0)
       printf("No of Words of length %d = %d\n", i+1, size[i]);

  printf("\nReformatted Sentence is:\n");
  puts(str2);

  system("pause");
  return 0;
}
```

Question 4: (24 points)

Write a C program that does the following:

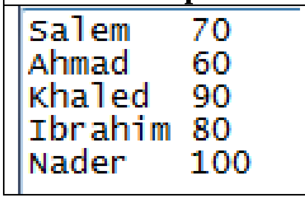
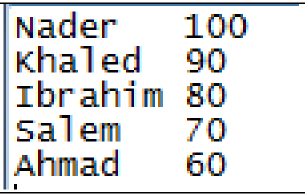
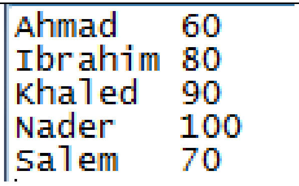
(i) Reads a list of names and scores from the file “input.txt” and stores them in appropriate arrays. Assume that your program does not know the size of data and that the maximum number of names and scores is 100 and the maximum name length is 20.

(ii) The **selection sort algorithm** to sort an array of integers in decreasing order is given below as a function. Modify the function and use it to sort the data read in part (i) from highest score to lowest score and store the results in file “sorted_scores.txt”.

```
void selection_sort(int x[], int size){
  int k,j,pos,temp;
  for (k=0; k < size - 1; k++)    {
    pos = k;
    for(j = k+1; j < size; j++){
       if(x[j] > x[pos])
          pos = j;
    }
    temp = x[pos];
    x[pos] = x[k];
    x[k] = temp;
  }
}
```

(iii) Write a function to sort an array of strings in alphabetical increasing order based on modifying the selection sort algorithm given in (ii). Then use this function to sort the data read in part (i) according to names and store the results in the file “sorted_names.txt”.

Sample execution of the program is given below:

input.txt	sorted_scores.txt	sorted_names.txt
 Salem 70 Ahmad 60 Khaled 90 Ibrahim 80 Nader 100	 Nader 100 Khaled 90 Ibrahim 80 Salem 70 Ahmad 60	 Ahmad 60 Ibrahim 80 Khaled 90 Nader 100 Salem 70

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

void selection_sort(int x[], char y[][20], int size);
void selection_sort2(int x[], char y[][20], int size);
int main(){
```

```
FILE *infile, *outfile1 , *outfile2;
int Scores[100], status, i, count=0;
char Names[100][20];

infile=fopen("input.txt","r");
outfile1=fopen("sorted_scores.txt","w");
outfile2=fopen("sorted_names.txt","w");

status=fscanf(infile,"%s%d",Names[count],&Scores[count]);
while (status != EOF){
   count++;
   status=fscanf(infile,"%s%d",Names[count],&Scores[count]);
}

selection_sort(Scores, Names, count);

for (i=0; i<count; i++)
  fprintf(outfile1,"%s\t%d\n",Names[i], Scores[i]);

selection_sort2(Scores, Names, count);

for (i=0; i<count; i++)
  fprintf(outfile2,"%s\t%d\n",Names[i], Scores[i]);

fclose(infile);
fclose(outfile1);
fclose(outfile2);

system("pause");
return 0;
}

void selection_sort(int x[], char y[][20], int size){
  int k,j,pos,temp;
  char temps[20];
  for (k=0; k < size - 1; k++)  {
    pos = k;
    for(j = k+1; j < size; j++){
       if(x[j] > x[pos])
           pos = j;
    }
    temp = x[pos];
    x[pos] = x[k];
    x[k] = temp;
    strcpy(temps, y[pos]);
    strcpy(y[pos], y[k]);
    strcpy(y[k], temps);
  }
}

void selection_sort2(int x[], char y[][20], int size){
  int k,j,pos,temp;
  char temps[20];
  for (k=0; k < size - 1; k++)  {
    pos = k;
    for(j = k+1; j < size; j++){
       if(strcmp(y[j], y[pos])<0)
          pos = j;
    }
```

```
      temp = x[pos];
      x[pos] = x[k];
      x[k] = temp;
      strcpy(temps, y[pos]);
      strcpy(y[pos], y[k]);
      strcpy(y[k], temps);
    }
  }
```