



King Fahd University of Petroleum and Minerals
Information and Computer Science Department
Spring Semester 132
ICS 103 - Computer Programming in C
Final Exam Key
Monday, May 26, 2014
Duration: 120 minutes

Name:

ID#:

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Section#:

Instructor:

| Question # | Maximum Grade | Obtained Grade |
|------------|---------------|----------------|
| 1 | 25 | |
| 2 | 15 | |
| 3 | 15 | |
| 4 | 10 | |
| 5 | 15 | |
| 6 | 20 | |
| Total | 100 | |

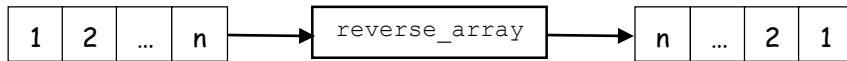
Question # 1 [25 points]

Answer the following questions:

| Question | Answer |
|--|---|
| <p>Having the following function prototype:</p> <pre>void calculate(int x, int *y);</pre> <p>and the following declaration</p> <pre>int x, y;</pre> <p>Write a call to the function calculate</p> | <p>4 marks</p> <pre>calculate(x, &y);</pre> |
| <p>Show the output</p> <pre>int A[6], i, n = 6; for(i = 0; i < n; i++) if (i % 2 == 0) A[i] = 5 * i; else A[n - i] = -5 * i; for(i = 0; i < n; i++) printf("%d\n", A[i]);</pre> | <p>6 marks</p> <pre>0 -25 10 -15 20 -5</pre> |
| <p>Show the output</p> <pre>if(strcmp("B", "Apple") > 0) printf("hello"); else printf("world");</pre> | <p>2 marks</p> <pre>hello</pre> |
| <p>Show the output</p> <pre>char first[10] = "Ahmed", last[10] = "Ali"; strcat(last, first); printf("%s\n", last); printf("%s", first);</pre> | <p>2 marks</p> <pre>AliAhmed Ahmed</pre> |
| <p>Show the output</p> <pre>char str1[12] = "Hello"; str1[2] = '\0'; printf("%d", strlen(str1));</pre> | <p>2 marks</p> <pre>2</pre> |
| <p>Show the output, if a user inputs the following values:</p> <p>5 3 1 7 8 6 15 11 2 -1 0 9</p> <pre>#include <stdio.h> int main () { int a[3][3], i, j; for(j = 1; j <= 5; j = j + 2) { for(i = j; i != j+3; i++) { scanf("%d", &a[i%3][j%3]); } } for(i = 0; i < 3; i++) { for(j = 0; j < 3; j++) printf("%4d", a[i][j]); printf("\n"); } return 0; }</pre> | <p>9 marks</p> <pre>7 1 11 8 5 2 6 3 15</pre> |

Question # 2 [15 points]

Design the algorithm then write a C function (`reverse_array`) which reverses the n elements of a given array.



Algorithm

1. Repeat starting from $i=0$ until half the array size
 - a. Swap the content of array element i with array element $size-1-i$

C function

```
void reverse_array(double a[], int n)
{
    int i;
    double temp;
    for (i = 0; i < n / 2; i++)
    {
        temp = a[i];
        a[i] = a[n - 1 - i];
        a[n - 1 - i] = temp;
    }
}
```

Question # 3 [15 points]

Apply the problem solving steps to develop a program to check whether a sequence of numbers entered by the user is in the ascending (increasing) order or not.

Analysis

Input: sequence of numbers

Output: increasing or not

Algorithm

1. Loop from $i=0$ to $n-1$
 - a. Read a number into $a[i]$
2. Loop from $i=0$ to $n-2$
 - a. If $a[i] > a[i+1]$
 - i. Display sequence is not increasing
 - ii. Exit
3. Display sequence is increasing

C program

```
/* Checking whether a sequence of numbers is increasing */
#include <stdio.h>
#define N 3
int main(void)
{
    int a[N], i, increasing = 1;
    for(i = 0; i < N; i++)
        scanf("%d",&a[i]);
    for(i = 0; i < N - 1 && increasing; i++)
        if(a[i] > a[i + 1])
            increasing = 0;
    if(increasing)
        printf("The sequence is increasing\n");
    else
        printf("The sequence is not increasing\n");
    return (0);
}
```

Question # 4 [10 points]

Write a function called `addFractions` that takes four input parameters which are the numerator (a) and denominator (b) of the first fraction and numerator (c) and denominator (d) of the second fraction. The `addFractions` function also has two output parameters, which will have the value of the numerator and denominator of the addition of the two input fractions.

$$\frac{a}{b} + \frac{c}{d} = \frac{ad + bc}{bd}$$

```
void addFractions(int a, int b, int c, int d, int *np, int *dp)
{
    *np = a * d + b * c;
    *dp = b * d;
}
```

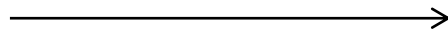
Question # 5 [15 points]

Write a function `sum_rows_cols` that sums all rows and all columns of an integer matrix, which is passed as a parameter. The matrix must have one additional column to sum all rows and one additional row to sum all columns. The matrix, actual number of rows, and actual number of columns should be passed as parameters.

For example, here is a call to `sum_rows_cols` to take the sum of 3 rows and 4 columns of matrix.

| | | | | |
|---|----|----|---|--|
| 4 | 8 | -2 | 5 | |
| 1 | 3 | 0 | 6 | |
| 7 | -1 | 9 | 2 | |
| | | | | |

`sum_rows_cols(matrix, 3, 4);`



| | | | | |
|----|----|----|----|----|
| 4 | 8 | -2 | 5 | 15 |
| 1 | 3 | 0 | 6 | 10 |
| 7 | -1 | 9 | 2 | 17 |
| 12 | 10 | 7 | 13 | 42 |

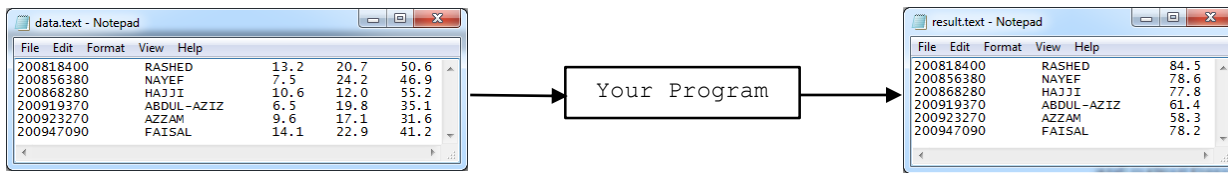
```
#define MAX 100
```

```
void sum_rows_cols(int matrix[][MAX], int rows, int cols)
{
    int i, j, sum;
    for(i = 0; i < rows; i++)
    {
        sum = 0;
        for(j = 0; j < cols; j++)
            sum += matrix[i][j];
        matrix[i][cols] = sum;
    }

    for(j = 0; j <= cols; j++)
    {
        sum = 0;
        for(i = 0; i < rows; i++)
            sum += matrix[i][j];
        matrix[rows][j] = sum;
    }
}
```

Question # 6 [20 points]

Write a program that reads the inputs (Student ID, Student Name, Scores of Quiz, Lab and Exam) from a file (**data.text**) and then computes and outputs the total score of each of the student, to one digit after the decimal point, in another data file named (**result.text**).



```
#include <stdio.h>
#include <string.h>
int main(void)
{
    FILE *f1, *f2;
    char name[80];
    int id;
    double quiz, lab, exam, total;
    f1 = fopen("data.text", "r");
    if(f1 == NULL)
    {
        printf("Error opening the file\n");
        return (1);
    }
    f2 = fopen("result.text", "w");
    while(fscanf(f1, "%d%s%lf%lf%lf", &id, name, &quiz, &lab, &exam) != EOF)
    {
        total = quiz + lab + exam;
        fprintf(f2, "%d %s %.1f\n", id, name, total);
    }
    fclose(f1);
    fclose(f2);
    return (0);
}
```