Princess Sumaya جامعة الأميرة سميّة للتكنولوجيا University for Technology

King Hussein School for Computing Sciences
Department of Computer Science
11103 - **Structured Programming** - Spring 2023

Final Exam

Full Name: **Student ID:**

Question	Marks	Score
1	5	
2	12	
3	3	
4	6	
5	7	
6	7	
Total	40	

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12/6/2023

Question 1. Basics (5 marks)

```
1.  double x = 5;
2.
3.  // ---- THIS LINE ---- //
4.
5.  int main() {
6.      x++;
7.      double x = 2.5;
8.      f(x);
9.      printf("%f\n", x);
10.     return 0;
11. }
```

A. [3 marks] For each of the following function definitions, show the output of the above program if the function definition is placed at line #3. If the code causes a compile-time or a run-time error, write "**ERROR**".

FUNCTION DEFINITION TO REPLACE LINE # 3	PROGRAM OUTPUT
1. `void f(double x) { x = 3; }`	
2. `void f(double* x) { *x = 3; }`	
3. `void f(double x) { int x = 3; }`	
4. `void f(double y) { x = 3; }`	
5. `void f(double y) { printf("%f ", x); }`	
6. `void f(int y) { printf("%d ", y); }`	

B. [2 marks] Assuming that `x` is defined as `int x = 1;` what is the output of each of the following pieces of code? If the code causes a compile-time or a run-time error, write "**ERROR**".

1.
```
printf("%d", x + 1 / 2);
```

2.
```
if   (x  > 2) printf("YES");
else (x <= 2) printf("NO");
```

3.
```
if (x = 2) printf("2");
else       printf("1");
```

4.
```
switch (rand() % x) {
 case 0:  printf("0 ");
          break;
 default: printf("NO"); }
```

Question 2. Mini Code Writing (12 marks)

Implement each of the following functions.

(A)

```
// Returns 1 if at least one argument is positive and at least one argument is
// negative, and 0 otherwise.
int diff_sign(int a, int b, int c) {



}
```

(B)

```
// Prints the pattern: 1 100 2 99 3 98 4 97 5 96 ... 99 2 100 1
void print_pattern() {




}
```

(C)

```
// Prints the pattern: 1-  2--  3---  4----  5----- ...         (assuming n > 0)
int n_dashes(int n) {         // the last term printed is n followed by n dashes




}
```

(D)

```
// Returns 1 if every row in a[][] sums to 50. Returns 0 otherwise.
int sum_50(int a[10][10]) {




}
```

Question 3. Code Comprehension (3 Marks)

```
void fun(int a[], int N) {
    for (int i = 0; i < N; i++) {
        for (int j = 0; j < N; j++)
            printf("A B ");

        int sum = 0;
        for (int j = 0; j < 100; j++) {
            sum += a[j];
            printf("B ");
        }

        a[i] = sum;
        printf("%d\n", N / sum);
    }
}
```

Answer the questions below about the above function.

A. [1 mark] Assume that `N=100`, and that `a[]` is of size `100`.

- How many times will "**A**" be printed out? ☐
- How many times will "**B**" be printed out? ☐

B. [1 mark] Mention two cases that might cause a run time error.

Case 1:

Case 2:

C. [1 mark] Assume that `N=100`, and `a[]` is of size `100` and every cell in `a[]` contains the value `1`. What will be stored at `a[0]` after the function finishes execution?

☐

Question 4. Recursion (6 marks)

1. [4 marks] Implement function **int** remainder(**int** n, **int** m) which returns n % m.

Notes.
- The function must be recursive. You are not allowed to use loops.
- You are not allowed to use the % or / operators.
- You can assume that n and m are greater than 0.

2. Answer the questions on the right about the following function.

```
void fun(int n) {
   if (n <= 0)
      return;
   fun(n-1);
   fun(n-2);

    printf("%d ", n);
}
```

1. [0.5 mark] What is the output of calling fun(**1**) ?

2. [0.5 mark] What is the output of calling fun(**2**) ?

3. [1 mark] What is the output of calling fun(**4**) ?

Question 5. Strings and Pointers (7 marks)

Implement function **void** remove_duplicates(**char*** str, **char*** result), which copies str to result after removing duplicate characters that are next to each other.

Examples.

str	**result**
aaabbbaaa	aba
ababab	ababab
helloooo, there!!!	helo, there!

Notes.
- You can assume that no string will be longer than 100 characters.
- You are not allowed to use the array [] notation. You must use pointer arithmetic only.
- You are not allowed to use the string.h library.

Provide your answer on the following page

Question 6. 2D Arrays (7 marks)

Implement function **void** print(**int**[N][N]), which prints the received 2D square matrix as follows:

```
1st row elements
1st column elements

2nd row elements
2nd column elements

3rd row elements
3rd column elements

etc.
```

Examples.

ARRAY
```
1 2 3 4
5 6 7 8
9 0 1 2
3 4 5 6
```

OUTPUT
```
1 2 3 4
1 5 9 3

5 6 7 8
2 6 0 4

9 0 1 2
3 7 1 5

3 4 5 6
4 8 2 6
```

ARRAY
```
1 2
3 4
```

OUTPUT
```
1 2
1 3

3 4
2 4
```

ARRAY
```
1
```

OUTPUT
```
1
1
```

You can assume that N is globally defined and accessible.

Provide your answer for **Q6 only** in the **Answers Booklet**