



Princess Sumaya جامعة
University الأميرة سميرة
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The King Hussein School for Computing Sciences
Department of Computer Science
Structured Programming - Spring 2022

First Exam

Full Name:

Reference Solution

Student ID:

Question	Points	Score
1	4	
2	6	
3	5	
4	5	
5	5	
Total	25	

Circle your section:

- Dr. Mu'awya Al-Dala'ien (section 1)
- Dr. Rawan Ghnemat (section 2)
- Dr. Abdullah Aref (section 3)
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Question 1 (4 points)

Fill the right column in the table below with the output of the C code provided in the left column. If the code does not compile, write **"compilation error"** instead of the output.

Assume x is defined as follows:

```
int x = 5;
```

Code	Output
1. <code>printf("%d", x / 2);</code>	2
2. <code>printf("%d", x + rand() % 1);</code>	5
3. <code>printf("%c", 'c' + x);</code>	h
4. <code>printf("%d", x++);</code>	5
5. <code>printf("%d", ++2);</code>	Compilation Error
6. <code>printf("%d", 2 + 3 - 4 / 2 * 3 + 4);</code>	3
7. <code>if (2 = 2) printf("equal"); else printf("not equal");</code>	Compilation Error
8. <code>void f(int y) { y = 5; } int main() { int y = 0; f(y); printf("%d", y); return 0; }</code>	0

Question 2 (6 points)

PART 1. What is the output of the function **f1(int n)** in each of the following cases?

```
void f1(int n) {
    int x = 0;
    int c = abs(n); // absolute value

    while (c > 0) {
        x = x + 2;
        c = c - 1;
    }

    if (n >= 0)
        printf("%d", x);
    else
        printf("%d", -x);
}
```

- A. If $n = 0$
Answer = 0
- B. If $n = 2$
Answer = 4
- C. If $n = 111$
Answer = 222

What is the purpose of (الهدف من) this function?
(Do not use > 10 words and write in the box).

Printing 2*n

PART 2. What are the contents of array **a[]** after calling the function **f2** in each of the following cases?

```
void f2(int a[], int n) {
    for (int i = 0; i < n-1; i = i + 2)
        a[i+1] = a[i];
}
```

- A. If $n = 2$ and $a[] = \{1, 2\}$
Answer = {1, 1}
- B. If $n = 1$ and $a[] = \{1\}$
Answer = {1}
- C. If $n = 1000$ and
 $a[] = \{1, 2, 3, 4, 5, \dots, 1000\}$
Answer = {1, 1, 3, 3, 5, 5, ...}

Rubric for PART 1, 2 and 3.

- 0.5 for A and 0.5 for B
- 1 for C:
The students gets this point if the answer is correct **or** if the textual description provided in the box is correct.
The textual description must not be a line-by-line explanation of the code. For example, the following answer is **not** acceptable for **PART 1**:

“Gets the absolute value of n and then adds the number 2 n times. If n is positive the function prints the sum, otherwise it prints sum $x - 1$ ”.

What is the purpose of (الهدف من) this function?
(Do not use > 20 words and write in the box).

To copy each even indexed cell
into the next cell

PART 3. What is the output of calling the function **f3** in each of the following cases?

```
void f3(int a[], int n) {
    int b[3] = {0};

    for (int i = 0; i < n; i++)
        if (a[i] >= 0 && a[i] <= 2)
            b[a[i]]++;

    printf("%d %d %d",
           b[0], b[1], b[2]);
}
```

A. If $n = 1$ and $a[] = \{5\}$

Answer = 0 0 0

B. If $n = 3$ and $a[] = \{0, 1, 2\}$

Answer = 1 1 1

C. If $n = 1000$ and
 $a[] = \{1, 0, 1, 0, 1, 0, \dots\}$

Answer = 500 500 0

What is the purpose of (الهدف من) this function?

(Do not use > 20 words and write in the box).

To count and print how many times 0, 1 and 2 appear in array a[]

Question 3 (5 points)

Implement a function named **median**, which receives three integer arguments and returns the median (الوسيط), where the median is the *middle* element if the elements are sorted.

Examples.

- `median(3, 1, 2)` returns 2
- `median(3, 0, 5)` returns 3
- `median(4, 3, 4)` returns 4
- `median(1, 1, 1)` returns 1
- `median(1, 2, 3)` returns 2
- `median(5, 8, 6)` returns 6

```
int median(int a, int b, int c) {
    if ((a <= b && b <= c) || ((c <= b && b <= a)) return b;
    else if ((a <= c && c <= b) || ((b <= c && c <= a)) return c;
    else return a;
}
```

Other Possible Solutions:

- Return $a + b + c - \max - \min$.
- Use nested if-statements instead of `&&` and `||`.
- Find the max and the min and then return the argument that is not the max and not the min (This solution is buggy. It works only if the arguments are unique).

Question 4 (5 points)

Implement a function named **almost_max**, which receives as arguments an array of integers and the size of this array. The function returns the number of elements in the array that are **1** below the max.

You can assume that the size is 1 or more (no need to check for this).

Example.

If the array = {1, 4, 2, 3} the function returns 1, because the max is 4 and the array has only one 3.

If the array = {1, 2, 1, 1} the function returns 3, because the max is 2 and the array has three 1s.

If the array = {1, 2, 5, 3} the function returns 0, because the max is 5 and there are no 4s.

```
int almost_max(int a[], int n) {
    int maximum = a[0];
    for (int i = 1; i < n; i++)
        if (a[i] > maximum)
            maximum = a[i];

    int count = 0;
    for (int i = 0; i < n; i++)
        if (a[i] == maximum - 1)
            count++;

    return count;
}
```

Question 5 (5 points)

Implement a function named **the_search**, which receives an array of characters and its size as arguments and returns **1** if **"the"** appears at least once in the array and **0** otherwise.

Examples.

- If the size is 4 and the array is "hello" the function returns 0
- If the size is 11 and the array is "hello there" the function returns 1
- If the size is 17 and the array is "the theater theme" the function returns 1
- If the size is 7 and the array is "The boy" the function returns 0
(Look for the not The)

```
int the_search(char s[], int n) {
    for (int i = 0; i <= n-3; i++)
        if (s[i] == 't' && s[i+1] == 'h' && s[i+2] == 'e')
            return 1;
    return 0;
}
```