Santa Monica College
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CS 20A: Data Structures with C++

Assignment 1

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True/False: Circle one

1. True / (False) Variable and functions identifiers can only begin with alphabet and digit.
2. True / (False) Array sizes can be non-constant variables.
3. (True) / False Array sizes must be known at compile time.
4. True / (False) An array can have size of 0.
5. True / (False) int m = 15.6; won't compile because the types do not match.
6. (True) / False int n = 11/5; will allocate memory for n and initialize with the value 2.
7. True / (False) Array indices begin with the number 1.
8. (True) / False You can define multiple functions with the same identifier.
9. True / (False) Variables declared local to a function are still accessible after the function completes execution.
10. True / (False) structs by default have private access specification.

11. Suppose you're tasked with fixing a function definition that does not work as intended. The function is supposed to compare two strings and set the count to the number of identical characters, two characters are identical if they are the same character and are in the same position in the cstring. This function will be case sensitive so the character 'a' is not the same as 'A'. Note that cstrings are just character arrays that have '\0' as their last character, for example

```
char name[7] = "harry";
```

might looks like this in memory:

h	a	r	r	y	\0	

Usage of this function might look like:

```
int count = 0;
compareCstrings("tacocat", "TACOCAT", count);    // should set count to 0
compareCstrings("Harry", "Malfoy", count);       // should set count to 1
compareCstrings("SMC","SBCC", count);            // should set count to 2
```

Currently the function definition is:

```
void compareCstrings(const char str1[], const char str2[], int count) {
        &count = 0;
        int index;
        while (str1 != '\0' || str2 != '\0') {
                if (str1 == str2)
                        &count++;
                index++;
        }
}
```

Identify the errors in the above implementation and rewrite the function so that it satisfies specification. Try to keep the general form of the original code, you should not have to add or remove any lines of code, just modify the existing ones.

```
void compareCstrings(const char str1[], const char str2[], int &count) {
        count = 0;
        int index = 0;
        while ((str1[index] != '\0') && (str2[index] != '\0')) {
                if (str1[index] == str2[index])
                        count++;
                index++;
        }
}
```

12. Use the code below to answer the questions that follow. Assume that all proper libraries and name spaces are included and that the code will compile without error. Within the main function, for the variable `int last_sid`, write in the last digit of your SMC student ID.

```
int foo(int a, int b) { //First
    int c = a+b;
    while(c>=3)
        c-=3;
    return c;
}
//-----------------------------------
char foo(string a, int b) { //Second
    return a[b];
}
//-----------------------------------
string foo(int b, string &a) { //Third
    string sub = a.substr(3*b,3);
    a.replace(3*b,3,"...");
    return sub;
}
//-----------------------------------
void main() {
    int last_sid = 6; //<-Last digit of your SID
    string letters("ggfiorkcboneat !!!ws adtarojot");
    string output("");
    int numbers[] = {0,8,3,7,4,6,9,1,2,5};   // size 10

    for(int i=0; i<10; i++) {
        int j = numbers[i];
        numbers[i] = foo(last_sid,i);    // first
        string s = foo(j, letters);      // third
        output += foo(s, numbers[i]);    // second
    }
    cout << output;
}
```

a.) For each of the three foo functions *briefly describe in plain language* what each function is doing. You may refer to the top function as the first function, the one below as the second function, and finally the last as the third function.

- The first function computes and returns the integer (a + b) mod 3.
- The second function returns the character at index b in the string parameter a.
- The third function returns the string equal to the substring from index (3*b) to (3*b + 3) of string parameter a. It also modifies the reference string parameter a by replacing the substring returned with the string literal "..." in the original string.

b.) What is it called when we use the same function identifier for multiple functions? What must we done to allow the compiler to differentiate between functions with the same identifier?

It is called function overloading. Each overloaded function must have a different function signature, namely, it must have a different number of parameters or its' parameters must have different types so the compiler knows which function to call.

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c.) What does the `string letters` look like at the end of second iteration? The blocks below are placed for your convenience, you may overwrite the values.

Iteration: 2

.	.	.	i	o	r	k	c	b	o	n	e	a	t		!	!	!	w	s		a	d	t	.	.	.	j	o	t
0	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26	27	28	29

i: 1

j: 8

d.) What does the numbers array look like at the end of the program? The blocks below are placed for your convenience, you may overwrite the values.

Iteration: 10

0	1	2	0	1	2	0	1	2	0

i: 9

f.) (3 points) What is printed with `cout << output << endl;` ?

g	r	e	a	t		j	o	b	!

Iteration: 10

i: 9

j: 5

numbers[i]: 0

s: !!!

*Extra blocks for work if needed:

0	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26	27	28	29

0	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26	27	28	29

13. Implement the class Hotel, as declared below, which keeps track of the reservation status of each room in a hotel. Each room can be RESERVED, OCCUPIED, or EMPTY, and this information is stored in a 2-dimensional array, where each row represents a floor, and each column represents a room. Each room is represented by an integer (e.g., 425). For example, the status of room 425 is stored in m_rooms[4][25]. Note that this hotel has a room 0 on floor 0. For this problem you may not define any additional member variables or functions.

Below is the definition of the Hotel class:

```
// In hotel.h
const char RESERVED = 'R';
const char OCCUPIED = 'O';
const char EMPTY = 'E';
const int FLOORS = 20;

const int ROOMSPERFLOOR = 50;

class Hotel {
public:
        Hotel();                            // TODO
        bool reserve(int roomNum);          // TODO
        bool cancel(int roomNum);           // TODO
        bool checkIn(int roomNum);          // TODO
        bool checkOut(int roomNum);         // TODO
        int numEmpty(int floor) const;      // TODO

private:
        char m_rooms[FLOORS][ROOMSPERFLOOR];
};
```

Implement Hotel's functions below:

```
// In hotel.cpp
Hotel::Hotel() {
        // TODO: Set all the rooms in the Hotel to be EMPTY
    for ( int i = 0; i < FLOORS; i++ ) {
        for ( int j = 0; j < ROOMSPERFLOOR; j++ ) {
            m_rooms[i][j] = EMPTY;
        }
    }
}
```

```
/*****************************************************************************/

bool Hotel::reserve(int roomNum) {
	// TODO: If the room is EMPTY, set it to RESERVED, and return true.
	// In all other cases, do not change anything and return false.
	if ( m_rooms[roomNum / 100][roomNum % 100] == EMPTY ) {
		m_rooms[roomNum / 100][roomNum % 100] = RESERVED;
		return true;
	}
	return false;
}

/*****************************************************************************/

bool Hotel::cancel(int roomNum) {
	// TODO: If the room is RESERVED, set it to EMPTY, and return true.
	// In all other cases, do not change anything and return false.
	if (m_rooms[roomNum / 100][roomNum % 100] == RESERVED) {
		m_rooms[roomNum / 100][roomNum % 100] = EMPTY;
		return true;
	}
	return false;
}

/*****************************************************************************/

bool Hotel::checkIn(int roomNum) {
	// TODO: If the room is RESERVED, set it to OCCUPIED, and return true.
	// In all other cases, do not change anything and return false.
	if (m_rooms[roomNum / 100][roomNum % 100] == RESERVED) {
		m_rooms[roomNum / 100][roomNum % 100] = OCCUPIED;
		return true;
	}
	return false;
}

/*****************************************************************************/
```

```
bool Hotel::checkOut(int roomNum) {
        // TODO: If the room is OCCUPIED, set it to EMPTY, and return true.
        // In all other cases, do not change anything and return false.
    if (m_rooms[roomNum / 100][roomNum % 100] == OCCUPIED) {
        m_rooms[roomNum / 100][roomNum % 100] = EMPTY;
        return true;

    }
    return false;


}
/*****************************************************************************/

                            const
int Hotel::numEmpty(int floor)^{
        // TODO: Return the number of empty rooms on the floor.
        // Return -1 if floor is invalid.
        if ((floor < 0) || (floor > FLOORS)) {
            return -1;
        }
        int count = 0;
        for (int i=0; i < ROOMSPERFLOOR; i++) {
            if (m_rooms[floor][i] == EMPTY) {
                count++;
            }
    }
    return count;
}
```