Neil Bryan F. Flauta
CMSC 21

BS Computer Science – 1
Section 1

CMSC 21 2nd Long Exam

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I. True or False

1. When calling a function, if the parenthesis is missing, the function won't get called. ***True***
2. The following version of sum_array is illegal: int sum_array(int a[n], int n){ … } ***False***
3. C allows functions to be nested. ***True***
4. The function prototype double average(); is illegal. ***False***
5. Suppose a variable fun is declared as a global variable with a value of 10 and redeclared as a local variable with a value of 5. If fun is printed inside the main function, the output is equal to 10. ***False***
6. If a variable point was declared as a pointer and a var was declared as an integer variable, *point = &var is valid. ***False***
7. The name of an array always points to the value of the first element of an array. ***True***

Suppose that a is one-dimensional int array and p is a pointer to int variable. Assuming that the assignment p = a has just been performed, which of the following expressions are illegal because of mismatched types? State whether the expression from 8 to 11 is true or not.

8. p == a[0] ***True***
9. p == &a[0] ***True***
10. *p == a[0] ***True***
11. p[0] == a[0] ***False***

II. Provide the answers to the following:

1. Why is it that the first dimension in an array parameter be left unspecified, but not the other dimensions?

The first dimension refers to the rows of an array while the second dimension refers to its columns. It is still legal to not leave a value for the rows however the second dimension, or the columns must be determined or crucial because it determines the number of elements in each group of rows. The columns will add length to the group but if you leave it undefined, it will cause chaos such that, the array may have 5 groups or rows, but it did not determine the number of elements in it. Subsequently, the whole array is just basically 1 group elements.

2. Write the function prototype given the following:

a. Function isPalindrome that takes character type pointer argument string and returns a bool value.

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

char isPalindrome (char wordp);


int main(){
    char word = 'c';
    isPalindrome(word);
}

char isPalindrome(char wordp){
    bool word = true;

    return word;
}
```

b. Function computeAverage that takes a floating-point array argument arr (with size of 20) and returns a float value.

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

float computeAverage(float *arr, int size);


int main(){

    float arr[20] ={1,1,1,1,1,1,1,1,1,1,1,1,1,1,1,1,1,1,1,1};
    float average;
    average = computeAverage(arr, 20);
    printf("%f", average);
}

float computeAverage(float *arr, int size){

    int i, sum = 0;
    float avg;

    for ( i = 0; i < size; ++i ){
        sum += arr[i];
    }
    avg = (float)sum / size;

    return avg;
}
```

c. Function reverseSentence that does not take any argument and returns nothing.

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

void reverseSentence(void);


int main(){

    reverseSentence();
}

void reverseSentence(void){

    return;
}
```

d. Function squareRoot that takes an integer number num and returns a floating-point result

```c
#include <stdio.h>
#include <stdbool.h>
#include <math.h>

float squareRoot(int num);


int main(){
    int num = 4;
    float square_root;

    square_root = squareRoot(num);

    printf("%f", square_root);

}

float squareRoot(int num){
    float sqroot = sqrt(num);

    return sqroot;
}
```

3. *Find the error in each of the following code snippets and explain how the error may be corrected*

a.
```
int fun(void){
        printf("%s", Inside function fun\n");

        int bored(void){
                printf("%s", Inside function bored\n");
        }
```

There seems to be a lacking double quotation mark since %s represents a string. Also, there is not function call and the indentions are doubled, making the code less readable and confusing. Because both functions don't take any argument, its best to function call them in order for them to work and separate the two functions so that we are able to call the bored function from the outside. Reduce the indention or tab spaces to 1 and enclose the strings "Inside function fun / bored".

b.
```
int product (int a, int b){
        int result = a * b;
}
```

The function seems to be working well if you put in the main function the declaration of values for a and b and the statement result = product (a, b). It would have been better if there is a return value from this function including the declaration of its data type to avoid confusion.

c.
```
void fun (float a);
{
        float a;
        printf("%f", a);
}
```

In this function, the variable "a" with the data type float is redeclared again, making it an error. The variable is no longer needed to be initialized in the function as it was declared already and passed on as argument. It would be better if the statement float a; is removed.

d.
```
void sum(void){
        printf("%s", "Enter three integers: ")
        int a, b, c;
        scanf("%d%d%d", &a, &b, &c);
        int total = a + b + c;
        printf("Result is %d", total);
        return total;
}
```

There is a missing semi-colon in the first print statement of the function. Also, make sure that the declaration or initialization comes before all the statements. Lastly, because the function is in void type or the return value is nothing, it is pointless to put a return statement in the last line of the function. The total will print itself in the second print statement so there is no need to return a value.

4. Provide the answers to each of the following. Assumption: integer numbers are stored in 4 bytes, and the first element of the array is at location 2500 in memory.

a. Define an integer array numbers with size = 5. Initialize the elements to values 1, 2, 3, 4, 5. Assume a constant SIZE is defined to 5.

```
#define SIZE 5

int main(){

    int arr[SIZE] = {1,2,3,4,5};

}
```

b. Define an integer pointer, ptr.

```
int *ptr;
```

c. Assign the address of the first element of array numbers to the pointer variable ptr.

```
ptr = &arr[0];
```

d. Print the elements of array numbers using pointer / offset notation with the pointer ptr.

```
ptr = arr;

printf("%d\t", *ptr);
printf("%d\t", *(ptr + 1));
printf("%d\t", *(ptr + 2));
printf("%d\t", *(ptr + 3));
printf("%d\t", *(ptr + 4));
```

```
1       2       3       4       5
```

e. Print the elements of array numbers using pointer/offset notation using the array name as the pointer.

```
ptr = arr;

printf("%d\t", *arr);
printf("%d\t", *(arr + 1));
printf("%d\t", *(arr + 2));
printf("%d\t", *(arr + 3));
printf("%d\t", *(arr + 4));
```

```
1       2       3       4       5
```

f. Refer to element 2 of numbers using a pointer/offset notation using (f.1) array index notation, (f.2) pointer notation with array name as the pointer, (f.3) pointer index notation with ptr, (f.4) pointer notation with ptr.

g. Assuming that ptr points to the address of the first element, what address is referenced by ptr+2? What value is stored at that address?

`6422024` 6422024 is the address referenced by ptr + 2 and the value stored in that address is 3.

5. Find the error in the codes in a-d given initial code.

```
int *xp;  //references array x
void *vp = NULL;
int num;
int x[5] = {1, 2, 3, 4, 5};
vp = arr;
```

a. ++xp;
b. num = xp; //use pointer to access first element (assume xp is initialized)
c. num = *xp[1]; //assign element 1 (value 2) to num
d. ++x;

In this code, it should have been vp = x not arr because the name of the variable for the array is x. The ++xp is used for determining the address of each value or elements in the array. However, it would have been better if the value increments by 1 after, which is xp++. For b, the pointer used to access the first element is either *vp or *x, xp is the address that references the array. For c, if we want to assign the element 2 to num, it would have been better if we have num = *(vp + 1) or num = *(x + 1) instead. Lastly, it should be x++ instead of a ++x so we won't disregard the first value before incrementing it by 1.

III. Application

1. The program below tests whether two words are anagrams (permutations of the same letters):

```c
#include <stdio.h>
#include <ctype.h> /* toupper, isalpha */

int main(void) {

    int i,
        same = 1,
        letters[26] = {0};
    char c;

    printf("Enter first word: ");
    while ((c = getchar()) != '\n') {
        if (isalpha(c)){
            letters[toupper(c) - 'A']++;
        }
    }
    printf("Enter second word: ");
    while ((c = getchar()) != '\n') {
        if (isalpha(c)){
            letters[toupper(c) - 'A']--;
        }
    }

    for (i = 0; i < 26; i++) {
        if (letters[i] != 0) {
            same = 0;
            break;
        }
    }
    if (same) {
        printf("The words are anagrams.\n");
        return 0;
    }
    printf("The words are not anagrams.\n");
    return 0;
}
```

```
Enter first word: smartest
Enter second word: mattress
The words are anagrams.

Enter the first word: dumbest
Enter the second word: stumble
The words are not anagrams.
```

The loop in lines 12-16 reads the first word, character by character, using an array of 26 integers to keep track of how many times each letter has been seen. (For example, after the word smartest has been read, the array should contain the values 1 0 0 0 1 0 0 0 0 0 0 0 1 0 0 0 0 1 2 2 0 0 0 0 0 0, reflecting the fact that smartest contains one a, one e, one m, one r, twos's and two t's.

The loop on lines 17-22 reads the second word, except this time decrementing the corresponding array element as each letter is read.

Both loops should ignore any characters that aren't letters and the function islpha is used. Both should treat upper-case letters in the same way as lower-case letters. One way to do this is by using toupper() to convert all letters to uppercase.

Header <ctype.h> allows the use of functions isalpha, tolower, or toupper.

After the second word has been read, use a third loop to check whether all the elements in the array is zero. If so, the words are anagrams. Hint: You may wish to use.

The issue with the given code:

Duplications. Lines 11-16 and Lines 17-22 are basically doing the same thing. You could write a function that can perform the same task on different words.
Your task:
• Modify the anagram code above such that following functions are added:
o void scan_word(int occurrences[26]);
o bool is_anagram(int occurrences1[26], int occurrences2[26]);
main will scan_word twice, once for each of the two words entered by the user. As each character/letter of the word is being scanned, scan_word will use the characters in the word to update the occurrences array.
An array for each word will be declared.
int occurrences1[26] – keep track how many times each letter occurs in word 1
int occurrences2[26] – keep track how many times each letter occurs in word 2
main will then call is_anagram, passing it the two arrays (occurrences1 and occurrences2), is_anagram will return true if the elements in the two words are identical (including that the words are anagrams) and false otherwise.
2. Convert your source code in Application Item #1 such that you operate on the arrays using pointers

Screenshot of the code:

```c
#include <stdio.h>
#include <ctype.h> /* toupper, isalpha */
#include <stdbool.h>

#define MAXLETTERS 26

void scan_word(int occurences, int length);
bool is_anagram(int occurences1, int length1, int occurences2, int length2);

int main(void) {

    int i,
        same = 1,
        letters[MAXLETTERS] = {0};
    char c;

    printf("Enter first word: ");
    scan_word();

    printf("Enter second word: ");
    scan_word();
}
bool is_anagram(int occurences1, MAXLETTERS, int occurences2, MAXLETTERS){
    bool check;
    check = (arr1 == arr2)
    for (i = 0; i < MAXLETTERS ; i++) {
        if (letters[i] != 0) {
            same = 0;
            break;
        }
    if check = (same) {
        printf("The words are anagrams.\n");
        return 0;
    }
    printf("The words are not anagrams.\n");
    return 0;
}

void scan_word(){

    int occurences1[MAX_LETTERS] = {0};
    int occurences2[MAX_LETTERS] = {0}

    while ((c = getchar()) != '\n') {
        if (isalpha(c)){
            letters[toupper(c) - 'A']++;
        }
    }
    main()

    bool is_anagram (int occurences1, int MAXLETTERS, int occurences2, int MAX_LETTERS);
}
```

I’m sorry ma’am. I really tried. Im just too tired

Github Link: https://github.com/nbbryy/CMSC-21.git