CSC 3320: System-Level Programming

50 Points

Homework 4

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Work on the following problems and submit your own answers. You are allowed to discuss with other students. However, do not copy the solutions from peers or other sources. If the assignment has any programming component, your program(s) must compile with **gcc** and execute on **snowball.cs.gsu.edu**! Please see https://cscit.cs.gsu.edu/sp/guide/snowball for more details.

Instructions:

- Upload an electronic copy (MS word or pdf) of your answer sheet to the folder named "HW4" in iCollege.

- Add the course number, homework number, and your name at the top of your answer sheet.

- Write down your answers with the question number only in the answer sheet.

- Use of ChatGPT or other generative models is strictly prohibited. You may receive 0.

- Name your file in the format of CSC3320_HW4_FisrtnameLastname (.docx/.pdf)

- Deadline: Submit by November 14, 2024, 11:59 pm

1. (5 points) Consider the following program:

```c
#include < stdio.h >
int main( )
{
    int arr[4][5];
    int  i, j;
    for (i=0; i<4; i++)
    {
        for (j=0; j<5; j++)
        {
            arr[i][j] = 10 * i + j;
        }
    }
    printf("%d", *(arr[1]+9));
    return 0;
}
```

What is the output of the above program? Explain your answer.

2. (5 points) What output the following fragment will produce? Explain why.

```c
int fun(char *str1)
{
    char *str2 = str1;
    while (*++str1)
        ;
    return (str1 - str2);
}
```

```c
int main()
{
    char *str = "GeorgiaState";
    printf("%d", fun(str));
    return 0;
}
```

3. (5 points) An example of a pointer to a function is given below. That is, `ptr` is pointing to a function `fun`. What will be the output of the following program?

```c
int fun(int n);

int main()
{
    // ptr is a pointer to function fun()
    int (*ptr)(int ) = fun;

    // fun() called using pointer
    (*ptr)(3);
    return 0;
}

int fun(int n)
{
  for(;n > 0; n--)
    printf("Computers ");
}
```

4. (5 points) Write the following function without using any `temp` variable:

   ```c
   void swap(int *p, in t *q);
   ```

   When passed the addresses of two variables, `swap` should exchange the values of the variables:

   ```c
   swap(&i, &j); /* exchanges values of i and j */
   ```

5. (5 points) Write the following function:

   ```c
   void find_two_largest(int a[], int n, int *largest, int *second_largest);
   ```

   When passed an array `a` of length `n`, the function will search `a` for its largest and second-largest elements, storing them in the variables pointed to by `largest` and `second_largest`, respectively.

6. (5 points) Rewrite the following function to use pointer arithmetic instead of array subscripting. (In other words, eliminate the variables i and j and all uses of the [] operator.) Use a single loop instead of nested loops.

   ```c
   int sum_two_dimensional_array(const int a[] [LEN], int n)
   {
       int i, j, sum = 0;
       for (i = 0; i < n; i++)
           for (j = 0; j < LEN; j++)
               sum += a[i][j];
       return sum;
   }
   ```

7. (7 points) A palindrome is a string if, after converting all uppercase letters into lowercase letters and removing all non-alphanumeric characters, it reads the same forward and backward. For example, strings like "22/02/2022", "A man, a plan, a canal – Panama" are palindrome. Alphanumeric characters include letters and numbers.

   Given a string `s`, write a function that returns `true` if it is a palindrome, or `false` otherwise. Do not use extra memory space to store the characters of `s`.

```c
bool isPalindrome(char* s) {

    /* Implement your code here */

}
```

Complete your program by writing a `main` function and check if it gives you correct results. For this question, you must also submit your `.c` files. Please check on `snowball.cs.gsu.edu` if your code executes normally.

8. (5 points) Suppose that we call `scanf` as follows: `scanf("%d%s%d", &i, s, &j);`

   If the user enters 12abc34 56def78, what will be the values of `i`, `s`, and `j` after the call? (Assume that `i` and `j` are `int` variables and `s` is an array of characters.) Explain your answer.

9. (5 points) What does the following program print? Explain.

```c
#include <stdio.h>
int main(void)
{
    char s[] = "Hsjodi", *p;
    for (p = S; *p; p++)
        --*p;
    puts(s);
    return 0;
}
```

10. What does the following function do? Explain in detail.

```c
int f(char *s, char *t)
{
    char *p1, *p2;
    for (p1 = s; *p1; p1++) {
        for (p2 = t; *p2; p2++) {
            if (*p1 == *p2)
                break;
        }
        if (*p2 == '\0')
            break;
    }
    return p1 - s;
}
```

   (a) (3 points) What is the value of `f("abcd", "babc")`?

   (b) (3 points (bonus)) What is the value of `f("abcd", "bcd")`?

   (c) (2 points (bonus)) In general, what value does `f` return when passed two strings `s` and `t`?

Question:	1	2	3	4	5	6	7	8	9	10	Total
Points:	5	5	5	5	5	5	7	5	5	3	50
Bonus Points:	0	0	0	0	0	0	0	0	0	5	5
Score:											