## CS 1713
Introduction to Computer Programming II
Midterm 2

<table>
<thead>
<tr>
<th>Question</th>
<th>Points</th>
</tr>
</thead>
<tbody>
<tr>
<td>Question 1</td>
<td></td>
</tr>
<tr>
<td>Question 2</td>
<td></td>
</tr>
<tr>
<td>Question 3</td>
<td></td>
</tr>
<tr>
<td>Question 4</td>
<td></td>
</tr>
<tr>
<td><strong>Total</strong></td>
<td></td>
</tr>
</tbody>
</table>

NAME: _______________________

**Instructions**
1. Do all of the 4 problems
2. You have 50 minutes for the exam
3. Show all your work
4. Do not separate midterm papers

<table>
<thead>
<tr>
<th>Easy</th>
<th>Difficulty Level</th>
<th>Difficulty</th>
</tr>
</thead>
<tbody>
<tr>
<td>□</td>
<td>□</td>
<td>□</td>
</tr>
<tr>
<td>1</td>
<td>2</td>
<td>3</td>
</tr>
<tr>
<td>4</td>
<td>5</td>
<td>6</td>
</tr>
<tr>
<td>7</td>
<td>8</td>
<td>9</td>
</tr>
<tr>
<td>10</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>
1. (20 pts) What is the output of the following program? Show all your work. Draw the contents of the array.

```c
#include <stdio.h>

int function1(int data[8], int a, int b) {
    data[a] = b;
    return (b-1);
}

int main() {
    int data[10];
    int i, x;
    for (i = 0; i < 10; i++)
        data[i] = i;
    i = 2;
    while (i <= 8)
    {
        x = function1(data, i, i*(i-1));
        printf("%d %d\n", i, x);
        i = i + 1;
    }
}
```

Output:

<table>
<thead>
<tr>
<th></th>
<th>2</th>
<th>1</th>
</tr>
</thead>
<tbody>
<tr>
<td>3</td>
<td>5</td>
<td></td>
</tr>
<tr>
<td>4</td>
<td>11</td>
<td></td>
</tr>
<tr>
<td>5</td>
<td>19</td>
<td></td>
</tr>
<tr>
<td>6</td>
<td>29</td>
<td></td>
</tr>
<tr>
<td>7</td>
<td>4</td>
<td></td>
</tr>
<tr>
<td>8</td>
<td>55</td>
<td></td>
</tr>
</tbody>
</table>

```
data[0] = 0
data[1] = 1
data[2] = 2
data[3] = 3
data[4] = 6
data[5] = 5
data[6] = 30
return (5)
data[7] = 42
return (41)
data[8] = 56
return (55)
```
2. (30 pts) Write a function to find the number of occurrences of "the" in a string. Count both "The" and "the" in a string. Count words that start with "the" and "The" as well. Sample execution of the function and function prototype is given below.

"The red car hit the blue car" returns 2
"An apple a day keeps the doctor away" returns 1
"There is a car on the street" returns 1

```c
int countthe(char *str)
{
    int count = 0;
    while((*(str++) != ' ') && (*(str+1) != ' ') && (*(str+2) != ' '))
    {
        if (((str == 'T') || 
             (str == 't')) && 
            ((str+1) == 'h') && 
            ((str+2) == 'e') && 
            ((str+3) == ' '))
            count++;
    }
    return(count);
}
```
3. (20 pts) Write a single function to find the minimum and maximum in an array. Add your
code to the below function example. Add the additional parameters you need for minimum
and maximum. size is the size of array data.

```c
void findminmax(int data[], int size, int *minptr, int *maxptr)
{
    int i;
    *minptr = data[0];
    *maxptr = data[0];
    for (i = 0; i < size; i++)
    {
        if (data[i] < *minptr)
            *minptr = data[i];
        else if (data[i] > *maxptr)
            *maxptr = data[i];
    }
}
```

```c
int main()
{
    int min, max
    int *ptr1, *ptr2
    ptr1 = &min
    ptr2 = &max
    findminmax(ptr1, ptr2)
    findminmax(data, 10, ptr1, ptr2);
    return 0;
}
```
4. (30 pts) **Complete the following program** to find the most frequent character in a string. If there are multiple characters with the same frequency, you can print one of them. Read a string from the user and print the most frequent character. Sample executions are given below

"apple for apple" has most frequent character 'p', since 'p' appears 4 times
"an apple a day" has most frequent character 'a' since 'a' appears 4 times
"abccdefgde" has most frequent character 'd' since 'd' appears 3 times

```
#include <stdio.h>
#include <string.h>

// returns how many times ch appears in str
int countchar(char ch, char *str)
{
    int count = 0;
    while (*str != '\0')
    {
        if (*str == ch)
            count++;
        str++;
    }
    return(count);
}

int main()
{
    char str[100];
    char *str1;
    char mostfrequent;
    int maxcount = 0, count = 0;

    fgets(str,100,stdin);
    str1=str;

    while (*str1 != '\101')
    {
        count = countchar(*str1, str);
        if (count > maxcount)
        {
            mostfrequent = *str1;
            maxcount = count;
            str1++;
        }
    }

    printf("Most frequent character is %c\n", mostfrequent);
    printf("It appears %d times\n", maxcount);
    return 0;
}
```