

COP 3223 (Introduction to C Programming) Final Exam
Date: 12/6/2014

First Name: _____ **Last Name:** _____

1) (7 pts) The volume of a sphere with radius r is $\frac{4}{3}\pi r^3$. Complete the program below so that it prompts the user to enter the radius of a sphere and prints out the volume of that sphere, to two decimal places.

```
#include <stdio.h>

#define PI 3.14159265

int main() {

    return 0;
}
```

2) (8 pts) What is the output of the following code segment? Briefly explain why the code does what it does.

```
int x = 3, y = 5;
if (x > y);
    printf("A");
if (x = 4)
    printf("%d\n", x+y);
```

Output: _____

Reason:

3) (5 pts) Let a, b and c be variables set to either 0 or 1. For which sets of values is the Boolean expression below equal to 1 (true)? (For each of your answers, write something of the form a = 1, b = 0, c = 1.) Write one answer per line.

```
!a || (b && c)
```

4) (10 pts) Given the current term of a sequence, n, we generate the subsequent term of the sequence as follows: if n is even, divide n by 2, or if n is odd, multiply n by 3 and add 1 to it. For example, if the current term in a sequence was 7, the subsequent term would be 22. If the current term in a sequence was 6, the subsequent term would be 3. A sequence ends when it generates the term 1.

For example, the sequence starting with 3 is 3, 10, 5, 16, 8, 4, 2, and 1.

Complete the program below so that it asks the user to enter the starting integer for the sequence and prints out each term in the corresponding sequence.

```
#include <stdio.h>

int main() {

    int n;
    printf("Please enter the starting term of your sequence.\n");
    scanf("%d", &n);
    printf("%d ", n);

    return 0;
}
```

5) (10 pts) Complete the function below so that takes in an integer array and its length, returns 1 if the array stores **only** negative numbers, and returns 0 if the array stores at least one number that is not negative. (Note: 0 is NOT a negative number.)

```
int allNeg(int array[], int length) {

}

```

6) (10 pts) What is the output of the following program?

```
#include <stdio.h>
int f(int a, int* b);

int main() {
    int a = 3, b = 7, c = 4;
    c = f(b, &a) + 3;
    printf("a=%d, b=%d, c=%d\n", a, b, c);
    b = f(a, &c);
    printf("a=%d, b=%d, c=%d\n", a, b, c);
    return 0;
}

int f(int a, int* b) {
    *b = (a+3)*2 + (*b)%4;
    a = *b - a%6;
    printf("a=%d, b=%d\n", a, *b);
    return 2*a - (*b);
}

```

7) (10 pts) A valid password must contain at least one lowercase letter, one uppercase letter, and at least one non-letter character. Write a function that takes in a string and returns 1 if it stores a valid password and 0 otherwise. Recall that the Ascii values of the lowercase letters are contiguous, in order by letter, as are the Ascii values of uppercase letters and that standard inequality operators can be used to compare characters. The function prototype is given below.

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

```
int isValidPassword(char pswd[]) {
```

```
}
```

8) (10 pts) Write a segment of code below so that it reads in 100 strings from the user, counts how many of those strings are equal to the string "vacation", all lowercase and prints out this count. You may assume that the user will enter alphabetic strings of length 19 or fewer letters and there's no need to prompt the user to enter the strings. Declare all necessary variables.

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

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

9) (10 pts) A potential mining area is broken into a grid of 100 cells arranged in 10 rows and 10 columns. Using a sampling technique, the potential mining value of each cell has been ascertained. The company is only willing to rent a 3 x 3 arrangement of the cells. We define the index of a 3 x 3 mining area to be 10 times the row number of its center cell plus the column number of its center cell. Complete the function below so that it takes in a two dimensional integer array of size 10 x 10 storing the values of each mining cell and returns the index of the 3 x 3 mining area with the largest total value. You may assume that a unique 3 x 3 mining area has maximal value. (Note: there will be four nested loops in your solution. Normally one would code an auxiliary function that sums the value of one mining area, but for this question, please write all of your code in this single function.)

```
#define SIZE 10
```

```
int getIndexBestArea(int grid[][SIZE]) {
```

```
}
```

10) (10 pts) In poker, a flush is a hand that contains all five cards of the same suit. Add a function to `poker.c` that takes in a pointer to a struct hand and returns 1 if the hand the pointer points to is a flush, and 0 otherwise. The prototype is provided for you below. Please use all of the structs and conventions in the code handout. Feel free to add a helper function below `isFlush` if you'd like.

```
int isFlush(const struct hand *h) {
```

```
}
```

11) (9 pts) The rank of the cards in poker by kind is in the same order as shown in the KINDS array, with 2 low and Ace high. Write a function that takes in a pointer to a hand and returns the character that corresponds to the kind of the high card in that hand. Note: You may call any function on the handout poker.c. One function in particular is very helpful!

```
char getHighCard(const struct hand *h) {
```

```
}
```

12) (1 pt) The Circle K logo has a K inside what type of shape? _____

Scratch Page - Please clearly mark any work on this page you would like graded.