Honors Introduction to Computer Programming (COP 3223H) Exam #2 - C

First Name: _____ Last Name: _____

1) (20 pts) Carbon dating is a technique commonly used to determine the age of old fossils. This dating technique involves counting the amount of Carbon-14 left in the artifact. The technique uses the fact that a radioactive isotope such as Carbon-14 decays at a particular rate, known as its half-life. Carbon-14's half-life is 5730 years. Thus, if a fossil has been around 5730 years, it contains half of the original amount of Carbon-14 it contained. If the fossil has been around 11460 years (this is twice of 5730), then it contains one-quarter of the original amount of Carbon-14. If the fossil has been around 17,190 years (this is three times 5730), then it contains one-eighth of the original amount of Carbon-14, etc. Write a program that, given the half life of an element, and the number of atoms of that element in present in a fossil originally, prints out a chart of the number of atoms left in that element for each multiple of the half-life. (Use integer division to determine the number of particles left after each half-life.) For example, if a sample contained 7 atoms of Carbon-14 originally, you should print the following chart:

```
Years     Atoms left
0         7
5730      3
11460     1
17190     0
```

Your chart should end when 0 atoms are left. Fill in the program to complete the task.

```
#include <stdio.h>

int main() {

  int halflife, numatoms, index;
  printf("Enter the half life of your element.\n");
  scanf("%d", &halflife);
  printf("Enter the number of atoms in your sample.\n");
  scanf("%d", &numatoms);
  printf("Years\tAtoms left\n");









}
```

2) (15 pts) Write a function below that takes in one integer parameter n and prints out a forward diagonal slash in n lines using *'s. You may assume that n is positive. An example of the shape of the slash for n=4 is provided below. **(Note: *Please do NOT use a scanf at all in this function*.)**

```
*
 *
  *
   *
```

```
void print_slash(int n) {









}
```

3) (20 pts) In your sociology class, your group project is to study the TV watching habits of high school students. Your other group members have collected the data and then wrote a program to store that data in a frequency array. Since you are the expert on arrays in your group, it is your job to process this data. In particular, your group needs you to calculate the average number of hours of TV the survey participants watch in a day. All the participants watched in between 0 and 9 hours of TV a day, inclusive. (All data was recorded as non-negative integers.) A frequency chart shows how many people in the survey watch 0 hours a day, how many watch 1 hour a day, etc. Here is an example of a frequency chart:

Number of Hours	0	1	2	3	4	5	6	7	8	9
Number of People	10	5	15	4	16	25	15	5	3	2

(Thus, in the example above, 10 people surveyed watched 0 hours of TV a day, 5 people watched 1 hour of TV a day, 15 people watched 2 hours of TV a day, 4 people watched 3 hours of TV a day, etc.)

Write a function that is passed the array freq of size 10 storing the frequency data collected from the surveys and returns a double representing the average number of hours of TV watched a day by all the survey participants. ***(Note: You may NOT assume that 100 people took part in the survey. You can use the input array to determine the number of people who were surveyed.)*** Please fill in the function skeleton provided below:

```
double calcavg(int freq[]) {




}
```

4) (20 pts) Superman must leap up and down a whole skyline of buildings in order to keep Metropolis safe. It takes him no energy to leap down from a tall building to a shorter one because he can glide down with his cape. But, he does expend energy whenever he must jump up from a shorter building to a taller one. You must write a function that takes in the heights of the buildings in feet of Metropolis in an integer array, along with the length of the array, and return the total number of feet Superman must "jump up" if he jumps from building to building in order. For example, if there were six buildings in Metropolis with the heights 1000, 800, 750, 900, 800, 900, then Superman would have to jump a height of 150 feet from the third building to the fourth and another 100 feet from the fifth building to the sixth for a total of 250 feet he must jump up. Please fill in the prototype below to complete this task. **Remember, do not put a printf or scanf in your function. You will automatically be given 0 if you do so.**

```
int distanceJumped(int buildings[], int length) {

}
```

5) (20 pts) Write a function that takes in a 10 x 10 integer array and determines if there exists at least one row or one column that store the same value. (This is essentially similar to checking for a winner in tic-tac-toe without having to check the diagonals.) If such a row or column exists, your function should return 1, otherwise it should return 0. You may assume that the dimensions of grid are 10 x 10.

```
#define SIZE 10

int hasSameRowOrCol(int grid[][SIZE]) {




}
```

6) (5 pts) How many "first dates" does Adam Sandler's character go on with his love interest in the movie, 50 First Dates? _____

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