Homework 7: Structs and Pointers

CS16 - Summer 2021

Due:	Thursday, August 12, 2021 (11:59 PM PDT)
Points:	45
Name:	_____
Homework buddy:	_____

- You may collaborate on this homework with **at most** one person, an optional "homework buddy."
- **Submission instructions:** All questions are to be written (either by hand or typed) *in the provided spaces* and turned in as a single PDF on Gradescope. In other words, you must edit this file directly! Reach out on Slack if you want some suggestions on how to do this. Do not copy and paste the text into a word processor; we will not accept this and your homework may not be graded. If you submit handwritten solutions, write legibly. We reserve the right to give 0 points to answers we cannot read.

1. (4 points) Write a definition for a structure type for records consisting of a person's wage rate (dollars per hour), accrued vacation (in whole days), and status (hourly or salaried represented as either 'H' or 'S', respectively). Call the type `EmployeeRecord`.

2. (6 points) Given the following structures defined:

```cpp
struct Date {
    int day;
    int month;
    int year;
};

struct Person {
    string name;
    Date dateOfBirth;
};

struct ProjectTeam {
    Person MemberA, MemberB;
    Person Leader;
    string projectName;
    double projectBudget;
    Date projectDueDate;
};
```

If we declare `ProjectTeam TheATeam;` which was then initialized fully and correctly:

a. (2 points) How would you print (to standard out) the project budget for `TheATeam`?

b. (2 points) How would you print (to standard out) the name of Member B of `TheATeam`?

c. (2 points) How would you print (to standard out) the year that the project leader of `TheATeam` was born?

3. (5 points) What is the output of the following code? If there's an error that will not allow an output, point it out. Briefly justify your answer.

```cpp
int arr[5];
for (int i = 0; i < 5; i++) {
    if (i < 3)
        arr[i] = 'a';
    else
        arr[i] = 'z';
    cout << arr[i] << endl;
}
```

4. (5 points) What is the output of the following code? If there's an error that will not allow an output, point it out. Briefly justify your answer.

```cpp
int arr[7] = {5};
for (int i = 0; i < 7; i++)
    cout << arr[i] + i << " ";
```

5. (5 points) What is the output of the following code? If there's an error that will not allow an output, point it out. Briefly justify your answer.

```cpp
int codes[] = {24, 66, 83, 973, -977};
for (int count : codes) {
    if ((count/2) < 50)
        cout << count << endl;
    else
        cout << "invalid" << endl;
}
```

6. (5 points) Draw a diagram to show how the content of the array `nums` changes in memory after every line of the following code is executed. Start by showing the elements of the array in memory when the array is initialized. Every time the element of an array changes, you may indicate the change by crossing out the old value and writing in the new value.

```
int nums[] = {44, 66, 83};
int tmp = nums[0];
nums[0] = nums[1];
nums[1] = nums[2];
nums[2]= tmp;
```

7. (5 points) Describe in your own words what the code in the previous question does. Your description of the code should be as abstract as possible. For example, "the above code sorts the elements of the array in ascending order..."

8. (10 points) Draw a pointer diagram to demonstrate how the state of memory changes as the following code is executed. Cross out old values/arrows and draw new ones. Is this program likely to result in a segmentation fault? If so, why?

```
int num = 10;
int* ptr1 = &num;
int* ptr2 = 0;
if (ptr2)
    ptr1 = ptr2;
else if (ptr1)
    ptr2 = ptr1;
(*ptr1)++;
```