

Name: (as it would appear on official course roster)		
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Optional: name you wish to be called if different from name above.		
Optional: name of "homework buddy" (leaving this blank signifies "I worked alone")		

h07: Chapter 6: File IO, Chapter 9: Dynamic memory allocation

ready?	assigned	due	points
true	Mon 11/11 11:00AM	Sat 11/16 11:59PM	40

You may collaborate on this homework with AT MOST one person, an optional "homework buddy".

UPLOAD A PDF OF YOUR ANSWERS TO GRADESCOPE BEFORE THE DUE DATE. ASSOCIATE EACH QUESTION WITH A SPECIFIC PAGE IN YOUR HOMEWORK AT THE TIME OF SUBMISSION. There is NO MAKEUP for missed assignments;

Read Chapter 6, Chapter 9, sections 9.1-9.2 (pages 508 - 533).

PLEASE MARK YOUR HOMEWORK CLEARLY, REGARDLESS OF IF YOU WRITE IT OUT IN INK OR PENCIL!

1.(5 pts) What is the output of the following program? Using a pointer diagram show the evolution of all data objects in memory, clearly marking elements on the run-time stack and on the heap. Mark the size of all data objects. Assume the code is embedded in a correct and complete program.

```
int *p1, *p2, *p3;
p1 = new int;
p2 = new int;
p3 = p1;
*p1 = 20;
*p2 = 30;
cout<< *p1<< " "<< *p2<< " "<<*p3<< endl;
p1 = p2;
cout<< *p1<< " "<< *p2<< " "<<*p3<< endl;
*p3 = *p2;
cout<< *p1<< " "<< *p2<< " "<<*p3<< endl;
```

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2.(5 pts) What is the output of the following program? Using a pointer diagram show the evolution of all data objects in memory, clearly marking elements on the run-time stack and on the heap. Mark the size of all data objects. Assume the code is embedded in a correct and complete program.

```
int array_size = 4, *a ;
a = new int[array_size];
int *p = a;
for(int i=0; i< array_size; i++)
    *(a+i) = 2*i;
p[0] = 10;
for(int i=0; i< array_size; i++)
    cout<<a[i]<<" ";
cout<<endl;
```

3.(5 pts) Write the definition of a structure type called UndergradStudents. This structure should contain student ID numbers, first and last names, major, and GPA scores for each undergraduate year.

4.(10 pts) Write a program that uses the definition of the structure UndergradStudents from the previous question to **declare** and then **initialize** an array of 3 objects of this structure (hint: you can do this with the same approach you define/initialize an array of any other type). You **must initialize the values in the program, not by user input**. The initial values are shown in the table below. Then write the definition of a function with the signature `void printRecords(UndergradStudents *records, int numrecords)`; The function should print out the values of the array of objects passed to it as shown in the sample below, along with each student's AVERAGE GPA score (calculated to a precision of 2 decimal places). You **must use a loop to print the output**. Your program should appropriately call the `printRecords()` function to print the student records and the average GPA.

ID	First name	Last Name	Major	GPA Yr1	GPA Yr2	GPA Yr3	GPA Yr4
1	Joe	Shmoe	EE	3.8	3.3	3.4	3.9
2	Macy	Chen	CS	3.9	3.9	4.0	4.0
3	Peter	Patrick	ME	3.8	3.0	2.4	1.9

OUTPUT:

```
These are the student records:
ID# 1, Shmoe, Joe, Major: EE, Average GPA: 3.60
ID# 2, Chen, Macy, Major: CS, Average GPA: 3.95
ID# 3, Peter, Patrick, Major: ME, Average GPA: 2.77
```

5.(3 pts) In C++, all the files are opened in _____ mode:

- (a) Binary
- (b) Text
- (c) Can't say

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6.(5 pts) Please fill the program below to make it output the expected output:

```
#include <fstream>
#include <iostream>
#include <string>
using namespace std;

int main ()
{
    string data;
    _____ outfile;
    outfile.open("file.dat");
    cout << "Writing to the file" << endl;
    cout << "Enter class name: ";

    _____
    outfile << data<< endl;
    cout << "Enter your id: ";
    cin >> data;
    outfile << data<< endl;
    outfile.close();
    ifstream infile;
    cout << "Reading from the file" << endl;
    infile.open("file.dat");

    _____
    cout << data << endl;

    _____
    cout << data << endl;
    infile.close();
    return 0;
}
```

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Output

```
Writing to the file
Enter class name: name
Enter your id: 123
Reading from the file
name
123
```

7.(2 pts) The <fstream> header provides three classes for operating file IO: ifstream, ofstream and fstream. What are these three used for respectively?

8.(5 pts) Write a C++ program to write the numbers 1 to 100 in a data file NOTES.TXT