

Name: _____

Section: _____

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COMPUTER SCIENCE 261

PROGRAMMING CONCEPTS

EXAM 2 – VERSION 1

Spring 2015

150 Points

Absolutely ***no electronic devices*** may be used during this exam.

1. No cell phones, computers, calculators, music players, headphones, etc.
2. Set your cell phone to be ***completely silent***, not vibrate. If it vibrates during the exam, it will be confiscated.
3. Place these and any other electronic devices in your backpack, ***out of immediate reach***.

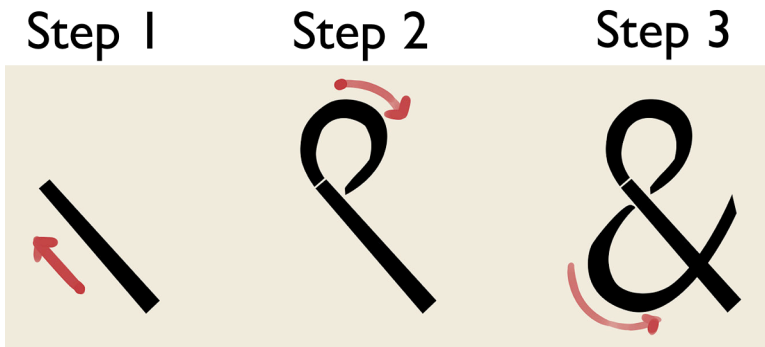
Failure to follow these instructions will result in a ***zero for the exam***.

You are expected to complete this exam ***in its entirety*** before leaving the exam room.

CLOSED BOOK – CLOSED NOTES

YOUR SCORE: _____ POINTS

How to draw an ampersand



All of your answers must be written in clear, readable text. *If we cannot read it, it is not correct.*

1. 11 points. **True** or **False**. Write T or F to the left of each statement.

- _____ Binary search works on ordered and unordered arrays.
- _____ The return type of a constructor is `void`.
- _____ Vector indices start at 1.
- _____ The size of a vector need not be specified in the vector's declaration.
- _____ When we pass an object to a function by reference, a copy of the object is passed.
- _____ An appropriate array definition and initialization follows:

```
char favoriteCity[10] = "Denver";
```
- _____ All vectors in a program have to be of the same data type.
- _____ Member functions are typically public and data members are typically private.
- _____ An accessor is a member function with no parameters that returns the value of a member variable.
- _____ Encapsulation is a way to combine simple class data types into other (more complex) classes.
- _____ A drawback of the separate file approach for classes (i.e., separate `.h`, and `.cpp` files) is longer compilation times.

5. 14 points. Write the declaration of a new class, named `Rectangle`. Use `const` whenever appropriate. Your `Rectangle` class must have:
- Two double data members that hold the length and width of the rectangle: `length` and `width`. These data members should only be accessible through other member functions, and should always be a positive value (>0).
 - A default constructor.
 - A parameterized constructor that takes two doubles as arguments.
 - Get functions for each data member.
 - Set functions for each data member.
 - A member function called `area` that takes no arguments and returns a double, which is the rectangle's area.
6. 4 points. Using your `Rectangle` class from problem 5, write the get function implementation for `length`.

9. 9 points. Fill in each of the 10 blanks.

- a. Consider the declaration below. If a `short` is half an `int` and an `int` is 4 bytes, this array will use _____ bytes in memory.

```
short importantData[10] = {1, 2, 3, 5, 7};
```
- b. Suppose a 2D array has 15 rows and 7 columns. Looping over one specific row's columns can be done with _____ `for` loop(s).
- c. Adding the character _____ specifies a parameter is passed by _____.
- d. To call a member function with an object, we separate the object variable name and the data member function name with the _____ operator.
- e. We expect a private *read-only* data member to have _____ public setter function(s).
- f. It is sometimes easier to represent repeated tasks with a _____ function instead of a loop.
- g. To ensure a function does not modify its data members, we use the _____ keyword.
- h. Given the declaration `int data[5][3];` If an `int` is 4 bytes, and the base address of the array is 4000, what is the address of `data[2]`? _____.

10. 4 points.

- a. Write **ONE** statement that declares a two-dimensional integer array (called `arr`) with 3 rows and 2 columns elements, such that each row is initialized with its column index?
- b. Considering an `int` requires 4 bytes of storage, how much memory is needed to store the array declared above?

11. 7 points. Lazy Joe is at it again, and didn't finish the following binary-search algorithm. Complete the function for him.

```
int binsearch( int arr[], int start, int end, int target) {
    int mid = (start + end)/2;
    if ( start > end ) {
        return -1;
    } else if (                ) {
        return mid;
    } else if (                ) {
        return binsearch(arr, start, mid-1, target);
    } else {
    }
}
```

12. 10 points. Write a function implementation (called `Avg`) that takes a 1D double array (called `data`) and array size (called `size`) as its parameters. The function returns the average of the numbers in the array. Ensure that the contents of the array being passed **cannot** be changed.

13. 8 points. Given the incomplete piece of code below:

```
class Box {
public:
    static const int DEFAULT_DIMENSION = 1;
    // ...
};

int Box::GetHeight() const {
    // ...
}
```

- a. What is the main purpose of the `static` keyword? Be specific.
- b. What is the purpose of `Box` in the `GetHeight ()` function? Be specific.
- c. What is the name of the operator “: :”?
- d. What is the purpose of `const` in the `GetHeight ()` function? Be specific.

14. 10 points. Consider the following classes. Assume both classes are declared in separate .h files, and their implementations are in separate .cpp files. To the right, declare a class `LibraryPatron` (only .h) that contains 2 *public* Books (`book1` and `book2`), 1 *public* DVD (`disc`), and a *private* name of the patron (`name`). Include the header file(s) that `LibraryPatron.h` needs, a default constructor, add appropriate get/set functions.

```
class Book { // in Book.h
private:
    int ISBN;
    string name;
public:
    const static int FINE = 19;
    Book();
    Book(int, string);
    // All get and set functions
};

class DVD { // in DVD.h
private:
    int ID;
    string name;
public:
    const static int FINE = 25;
    DVD();
    DVD(int, string);
    // All get and set functions
};
```

15. 8 points. Write code in a `main()` function that
- declares a `LibraryPatron` named `thePatron`.
 - sets `thePatron`'s name to be Tom.
 - sets the name of the DVD Tom has to be "The Imitation Game", and then prints this name.
 - displays the total fine to Tom (a `LibraryPatron` object), if he were to lose both his books and DVD.

16. 7 points. Consider the following class.

```
class Car {
    private:
        int model;
        string make;
    public:
        Car();
        Car(int, string);
        int GetModel();
        string GetMake();
};
```

In main, declare a vector `myCars` that can hold `Car` objects. In a `for` loop, populate your `myCars` vector with five cars. (As shown below, you obtain `make` and `model` from the user.) . Fill in the template provided.

```
// Declare vector variable here (2 points)

int model; string make;
cin >> model >> make;
// Populate vector with 5 cars, all with same model/make (3 points)

// Display the make of the 2nd Car entered. (2 points)
```

17. 8 points. Draw a conceptual picture of the array that would be created by the following code. Include both the indices and values.

```
const int COLS = 4;
const int ROWS = 2;
int data[ROWS][COLS] = {{2}, {7, 9}};
data[0][1] = data[1][0];
data[1][2] = data[0][0] * 2;
data[0][3] = data[0][0];
```

18. 10 points. Suppose your program contains the following class definition:

```
class Cylinder {  
    public:  
        Cylinder();  
        Cylinder(double r, double h);  
        double GetVolume() const;  
        double GetRadius() const;  
        double GetHeight() const;  
        void SetRadius(double r);  
        void SetHeight(double h);  
  
    private:  
        double radius,  
        double height;  
  
};
```

and suppose the main part of your program contains the following declarations.

```
Cylinder myCylinder, yourCylinder;  
double myVolume, yourVolume;  
double myRadius, yourRadius;
```

First state YES or NO for each of the following statements on whether the statement would compile in the main part of your program. For those that you answer NO, briefly explain why not.

- a). `myVolume = myCylinder.GetVolume;`
- b). `myCylinder.SetHeight(4.0);`
- c). `yourRadius = yourCylinder.GetRadius();`
- d). `yourCylinder.SetRadius(myCylinder.GetRadius());`
- e). `myCylinder.SetHeight() = 7.3;`

19. 8 points. Consider the C++ code below. It does not show some of the function implementations, but you may assume these are implemented and “do the right thing.” Write what is printed to the screen?

```
class Clock
{
public:
    Clock();
    Clock(int h);
    void ChangeTime(const int h, const int m);
    void PrintTime() const;
    void SetMinutes(const int m);
    void SetHours(const int h);
    int GetHours() const;
    int GetMinutes() const;
private:
    int hours;
    int minutes;
};
Clock::Clock() {
    hours = 12;
    minutes = 0;
}
Clock::Clock(int h) {
    hours = h;
    minutes = 0;
}
void Clock::PrintTime() const {
    cout << "Time is " << hours << ":" << minutes << endl;
}
int main() {
    Clock clockList[2];

    clockList[0].SetHours(5);
    clockList[0].SetMinutes(30);

    Clock b(12);
    clockList[1] = b;

    clockList[0].PrintTime();
    clockList[1].PrintTime();

    clockList[1].ChangeTime(clockList[0].GetHours(), clockList[0].GetMinutes());

    b.PrintTime();
    clockList[0].PrintTime();
}
```

PUT OUTPUT HERE