

Name: _____

Section: _____

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COMPUTER SCIENCE 261

PROGRAMMING CONCEPTS

EXAM 2 – VERSION 1

Fall 2014

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***.

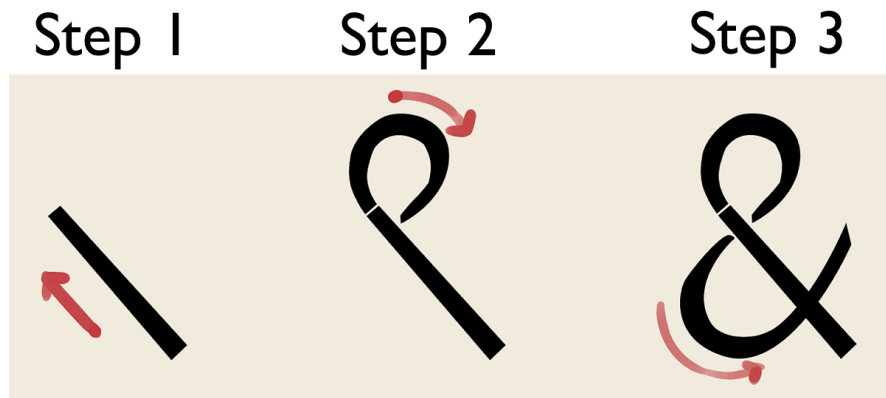
Failure to follow these instructions will result in a ***zero for the exam***.

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

_____ An `int` takes up more space than a `char` in memory.

_____ Vectors can hold different types of elements inside the same object. In other words, I can have a vector that contains both `ints` and `doubles`.

_____ Arrays are stored in contiguous blocks of memory.

_____ It is NOT possible to create a multi-dimensional array that has more than three dimensions.

_____ C-style strings are dynamic, i.e., the user can change their size during run-time.

_____ To declare a 3x4 array of integers called `myArray` with all values set to 0 you can use:

```
int myArray[3][4] = { 0 };
```

_____ Because of memory restrictions, we can only create multi-dimensional arrays of built-in data-types (`int`, `float`, `double`, `char`, and `bool`).

_____ The default constructor is *always* called whenever a class instance (object) is created.

_____ A global function in `main.cpp` has the same access to the members of a class as a member function of the class.

_____ Setter functions always require a parameter.

2. 10 points. Consider the class declaration for a `Widget` below.
- How many constructors are declared in the class?
 - How many default constructors are declared in the class?
 - List the names of the data members of the class.
 - How many member functions (both public and private) are declared in the class?
 - The member function `punch` is given a special name. What is it?
 - A private operator
 - The default constructor
 - A helper function
 - An accessor function

```
Class Widget
{
    public:
        Widget();
        Widget(double h);
        Widget(char n);
        Widget(double h, int f, char n);
        double getHappy();
        int getFun();
        void setFun(int f);
        void attack(Widget &w);
        bool havingFun();
    private:
        double happy;
        int fun;
        char name;
        int punch(Widget &w);
};
```

3. 5 points. Circle all the valid constructor prototypes for a class named `MyAccount`? Assume the appropriate header files and namespace statements are provided.
- `myAccount(double balance);`
 - `MyAccount() const;`
 - `void MyAccount();`
 - `MyAccount(const string& accountNumber, double balance);`
 - `MyAccount();`

4. 8 points. Draw a conceptual picture of the array that would be created by the following code. Include both the indices and values.

```
int data[] = { 42, 37, 23, 88, 51, 91, 12, 67 };
int x = 5;
data[x] = data[6];
data[6] = data[x];
data[x-1] = data[x] - 2;
data[1] = 1;
```

5. 10 points. Suppose your program contains the following class definition:

```
class Automobile
{
    public:
        Automobile();
        Automobile(double newPrice, double newProfit);
        void setPrice(double newPrice);
        void setProfit(double newProfit);
        double getPrice() const;
        double getProfit() const;
    private:
        double price,
        double profit;
};
```

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

```
Automobile prius, jaguar;
double aPrice, aProfit;
```

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). `aPrice = prius.getPrice;`
- b). `prius.price = 25999.99;`
- c). `aProfit = jaguar.getProfit();`
- d). `jaguar.setPrice(37999.97);`
- e). `Automobile myAuto(429.5, 67.8);`

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

- a. Consider the declaration below. The size of the array in memory is _____ elements.
`int a[4] = {0,0};`
- b. We use the keyword _____ to ensure that a function cannot modify the contents of an array passed to it.
- c. To loop through all of the elements of a 5x8 2-D array you would use an index for the second dimension that goes from _____ to _____.
- d. In a 2D array, the first and second dimensions are normally associated to the _____ and _____ of a table, respectively.
- e. To pass an integer to a function by reference, we use _____.
- f. To access member functions of the string class, we use the _____.
- g. Given that an integer takes 4 bytes of storage, and myNumbers[1] is stored at memory location 240, the address of myNumbers[3] is _____.
- h. In general, if a class has R private data members, you expect to have _____ setter functions and _____ getter functions.

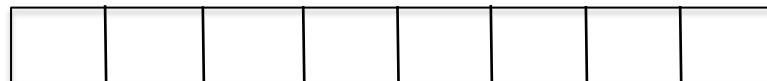
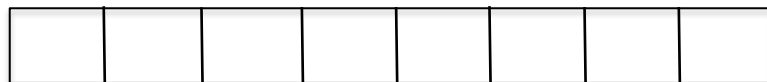
10. 4 points.

- a. Write ONE statement that declares a one dimensional character array (called `arr`) with four elements, such that each of the elements are initialized to 'A'?

- b. Considering a character requires 1 byte of storage, how much memory is needed to store the array declared above?

11. 6 points. Draw a conceptual picture of the following array for THREE passes of the selection sort algorithm, which was described in both class and in your text required reading. In this example, data should be sorted in **descending** order. Show each pass of the algorithm in the space provided.

```
int data[] = { 25, 30, 101, 76, 5, 99, 15, 64 };
```



12. 14 points. Write a function implementation (called `diffMinMax`) that has a 1D integer array and array size as its parameters. The function returns the difference between the maximum and minimum numbers in the array. Your function should NOT use more than one `for` loop; that is, your function should find the max and min numbers in a single pass of the array. Also ensure that the contents of the array being passed **cannot** be changed.

13. 12 points. Given the following function header:

```
Foo Foo::doIt (const Foo& f) const
```

- a. The FIRST Foo in the function header is the (be specific): _____
- b. The SECOND Foo in the function header is the (be specific): _____
- c. The THIRD Foo in the function head is the (be specific): _____
- d. What is the purpose of the FIRST const (be specific)?
- e. What is the purpose of the SECOND const (be specific)?

14. 8 points. Consider the C++ source below. It does not show some of the Time class' member function implementations, but you may assume these are implemented and “do the right thing.” Write what will be printed for the values of the A and B calls to getSecs ().

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

class Time
{
public:
    Time( double seconds );
    void setSecs( double seconds );
    double getSecs() const;
    void doTheTimeWarp( const Time& warpFactor );
    void doTheTimeWarp( double warpFactor );
private:
    double secs;
};

void Time::doTheTimeWarp( const Time& warpFactor )
{
    secs = secs * warpFactor.secs; // multiply
}
void Time::doTheTimeWarp( double warpFactor )
{
    secs = secs + warpFactor; // add
}

int main()
{
    Time A(3), B(-1);
    cout << A.getSecs() << " " << B.getSecs() << endl;
    B.doTheTimeWarp( A );
    cout << A.getSecs() << " " << B.getSecs() << endl;
    A.doTheTimeWarp( B.getSecs() );
    cout << A.getSecs() << " " << B.getSecs() << endl;
    B.doTheTimeWarp( B );
    cout << A.getSecs() << " " << B.getSecs() << endl;

    return 0;
}
```


15. 16 points. Write the declaration of a new class, named `Thermostat`. Use `const` whenever appropriate. Your `Thermostat` class must have:
- One private double data member that holds the temperature (in Fahrenheit) at a given hour.
 - One private integer data member that holds the hour (0 to 23) that the temperature was taken.
 - A default constructor.
 - A parameterized constructor that sets both the temperature and the hour.
 - Accessor member functions for each data member.
 - A member function that returns the callee's temperature in Celsius (i.e., converts Fahrenheit to Celsius. Note: $C = (F - 32)/1.8$).

16. 5 points. Using your `Thermostat` class from problem 15, write one of the get functions.

17. 5 points. Using your `Thermostat` class from problem 15, write the implementation for the parameterized constructor.
18. 10 points. Using your `Thermostat` class from problem 15, write a main function that:
- Declares two `Thermostat` objects that are initialized with (72.1, 14) and (52.8, 4).
 - Prints the temperature of the **first** (72.1, 14) `Thermostat` object in Fahrenheit.
 - Sets the temperature of the **second** (52.8, 4) `Thermostat` object to 62.8.
 - Prints the temperature of the object just modified in Celsius.