CSE 232, Lab Exercise 09

Wildcards and Filenames

When compiling multiple file C++ projects, it is often annoying to have to specify each individual cpp file to the compiler. Example:

```
g++ -std=c++14 -Wall -g main.cpp stack.cpp disk.cpp io.cpp
```

BASH gives an alternative way to select files that match a particular pattern. Notice that the above files were all the files in the folder that ended with '.cpp'. You can use a wildcard (the asterisk '*') to denote all of those files at once. Example:

```
g++ -std=c++14 -Wall -g *.cpp
```

The `*.cpp` expands to all of the files that end with '.cpp'.

This is often useful when you want to do things to multiple files. Lets say you have a folder named `headers` that you want to move all the '.h' files to. You can do so with:

```
mv *.h headers/
```

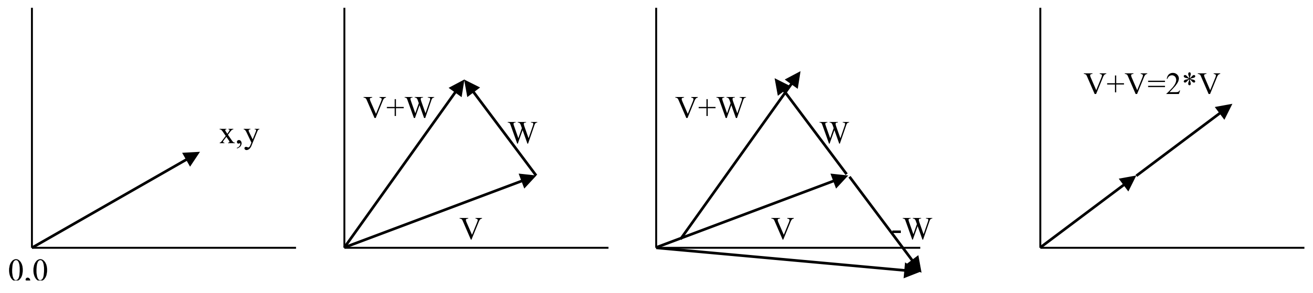
★ Show your TA what happens when you use wildcards to open multiple '.cpp' files with the `gedit` command.

The Lab Problem

We are going to work on making our own data structures using a C++ `struct`. Specifically, we are going to create both data members and member functions. We are going to make a 2D `MathVector struct`. Keep it straight, these are the mathematical entitles called Vectors (a geometric entity with direction and magnitude).

Some Background

So if you don't remember, here is a little background on two-dimensional vectors.
A vector is basically an arrow that has a magnitude (a length) and a direction (an angle with respect to typically the x axis). It usually is represented as an x,y pair, where the origin of the vector is assumed to be at 0,0 and the head of the vector is as the listed x,y pair.



A vector   V + W   V-W   V*2

Here are some of the operations you can perform on your new `MathVector` struct.

- `MathVector` addition. If V1 is (x,y) and V2 is (a,b), the V+W is a new `MathVector` with the values (x+a, y+b)
- `MathVector` multiplication by a scalar integer type. If V1 is (x,y), then V*n is (x*n,y*n), returning a new `MathVector`
- `MathVector` multiplication with another `MathVector`. There are two possibilities, dot product or cross product. We'll do ***dot product***. If V=(x,y) and W=(a,b), then V*W = x*a + y*b, a scalar. Thus the dot product returns a scalar type `long`, **not** a `MathVector`
- `MathVector` magnitude. The magnitude based on the Pythagorean theorem. For V=(x,y), the magnitude is `sqrt`(x^2 + y^2).

Your Tasks

Make a `MathVector struct`. Data members are:

- `long x`
- `long y`

Constructors are:

- default constructor
- two args, each a long, constructor: first arg is the x value, the second is the y value. No defaults.

The member functions are:

- `MathVector add(const MathVector&).` Single arg a `const` ref to `MathVector`. Adds two `MathVectors` as described. Returns a new `MathVector`.
- `MathVector mult(long)`. Multiplies a single `MathVector` element by a long as described. Returns a new `MathVector`.
- `long mult(const MathVector&)`. Single arg a `const` ref to `MathVector` . Multiplies the two `MathVectors` as a dot product, yielding a `long` as described above.
- `double magnitude()`. No args. Calculate the magnitude of the `MathVector` as described. Returns a double.

Make the following ***regular function*** (not a member)

- `string vec_to_str(const MathVector &v)`. No args, returns a `string` representation of the MathVector in the format: `"x:y"`

We provide `lab09_vector.h` you write `lab09_vector.cpp`. Make your own `lab09_main.cpp` that is in the lab directory and run and test your work. Show your TA your work.

Online Students

Turn in your `lab09_vector.cpp` to Mimir for testing