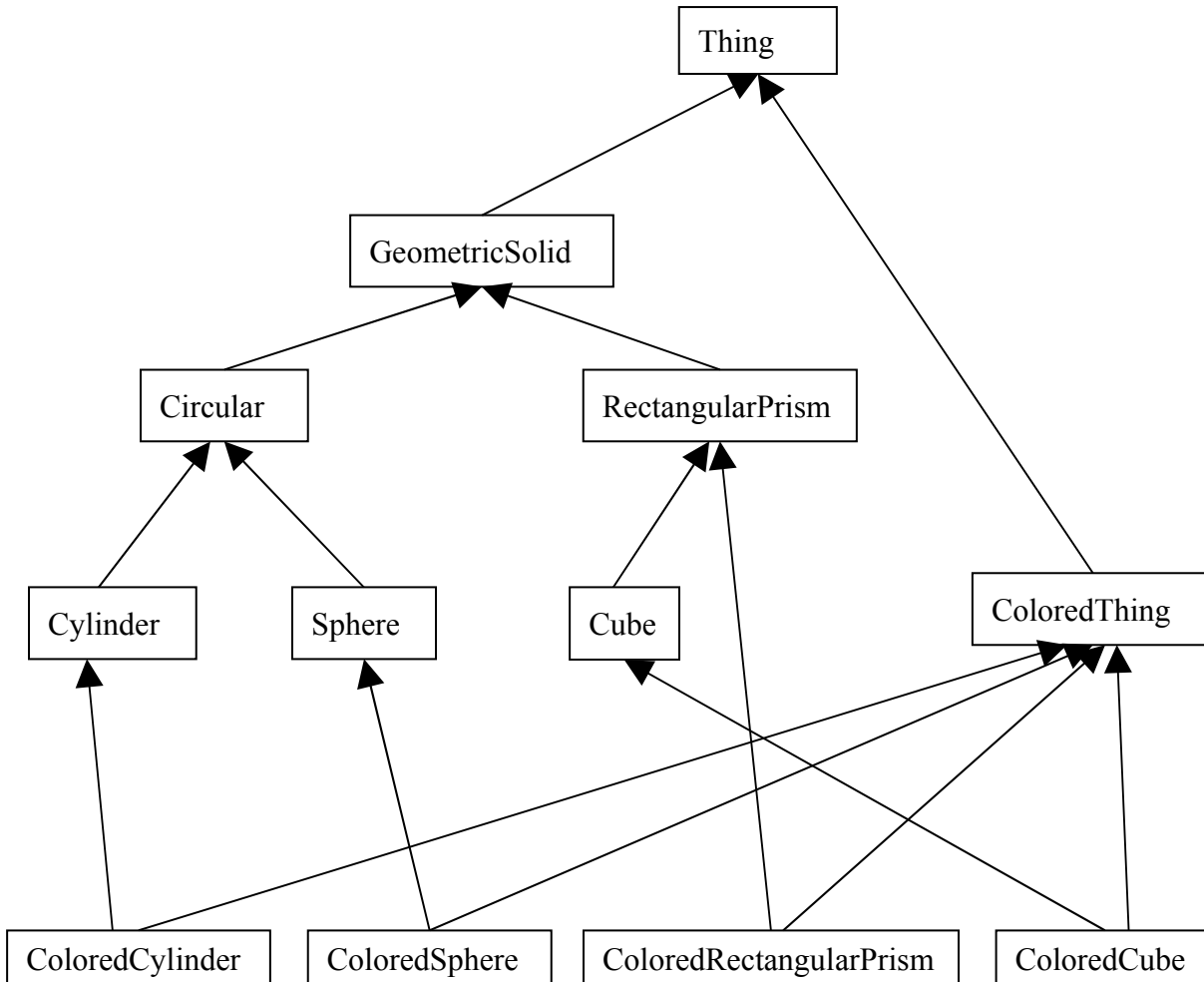


Assignment 4

This assignment will give you practice with multiple inheritance and use of the C++ style casts. You will create the inheritance hierarchy shown below and set up a polymorphic relationship using a base Thing class pointer.



Class Descriptions

- Thing – Abstract, contains a pure virtual function, name() that returns the class name.
- GeometricSolid – Abstract, contains a pure virtual function, volume().
- Circular – Abstract, contains a floating-point radius data member.
- RectangularPrism – contains 3 floating-point data members, define the volume function in this class.
- ColoredThing – Abstract, contains string and double data members to store the color and weight. Contains a pure virtual function, density().
- ColoredCylinder – Derived from ColoredThing and Cylinder. Define density for this class.
- ColoredSphere – Derived from ColoredThing and Sphere. Define density for this class.
- ColoredRectangularPrism – Derived from ColoredThing and Rectangular. Define density for this class.
- ColoredCube – Derived from ColoredThing and Cube. Define density for this class.

Input data for this assignment will be provided in a 50 record randomly ordered binary file, **ass4data**. The format for this file will be a three-byte character code (“cyn”, “spn”, “ren”, “cun”, “cyc”, “spc”, “rec”, “cuc”) indicating the type of solid and whether or not it is a “Colored” Thing. The three-byte code (actually it’s 4 bytes – code is null-terminated) is followed by 1, 2, or 3 doubles representing requisite data members of the class. For ColoredThings, another double and an 8-byte char array for the color. Specifically the data format will appear as:

<u>Thing</u>	<u>Code</u>	<u>Binary data</u>	<u>Representing</u>
Cylinder	cyn	2 doubles	radius and height
Sphere	spn	1 double	radius
RectangularPrism	ren	3 double	length, width, and height
Cube	cun	1 double	side
ColoredCylinder	cyc	3 doubles, 8 char	radius, height, weight, color
ColoredSphere	spc	2 doubles, 8 char	radius, weight, color
ColoredRectangularPrism	rec	4 doubles, 8 char	length, width, height, weight, color
ColoredCube	cuc	2 doubles, 8 char	side, weight, color

A text file, **ass4data.txt** (see below), is also provided as a check to make sure you read the input data correctly. Do not use the **ass4data.txt** file as the input file for your program.

“Firm” program Requirements

Your program should perform the following tasks:

1. Read in the binary data file, correctly processing each particular type of Thing.
2. Using a pointer to a Thing, and making use of polymorphism, allocate memory dynamically for a specific type of GeometricSolid. Don’t forget your delete.
3. Overload the insertion operator (e.g. ostream& operator<<(ostream&, const GeometricSolid&)) for printing both GeometricSolid objects and ColoredThing objects. Note: the ColoredCylinder, ColoredSphere, etc. will have to use both overloaded insertion operators.
4. Use the correct C++ cast types. In particular, you should use a reinterpret_cast when reading in the binary file using the istream::read() function, and use a dynamic_cast to downcast a Thing pointer to utilize the correct operator<<() function call for printing either a GeometricSolid or a ColoredThing object.
5. The output should be produced by your overloaded insertion operators and *match* that which is partially displayed below.
6. Use the same formulas from assignment 2.

Additional Notes

Do not attempt to solve all of the program requirements in one pass. There are some sophisticated requirements for this assignment. Try to “sneak up” on the solution. For example, check your binary input data against the text data to make sure you read it in correctly. Also, check the instantiation of the class objects before you attempt to use the overloaded insertion operators.

You will need *virtual inheritance* as demonstrated in class (CIS27 - Example 7-8).

The program used to create the assignment 4 data is provided as a review on writing a binary file.

Program Output

Type of Object	Volume	Color	Density
sphere	373.2839		
ColoredCube	2.3704	red	16.0313
Cube	236.8894		
ColoredRectangularPrism	59.5706	yellow	0.5341
cylinder	950.0176		
ColoredRectangularPrism	70.1365	red	0.8147
Cube	4.0960		
sphere	105.2098		
sphere	279.4085		
ColoredCube	105.6409	black	0.1946
sphere	1188.6883		
Cube	72.3380		
ColoredCylinder	96.5458	orange	0.1977
ColoredSphere	11.4940	black	2.5643
...			

ass4data.txt (partial)

spn	4.46667			
cuc	1.33333	38	red	
cun	6.1875			
rec	3.16667	4.1	4.58824	31.8182 yellow
cyn	6	8.4		
rec	4.8	4.6	3.17647	57.1429 red
cun	1.6			
spn	2.92857			
spn	4.05556			
cuc	4.72727	20.5556	black	
spn	6.57143			
cun	4.16667			
cyc	2.42857	5.21053	19.0909	orange
spc	1.4	29.4737	black	
...				