CSE 333 Section 7 - C++ Inheritance, Intro to Networks

Welcome back to section! We're happy you're here ʕ•ᴥ•ʔ⊹₊⟡⋆

Inheritance

A **Derived** class inherits from a **base** class (*Similar to*: A subclass inherits from a superclass)

- The public interface of a derived class Inherits all **non-private** member variables and functions (**except** for ctor, cctor, dtor, op=)
- Aside: We will be only using **public** inheritance in CSE 333

Inheritance in HW3

Base Class: HashTableReader (Protected)	Derived Classes
• `list<IndexFileOffset_t> LookupElementPositions( HTKey_t hash_val) const;` • `FILE* file_;` • `IndexFileOffset_t offset_;` • `BucketListHader header_;`	• `IndexTableReader` – Reads index table • `DocIDTableReader` – Reads DocID Table • `DocTableReader` – Reads DocTable • `FileIndexReader` – Reads File's Index

Style Considerations

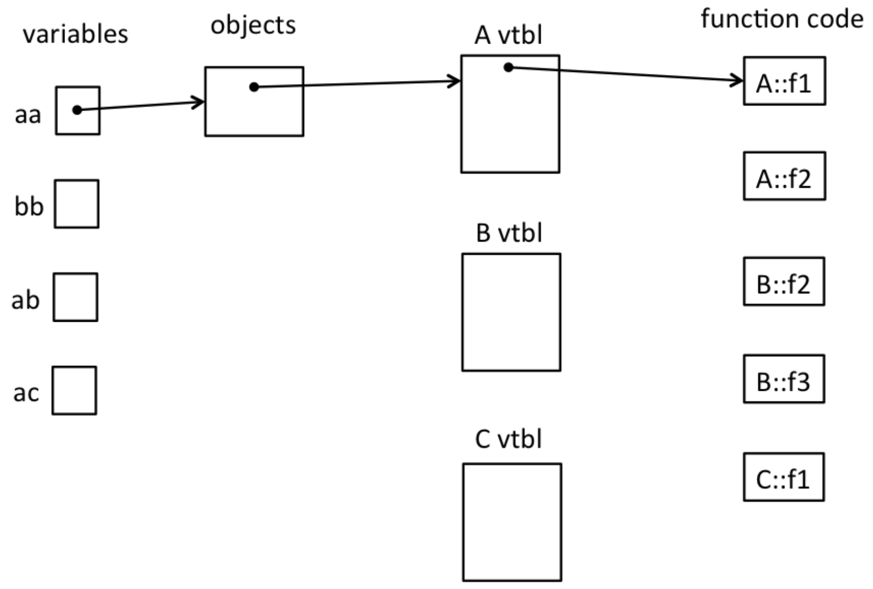
- Use `virtual` **only once** when first defined in the base class
- All derived classes of a base class should use `override` to get the compiler to check that a function overrides a virtual function from a base class
- Use `virtual` for destructors of a base class of a base class – Guarantees all derived classes will use dynamic dispatch to ensure use of appropriate destructors

Exercise 1:
Consider the program below, which does compile and execute with no errors, except that it leaks memory (which doesn't matter for this question).

(a) Complete the diagram on the next page by adding the remaining objects and all of the additional pointers needed to link variables, objects, virtual function tables, and function bodies. Be sure that the order of pointers in the virtual function tables is clear (i.e., which one is first, then next, etc.). One of the objects and a couple of the pointers are already included to help you get started.

(b) Write the output produced when this program is executed. If the output doesn't fit in one column in the space provided, write multiple vertical columns showing the output going from top to bottom, then successive columns to the right

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

class A {
 public:
  virtual void f1() { f2(); cout << "A::f1" << endl; }
  void f2() { cout << "A::f2" << endl; }
};
class B : public A {
 public:
  virtual void f3() { f1(); cout << "B::f3" << endl; }
  virtual void f2() { cout << "B::f2" << endl; }
};
class C : public B {
 public:
  void f1() { f2(); cout << "C::f1" << endl; }
};
```



```
int main() {
  A* aa = new A();
  B* bb = new B();
  A* ab = bb;
  A* ac = new C();
  aa->f1();
  cout << "---" << endl;
  bb->f1();
  cout << "---" << endl;
  bb->f2();
  cout << "---" << endl;
  ab->f2();
  cout << "---" << endl;
  bb->f3();
  cout << "---" << endl;
  ac->f1();
  return EXIT_SUCCESS;
}
```

Output:

Bonus:

Virtual holidays! Consider the following C++ program, which does compile and execute successfully.

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

class One
{ public:
        void m1() { cout << "H"; }
virtual void m2() { cout << "l"; }
virtual void m3() { cout << "p"; }
};

class Two: public One
{         public:
 virtual void m1() { cout << "a"; }
         void m2() { cout << "d"; }
 virtual void m3() { cout << "y"; }
         void m4() { cout << "p";}
};

class Three: public Two
{
  public:
         void m1() { cout << "o"; }
         void m2() { cout << "i"; }
         void m3() { cout << "s"; }
         void m4() { cout << "!"; }
   };
```

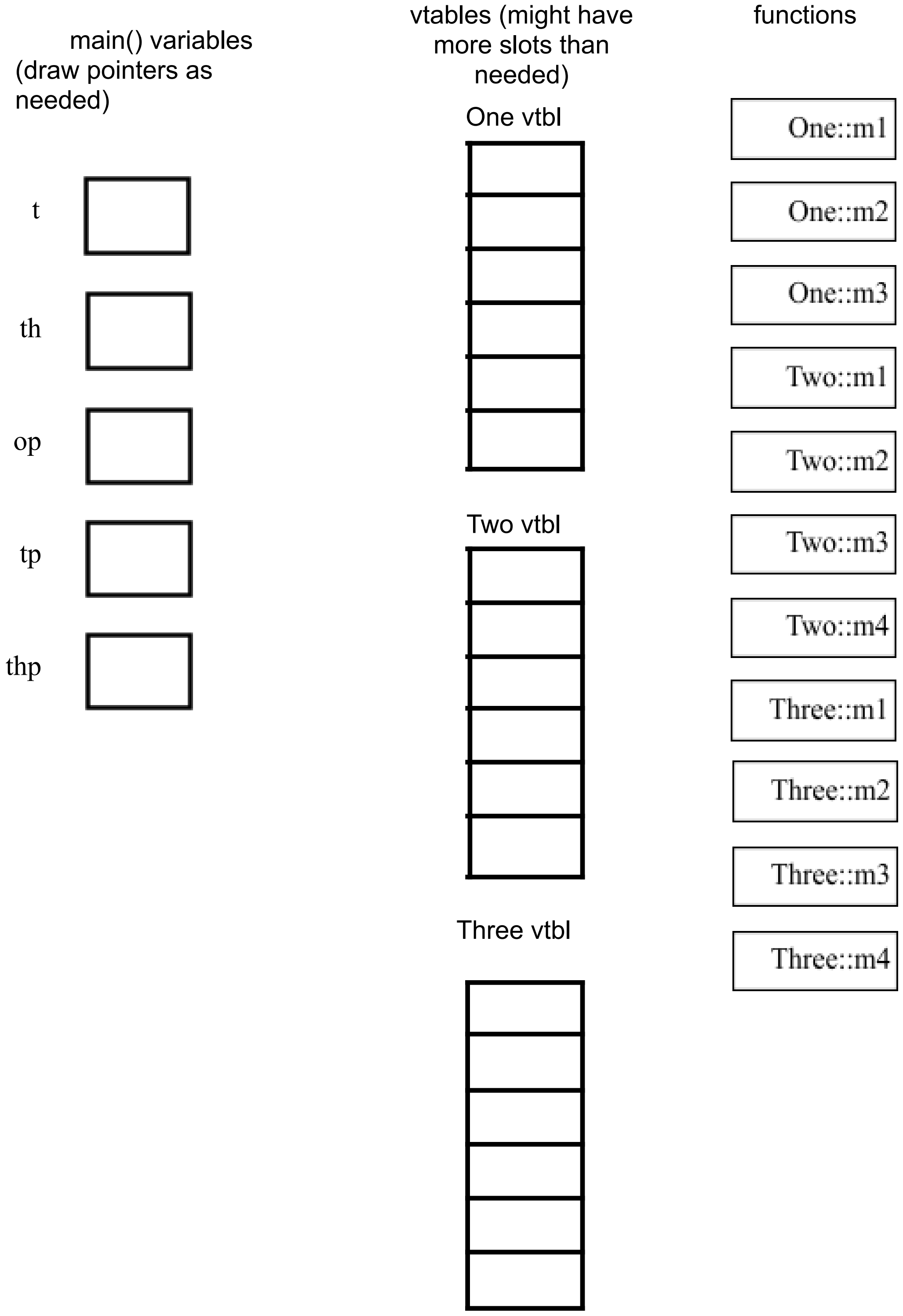
```
int main() {
    Two t;
    Three th;
    One *op = &t;
    Two *tp = &th;
    Three *thp = &th;

    op->m1();
    tp->m1();
    op->m3();
    op->m3();
    tp->m3();

    op->m1();
    thp->m1();
    op->m2();
    thp->m2();
    tp->m2();
    tp->m1();
    tp->m3();
    thp->m3();
    tp->m4(); cout <<
    endl;
```

(a) On the next page, complete the diagram showing all of the variables, objects, virtual method tables (vtables) and functions in this program.

(b) What does this program print when it executes?

(c) Modify the above program by removing and/or adding the virtual keyword in appropriate place(s) so that the modified program prints `HappyHolidays!` (including the ! at the end). Draw a line through the `virtual` keyword where it should be deleted and write in `virtual` where it needs to be added.

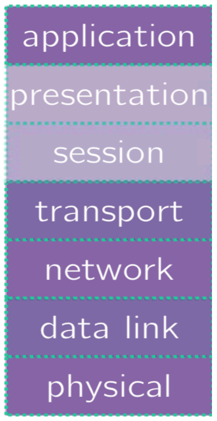
(Bonus cont.) Draw your answer to part (a) here. Complete the vtable diagram below. Draw arrows to show pointers from variables to objects, from objects to vtables, and from vtable slots to functions. Note that there may be more slots provided in the blank vtables than you actually need. Leave any unused slots blank.



Computer Networking Review

<u>Exercise 3</u>

a) Match the following protocols to what they are used for. (Bonus: In what *layer* of the networking stack is it found?)



DNS	Reliable transport protocol on top of IP.
IP	Translating between IP addresses and host names.
TCP	Sending websites and data over the Internet.
UDP	Unreliable transport protocol on top of IP.
HTTP	Routing packets across the Internet.

b) Why would you want to use TCP over UDP?

c) Why would you want to use UDP over TCP?