Lecture 12c
Review of Midterm #2
April 15th, 2016

Announcements

- Reading Assignment
  - Read Chapter 7
  - Quiz before class Monday
- Recitations: Version Control (subversion)
- PA8 is due next Wednesday
  - Any questions?

Midterm #2: Raw Scores

- Min 33
- Avg 63.06
- Median 63.5
- St. Dev. 12.25
- Max 96

Midterm #2: The Curve

- Distribution is approximately Gaussian
- St. Dev of 12 ≈ 10
  - So a standard deviation is a letter grade
  - Need to move the center
    - 63 is too low a mean

So the curve adds 15 points
(scores above 100 are OK)

Part 1

- Focus:
  - Inheritance as Union
  - Dynamic dispatch mechanisms
  - Static data (to count instances)
1. What value does the program return?
   - 3
2. Is there a memory leak?
   - No

Part 1 (cont)

3. How many VFPTs are created?
   - 4
   - Animal, Mammal, ZooProperty, Quagga
4. How many pointers to VFPTs are created?
   - 1
Part 1 (III)

5. What is the size of q?
   - Sizeof(Mammal) + Sizeof(ZooProperty) + Sizeof(double)
6. List constructors in order
   - Animal
   - Mammal
   - ZooProperty
   - IDstruct
   - Quagga
7. List destructors in order
   - Quagga
   - ZooProperty
   - IDstruct
   - Mammal
   - Animal

Part 2

• Focus
  - Vectors: copying and storage
  - Dynamic vs static dispatch
  - (lack of) slicing
8. What value does the program return?
   - 27
   - 10 calls to Quagga q(d)
   - 10 calls to push_back (which copies)
   - 5 spots were were the capacity of the initial vector; after 5 it doubles, copying 5 more times
   - So 25 quaggas made; initial value of ctr adds 2.

Part 2 (cont)

9. How many times is Quagga(double) called?
   - 10
10. How many times is ~Quagga() called?
    - 25
    - 10 times when q(d) falls out of scope
    - 10 times when the vector falls out of scope
    - 5 times when the vector grows

Part 2 (III)

11. What is printed?
    - Value = 0.91
    - Herd.at(0) is a Quagga
    - Quagga inherits Value() from ZooProperty
    - ZooProperties are created with value = 0.99
    - But when they are copied, value becomes 0.91
    - Herd.at(0) was copied by push_back
12. How much data is stored on the heap?
    - Sizeof(Quagga) * (10 or 15 or 20) + Sizeof(Quagga*) * (10 or 15) + Sizeof(IDstruct) * (10 or 15 or 20)

Part 3

• Focus
  - Slicing
  - Memory management with hierarchies
13. How many times is Quagga(double) called?
    - 10
    - Everything else just manipulates the pointers
14. How many times is the destructor called?
    - 0
    - The destructor for vector<Quagga*> is shallow

Part 3

15. Is there a memory leak?
    - Yes
    - 10 Quaggas
    - 10 IDstructs!
16. What value does the program return?
    - 12 (10 + 2)
17. What does the program print?
    - Value = 0.99 (object is never copied)
    - Name = Qiana
      • Name is virtual starting with Mammal
      • Redefined in Quagga to return Qiana
18. How much data is stored on the heap?
    - 10*Sizeof(Quagga) + 10*Sizeof(Quagga*) + 10*Sizeof(IDstruct)
Part 4

- Focus
  - Dynamic vs static dispatch
  - Dynamic casting

19. What is the 1st line of printed output?
   - Name = Qiana warm_up = shiver
   - Called through Quagga*
   - Name() is virtual; Quagga’s returns Qiana
   - Behave() calls virtual WarmUp(); Mammal’s returns shiver

20. What is the 2nd line of printed output?
   - Name = Qiana warm_up = shiver
   - Called through Mammal*
   - Nothing changes!

21. What is the 3rd line of printed output?
   - Name = Arianna warm_up = shiver
   - Called through Animal*
   - Name() only becomes virtual at Mammal!

22. What is the 4th line of printed output?
   - ID = 3 Value = 0.99
   - Called through ZooProperty*
   - Value is 0.99 because object never copied
   - ID = 3 because only one object is made

23. Is there a memory leak?
   - Yes
   - The pointer is returned, but IDStruct is leaked
     - May or may not leak part of Quagga, depending on OS
     - ~Animal() is only destructor called (not virtual)
     - Pointer to IDStruct never deleted!

Part 5

- Focus: General Concepts

24. What is the parent class of ZooProperty?
   - None!
   - There are no default parent classes in C++!

25. Of all the classes in Animal.h, there is one class it is not possible to make an instance of. Which one is it?
   - Animal
   - It has a pure virtual method, so it is abstract

Part 4 (cont)

1. What is the 3rd line of printed output?
   - Name = Arianna warm_up = shiver
   - Called through Animal*
   - Name() only becomes virtual at Mammal!

2. What is the 4th line of printed output?
   - ID = 3 Value = 0.99
   - Called through ZooProperty*
   - Value is 0.99 because object never copied
   - ID = 3 because only one object is made

3. Is there a memory leak?
   - Yes
   - The pointer is returned, but IDStruct is leaked
     - May or may not leak part of Quagga, depending on OS
     - ~Animal() is only destructor called (not virtual)
     - Pointer to IDStruct never deleted!