Inheritance: runtime vs. compile time binding

- virtual functions
  - which function is actually called? determined at runtime
  - must call through pointer or reference
- word “virtual” not needed in derived classes, but good idea for documenting code
- non-virtual functions are bound at compile-time
- base classes must have virtual destructor

```c
void bearYoung(Mammal * m) {
    m->gestate();
    m->giveBirth();
}
```
Trees: solving problems

- Store keys, support map aka dictionary operations
  - insert
  - find
  - delete

- We’ve used arrays/vectors, linked-lists, search trees
  - vector
  - linked list
  - search tree

- trees used for directories, expressions, games
  - class or struct? template or not?
Tree cloning

- Return a copy of a tree (who clones?)

```c
Tree * clone(Tree * t)
{
}
```

- can a Tree node clone itself? delete itself? issues?
- what about a mirror copy?
Twenty questions (tree applications)

Does it have feathers? No
Is it a feline? Yes
Is it the king of beasts? No
Is it a tiger? No
I give up, what animal are you thinking of? cheetah
Ask a question that has a “yes” answer for a tiger and a “no” answer for a cheetah: does it have stripes

...
Animal trees

- from one node tree to many node tree
  - different behavior: internal nodes vs. leaves
  - how can tree be saved to a file (to be read later)?

- Who is responsible for asking questions, printing,...