Scope

Def: A definition is anything that establishes a possible binding to a name.

Def: Scope is a programming language tool to limit the visibility of definitions.

Example: Early dialects of Basic did not have scoping rules, all definitions of all variables were visible in the global scope.

```
$A = "This is a global string"
                ...
Function Foo ()
  $A = "This is a local string"
                ...
End
Call Foo        ...
$B = $A   <----------  What is the content of $B?
```

Chapter 10

Problem: When everything is visible everywhere then it is up to the programmer to control visibility of definitions (e.g. globally unique names).

Scoping with Namespaces

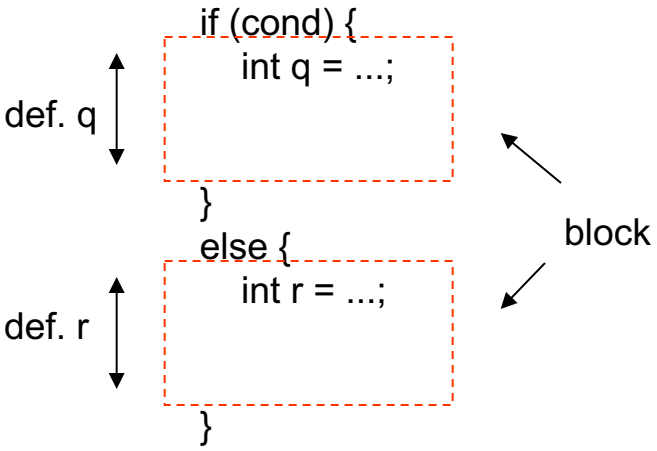
Def: A namespace is a zone in a programming language which is populated by names. In a namespace, each name must be unique.

The most common namespace in programming languages is the block.

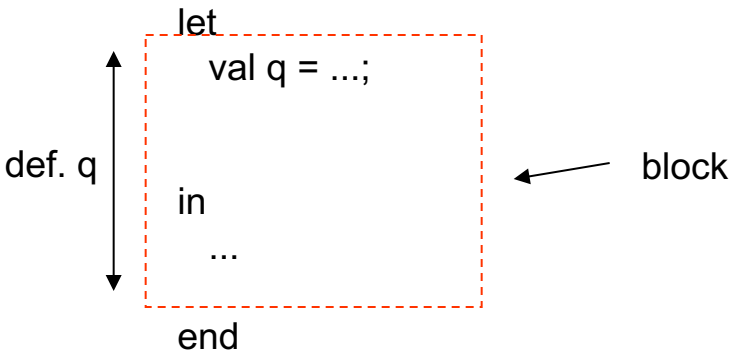
Scoping with Blocks

Def: A block is any language construct that contains definitions and delineates the region of the program where those definitions apply.

Example: Java



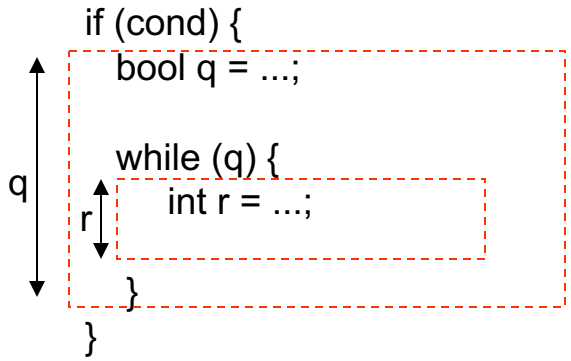
Example: ML



Nested Blocks

In most modern programming languages blocks can be nested.

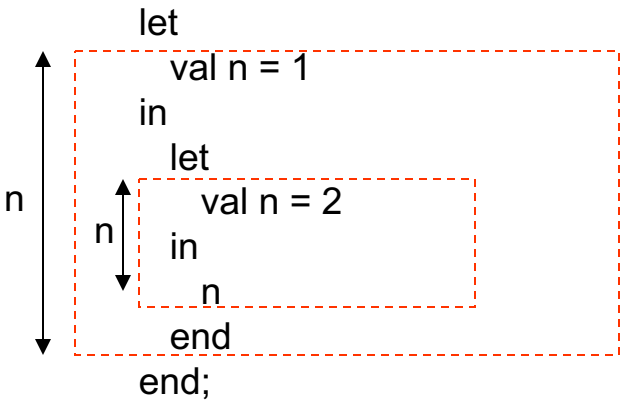
Example: Java



Nested Blocks

This can lead to interesting anomalies, consider;

Example: ML



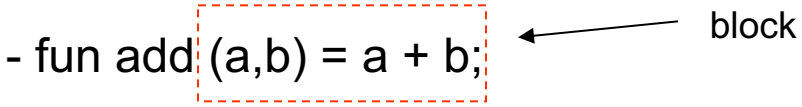
What is the value of this expression?

Implicit Blocks

Def: A block is any language construct that contains definitions and delineates the region of the program where those definitions apply.

Blocks can also be defined implicitly by some language construct.

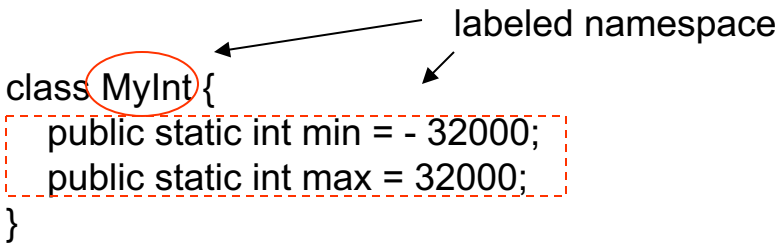
Example: ML



Labeled Namespaces

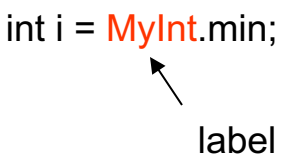
Def: A labeled namespace is any language construct that contains definitions and delineates a region of the program where those definitions apply; and also have a name that can be used to access those definitions.

Example: Java



Other labeled namespaces:
Java: packages, class
C++: class, namespace
C: struct
ML: structure

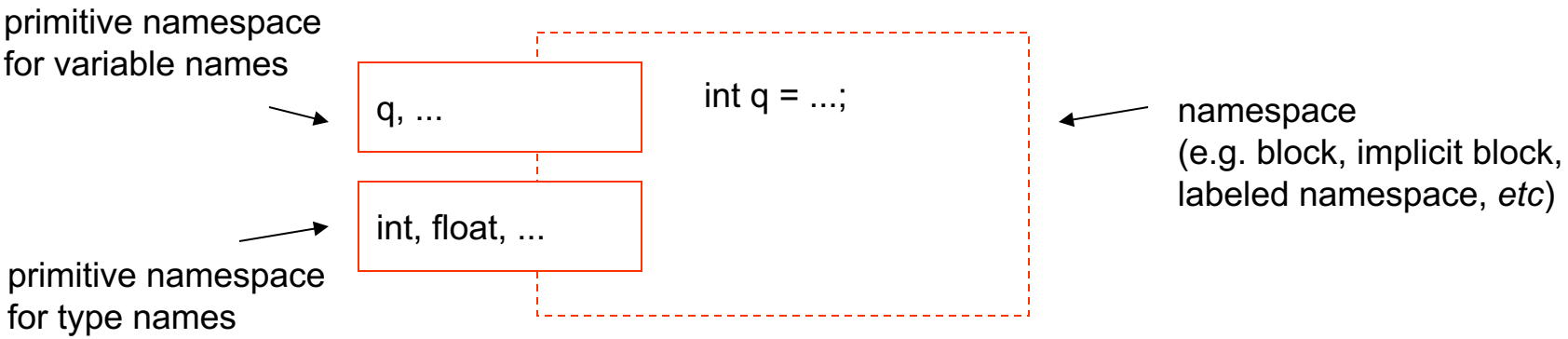
to access definitions in the labeled namespace:



Primitive Namespaces

Def: A primitive namespace is a language construct that contains definitions and delineates a region of the program where those definitions apply; but the region was defined at language design time (similar to primitive data types, you can use them but not define them).

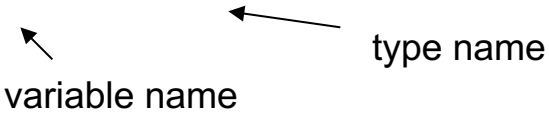
Most modern programming languages define two primitive namespaces – one for user defined variable names and one for type names (both primitive and constructed).



Primitive Namespaces

Example: ML

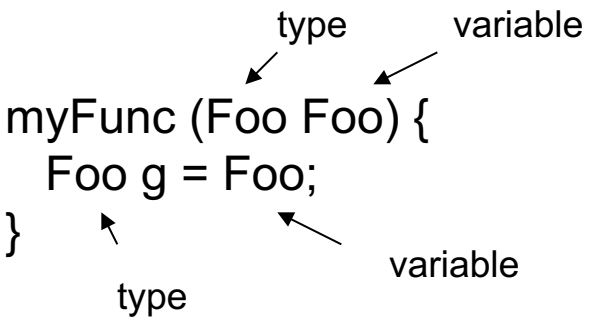
```
- val int = 3;
val int = 3 : int
```



Example: Java

```
class Foo { ... };

myFunc (Foo Foo) {
   Foo g = Foo;
}
```



Observation: Because of the primitive namespaces modern programming languages never get confused about whether a name is a type or a variable – they simply look up the name in the corresponding primitive namespace.