CS180 – More C++

Note Title 8/31/2011

Announcements

- Intro to linux lab today at 4pm
- lab 1 is posted
  (actually, all labs are posted)
- HW1 is posted, due 1 week from Sat.
- Transition guide is posted

door code: 80386

Comparison

Python

```python
def gcd(u, v):
    # we will use Euclid's algorithm
    # for computing the GCD
    while v != 0:
        r = u % v     # compute remainder
        u = v
        v = r
    return u

if __name__ == '__main__':
    a = int(raw_input('First value: '))
    b = int(raw_input('Second value: '))
    print 'gcd:', gcd(a,b)
```

C++

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

int gcd(int u, int v) {
  /* We will use Euclid's algorithm
     for computing the GCD */
  int r;
  while (v != 0) {
    r = u % v;    // compute remainder
    u = v;
    v = r;
  }
  return u;
}

int main( ) {
  int a, b;
  cout << "First value: ";
  cin >> a;
  cout << "Second value: ";
  cin >> b;
  cout << "gcd: " << gcd(a,b) << endl;
  return 0;
}
```

White space

- returns, tabs, etc. are ignored in C++

```
int gcd(int u, int v) { int r; while (v != 0) { r = u % v; u = v; v = r; } return u; }
```

↑ this is not acceptable to submit

(Recall that these were very important in Python)

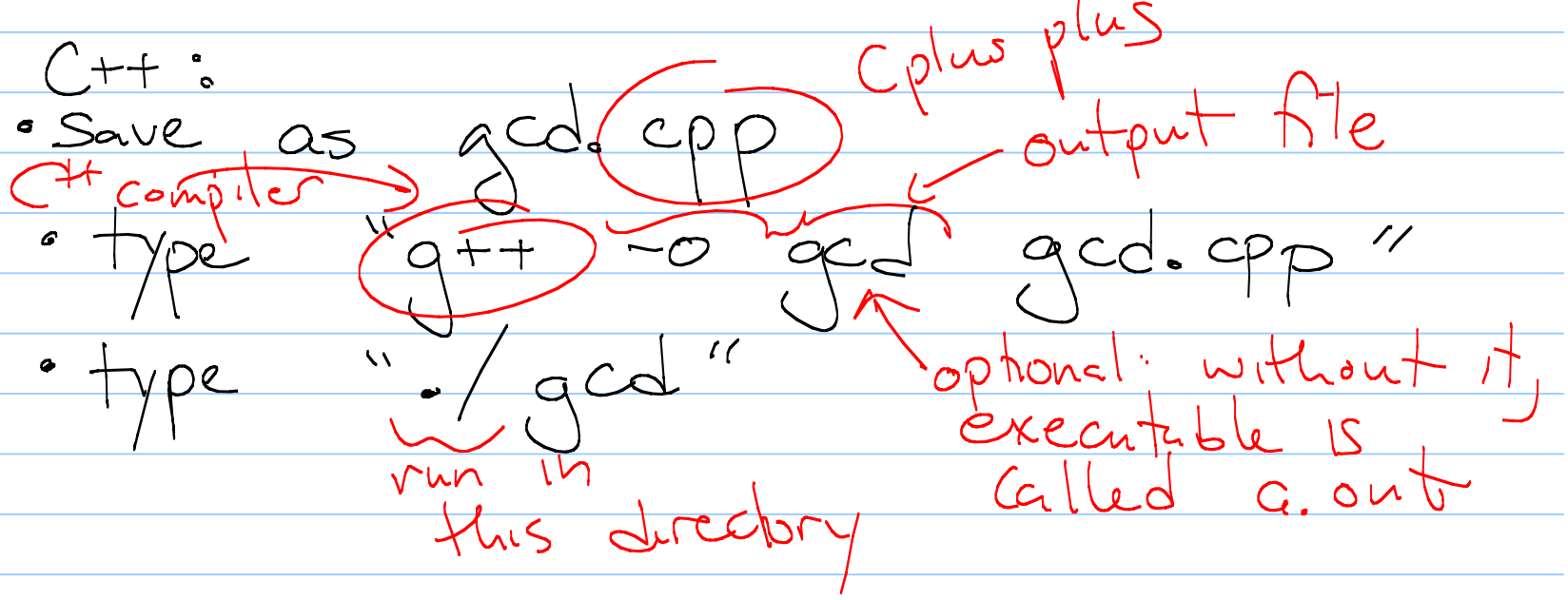
Here, we use () and {} to mark loops, booleans, etc.

Compiling

- In Python, you save code as gcd.py & then type "python gcd.py" to run it.

Later: makefile

- In C++:
  - Save as gcd.cpp
  - type "g++ -o gcd gcd.cpp"
  - type "./gcd"



Data Types

really a #

C++ Type	Description	Literals	Python analog
bool	logical value	**true** **false**	**bool**
short	integer (often 16 bits)		
int	integer (often 32 bits)	39	
long	integer (often 32 or 64 bits)	39L	**int**
——	integer (arbitrary-precision)		**long**
float	floating-point (often 32 bits)	3.14f	
double	floating-point (often 64 bits)	3.14	**float**
char	single character	'a'	
string[a]	character sequence	"Hello"	**str**

numeric

numbers also

← import string

Data Types (cont)

- Ints can also be unsigned: instead of ranging from $-(2^{b-1})$ to $(2^{b-1}-1)$, go from 0 to $2^{(b-1)}$.

- Strings and chars are very different.

Char versus string

```
char a;
a = 'a';
a = 'h';
```

```
string word;
word = "CS 180";
```

Strings are not automatically included.
Standard in most libraries, but need to import.

Strings

cplusplus.com

Syntax	Semantics
s.size( ) s.length( )	Either form returns the number of characters in string s.
s.empty( )	Returns **true** if s is an empty string, **false** otherwise.
s[index]	Returns the character of string s at the given index (unpredictable when index is out of range).
s.at(index)	Returns the character of string s at the given index (throws exception when index is out of range).
s == t	Returns **true** if strings s and t have same contents, **false** otherwise.
s < t	Returns **true** if s is lexicographical less than t, **false** otherwise.
s.compare(t)	Returns a negative value if string s is lexicographical less than string t, zero if equal, and a positive value if s is greater than t.
s.find(pattern) s.find(pattern, pos)	Returns the least index (greater than or equal to index pos, if given), at which pattern begins; returns **string**::npos if not found.
s.rfind(pattern) s.rfind(pattern, pos)	Returns the greatest index (less than or equal to index pos, if given) at which pattern begins; returns **string**::npos if not found.
s.find_first_of(charset) s.find_first_of(charset, pos)	Returns the least index (greater than or equal to index pos, if given) at which a character of the indicated string charset is found; returns **string**::npos if not found.
s.find_last_of(charset) s.find_last_of(charset, pos)	Returns the greatest index (less than or equal to index pos, if given) at which a character of the indicated string charset is found; returns **string**::npos if not found.
s + t	Returns a concatenation of strings s and t.
s.substr(start)	Returns the substring from index start through the end.
s.substr(start, num)	Returns the substring from index start, continuing num characters.
s.c_str( )	Returns a C-style character array representing the same sequence of characters as s.

Mutable versus immutable

Dfn: mutable : you can change it

list

Dfn: immutable : you can't change it

strings in Python

tuples

In C++, everything is mutable.

C++ : Maximum flexibility

Everything is mutable by default!

```
string word;
word = "Hello";
word[0] = 'J';
```

→ word = "Jello"

Creating variables

All variables must be explicitly created and given a type.

```
int number;
int a, b;
int age(35);
int age2(currYear - birthYear);
int age3(21), zipcode(63116);
String greeting("Hello");
```

not `char a, int b;`

Immutable variables

We can force some variables to be immutable — use const:

```
const float gravity(-9.8);
```

Why?

- don't allow changes

Converting between types

Be careful!

```
int a(5);
double b;
b=a;
```

b is 5.0

```
int a;
double b(2.67);
a=b;
```

a = 2

Converting with strings

- Can't go between strings & numeric types at all.

int x = "37";

- But chars will convert to numbers. How?

ASCII

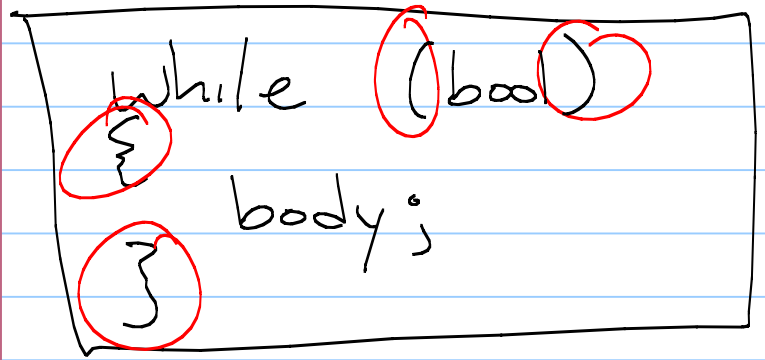
Control Structures

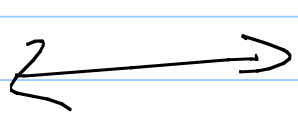
C++ has loops, conditionals, functions, & objects!

Syntax is similar, but just different enough to get into trouble.

(Remember to use your book's index in a pinch!)

While loops





while (bool) {body;}

Notes:

- bool is any boolean expression
- don't need {} if only 1 command in the loop:

```
while (a<b)
    a++;
```

Booleans

Python C++

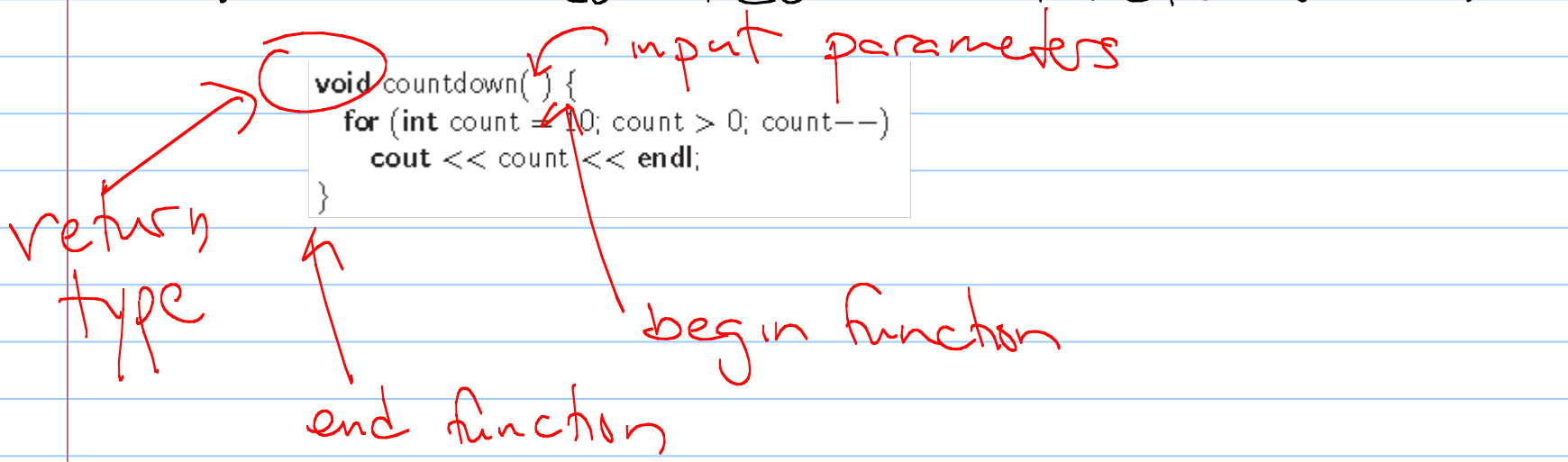
while (!(a==b))

Boolean Operators		
and	&&	logical and
or	||	logical or
not	!	logical negation
a **if** cond **else** b	cond ? a : b	conditional expression

Comparison Operators		
a < b	a < b	less than
a <= b	a <= b	less than or equal to
a > b	a > b	greater than
a >= b	a >= b	greater than or equal to
a == b	a == b	equal
a < b < c	a < b && b < c	chained comparison

Defining a function : example

Remember countdown function from 150?



- Functions go at top, before main.

Optional arguments

```
void countdown(int start=10, int end=1) {
  for (int count = start; count >= end; count--)
    cout << count << endl;
}
```

```
void myfun(int a, int b){
    cout<<a;
}
```

If statements

```
if (bool) {
    body 1;
} else {
    body 2;
}
```

if
if
else

Ex:

```
if (x < 0)
  x = -x;
```

```
if (groceries.length( ) > 15)
  cout << "Go to the grocery store" << endl;
else if (groceries.contains("milk"))
  cout << "Go to the convenience store" << endl;
```

Note: - Don't need brackets if 1 line
- don't need else
- no elif

if —
else if —

Booleans & if/whiles

If & while statements can be written with numeric conditions (which are really booleans).

Ex:
```
if (mistakeCount)
    cout << "Error!" << endl;
```

0 $\Longleftrightarrow$ false

anything else $\hookrightarrow$ true

Try accounts
+ change passwords!

get console
type passwd