CS 161
Intro to CS I

More Programming and Conditional Statements
Odds and Ends...

• Make demo appointment (signup homepage)
• Assignment #2 posted/due next Sunday.
• Recitation quiz (study)
Additional Operators

• Common operation: fetch/store same variable
  var = var + 2;  // increment variable contents
  var = var * 2;  // double variable contents
  – Assignment/operator combination (all ops supported):
    var += 2;
    var *= 2;

• Pre/Post increment/decrement: ++ and –
  – Example: age++ vs. ++age
```cpp
#include <iostream>

using namespace std;

int main() {
    int age = 5;

    cout << age << endl; // This will print 5
    cout << "post: " << age++ << endl; // Print age before incrementing, 5
    cout << age << endl; // However, 6 is stored in age after ++ from above
    cout << "pre: " << ++age << endl; // Increment age before printing, 7
    cout << age << endl; // Age is 7 after ++ from above

    // Undefined behaviour left up to compiler
    // You would expect 8 8, and age would be 9 afterward
    // g++ and clang++ give different answers
    cout << ++age << " " << age++ << endl;

    return 0;
}
```
5
post: 5
pre: 7
7
7
flip1 ~/cs161/private 156% clang++ conditionals.cpp
conditionals.cpp:17:12: warning: multiple unsequenced modifications to 'age'
   [-Wunsequenced]
   cout << ++age << " " << age++ << endl;
^ ~ ~
1 warning generated.
flip1 ~/cs161/private 157% a.out
5
post: 5
pre: 7
7
8
8
flip1 ~/cs161/private 158% g++ conditionals.cpp -Wall
conditionals.cpp: In function ‘int main()’:
conditionals.cpp:17:42: warning: operation on ‘age’ may be undefined [-Wsequence]
   cout << ++age << " " << age++ << endl;
   ^ ~ ~
flip1 ~/cs161/private 159%
Decisions in Life

• What is a decision?
• When do we make decisions?
• How do we make decisions?
  If it is sunny today
    then I’ll go to the beach and fly a kite
  Else if it is raining today
    then I’ll stay inside and read a book
  Else if it is snowing
    then I’ll go to the mountains to ski
Decisions within Decisions

- What happens if there is no wind at the beach?
- How does this change our decisions?
  - If it is sunny today
    - then I’ll go to the beach
      - if it is windy at the beach
        - then I’ll fly a kite
        - if it is not windy at the beach
          - then I’ll walk on the shore
Flow chart for decisions

Start

Is it sunny? Yes → Go to beach
No → Is it raining?

Yes → Read book
No → Walk on beach

Is it windy? Yes → Fly kite
No → Go outside
Decisions in our programs

- Use an if/else

  ```java
  if (<expression>) {
    <statement>
    ...
    <statement>
  }
  else {
    <statement>
    ...
    <statement>
  }
  ```
What is the <expression>?

Could be a relational expression:

<expression> <relational op> <expression>

• Relational Ops
  
  == - equal to
  != - not equal to
  < - less than
  > - greater than
  <= - less than or equal to
  >= - greater than or equal to
Examples

• if(2 + 1)
• if(2 - 4)
• if(2 - 2)
• if(4 == 4)
• if((2+1) == 4)
• if(4.1 != 4)
• if(3 <= 4)
• if(4 >= 4)
• if(3.5 > 4)
• if(4 < 4)
• if(3+2*2 > 9)
• if((3+2)*2 > 9)
Logical Operators

• AND: if((1>2) && (2<5))
• OR: if((1>2) || (2<5))
• NOT: if(!(1>2) && (2<5))

C++ If/Else Syntax...

```cpp
int x = 2, y = 3;
if( x > y) {
    std::cout << "X is greater than Y\n";
}
else {
    std::cout << "X is less than Y\n";
}
```

• When does this logic fail?
C++ If/Else...

```cpp
if (x > y) {
    std::cout << "X is greater than Y\n";
}
else if (x < y) {
    std::cout << "X is less than Y\n";
}
else {
    std::cout << "X is equal to Y\n";
}
```