Conditional Execution

• many problems require executing statements only in some circumstances
e.g. read two integers and print largest one
• sometimes called **control flow**, **branching** or **conditional execution**
• The C if Statement can do this.

### The if Statement

```c
if (expression) {
    statement1;
    statement2;
    ....
}
```

• **statement1, statement2, ...** are executed if **expression** is non-zero.
• **statement1, statement2, ...** are NOT executed if **expression** is zero.
• There is no “boolean” type in C.
  0 is regarded as “FALSE”
  anything non-zero is regarded as “TRUE”

### The else keyword

```c
if (expression) {
    statement1;
    statement2;
    ....
} else {
    statement3;
    statement4;
    ....
}
```

• **statement1, statement2, ...** are executed if **expression** is non-zero.
• **statement3, statement4, ...** are executed if **expression** is zero.

### The if Statement

Multiple if statements can be chained together:

```c
int a, b;

printf("Please enter two numbers, a and b: ");
scanf("%d %d", &a, &b);

if (a > b) {
    printf("a is greater than b\n");
} else if (a < b) {
    printf("a is less than b\n");
} else {
    printf("a is equal to b\n");
}
```
Relational Operators

C has the usual operators to compare numbers:

- `>` greater than
- `>=` greater than or equal to
- `<` less than
- `<=` less than or equal to
- `!=` not equal to
- `==` equal to

- Be careful comparing doubles for equality using `==` or `!=`
- Remember doubles are approximations.

Logical Operators

- C has logical operators: `&&` `||` `!`
- Logical operators allow us to combine comparisons, eg:
  
  - `mark > 0 && mark < 100`

- Logical operators return:
  
  - the int 0 for false
  - the int 1 for true

- `&&` is the and operator - true if both operands are true
  
  - `2 > 0 && 2 < 10` `⇒` 1

- `||` is the or operator - true if either operand is true
  
  - `24 > 42 || 2 < 10` `⇒` 1

- `!` is the not operator - true iff its operands is false
  
  - `(24 > 42)` `⇒` `!0` `⇒` 1

Logical Operators - Conditional evaluation

- The C operator `&&` `||` have a useful property.
- They always evaluate their left-hand side first.
- They only evaluate their right-hand side if needed.
- `&&` will not evaluate right-hand side if left-hand side is false (zero).
- `||` will not evaluate right-hand side if left-hand side is true (non-zero).
- For example we can write
  
  - `x != 0 && y/x > 2`

  without risking division by zero.
Unary Negation operator

The unary negation operator converts a non-zero operand into 0 and 0 into 1. For example,

```c
if (!(height <= 130 && width <= 240)) {
    printf("Envelope too large!\n");
}
```

.. is the same as..

```c
if (height > 130 || width > 240) {
    printf("Envelope too large!\n");
}
```