

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

```
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

```
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:

```
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.

Relational Operators

- Many languages have a separate type for true & false.
- C just uses numbers.
- C convention is zero is false, other numbers true.
- relational operators return:
the int **0** for false
the int **1** for true
- For example:
 - $5 > 4 \mapsto 1$
 - $5 \geq 4 \mapsto 1$
 - $5 < 4 \mapsto 0$
 - $5 \leq 4 \mapsto 0$
 - $5 \neq 4 \mapsto 1$
 - $5 == 4 \mapsto 0$

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
 $2 > 0 \ \&\& \ 2 < 10 \mapsto 1 \ \&\& \ 1 \mapsto 1$
- `||` is the **or** operator - true if either operand is true
 $24 > 42 \ || \ 2 < 10 \mapsto 0 \ || \ 1 \mapsto 1$
- `!` is the **not** operator - true iff its operands is false
 $!(24 > 42) \mapsto !0 \mapsto 1$

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,

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

.. is the same as ..

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