C introduction

Control structures

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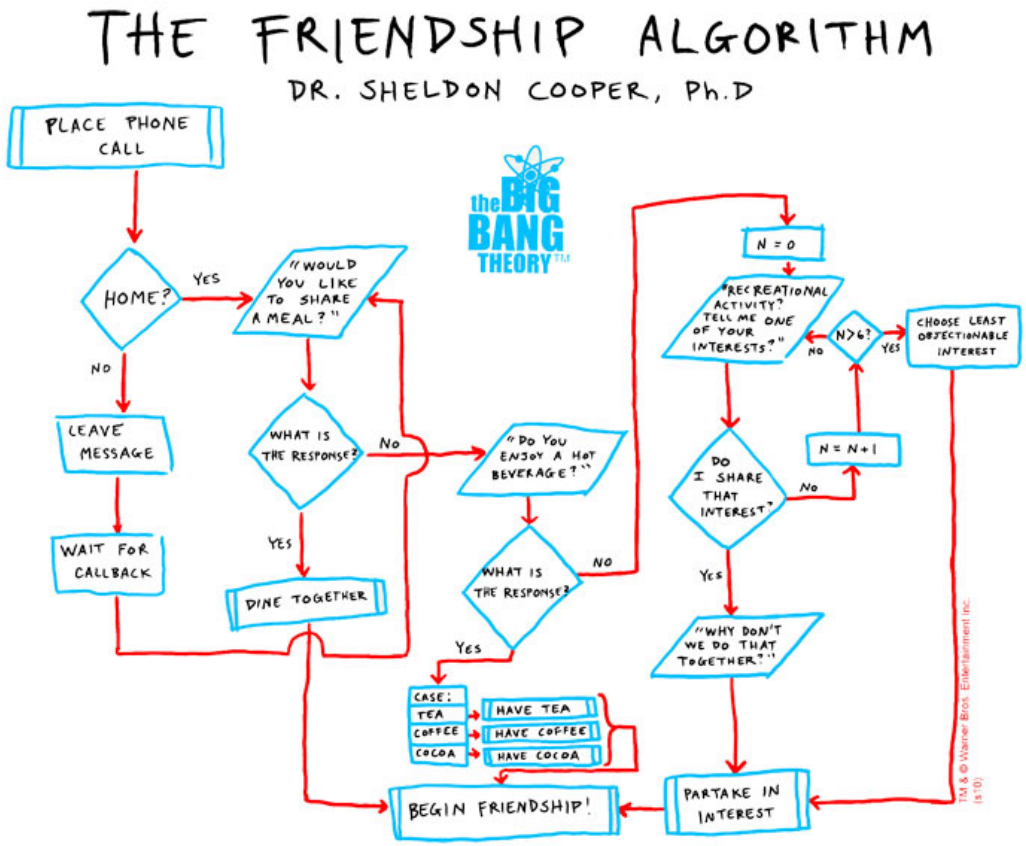
Even though C is a sequential programming language, the program flow can branch. Use conditions to determine the behaviour of your program.



The truth about expressions

Expressions can also be evaluated to truth values.
If a value or a variable equals 0, its corresponding truth value is *false*.
Otherwise it's *true*.
The representations of *false* and *true* are 0 and 1.
An expression containing relational operators gets evaluated to such a truth value.

Relational operators:

- $<$, $>$, $<=$, $>=$
- $==$ for "equal to"
- $!=$ for "not equal to"

Do not get confused

Imagine the following

```
(5 < 7) == 1;    /* evaluated to 1 */
```

Why?

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Why?

- $(5 < 7)$ is **true** $\rightarrow$ **1**
- $1 == 1$ is **true** $\rightarrow$ **1**

A sign meant...

Assignments are expressions that get evaluated and have a truth value, too. Consider:

```
c = 0;                  /* 0 -> false */
c = 2 * 5;              /* 2 * 5 = 10,   c = 10, true */
c = (0 < 1);            /* 0 < 1 = true, c = 1,  true */

a = (b == (c = d)); /* Wat? */
```

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c++ expressions are evaluated before the increment while *++c* increments first (the same applies on *c−−* and *−−c*):

```
int c = 42;
int a = c++;    /* evaluates to c,     a is 42, c is 43 */
int b = ++c;    /* evaluates to c + 1, b is 44, c is 44 */
```

Boolean arithmetic

Truth values can be connected by boolean operators resulting in a new truth value.

- && for AND (results in **1** if both operands are true, else **0**)
- || for OR (results in **1** if at least one operator is true, else **0**)
- ! for NOT (results in **1** if the operand is false, else **0**)

Precedence order:

$$! \ > \ \&\& \ > \ ||$$

Seems logical

- How do you get NAND, NOR and XOR?

Seems logical

- How do you get NAND, NOR and XOR?

```
int a, b;
...
!(a && b);   /* NAND */
!(a || b);   /* NOR */
a != b;      /* XOR */
(a == a) != (b == b);    /* safe XOR */
```

if...else

To make decisions during run time, you can use the truth value of an expression:

```
if (condition)
    statement1;
else
    statement2;
```

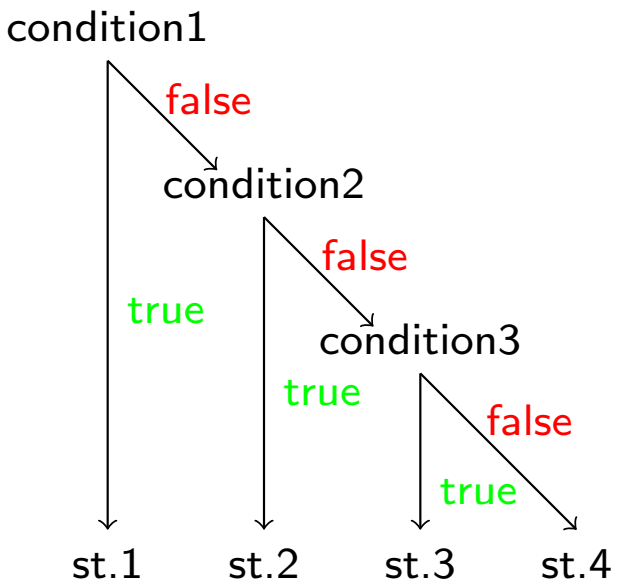
Now **statement1** is only executed if the truth value of **condition** is *true*. Otherwise **statement2** is executed. The *else* part is optional.

For multiple statements in the *if* or *else body*, use braces:

```
if (condition) {
    statement1;
    statement2;
}
```

else if

To differentiate between more than two cases, you can use the if condition as a statement in the else body:




```
if (condition1)
    statement1;
else if (condition2)
    statement2;
else if (condition3)
    statement3;
else
    statement4;
```

switch

If you have to check one variable for many constant values, *switch case* is your friend:

```
switch (variable) {
    case option1: statement1; break;
    case option2: statement2; break;
    case option3: statement3; break;
    default: statement4; break;
}
```

- *case option* defines a jump label
- More than one statement after it possible without braces
- All statements until the next *break;* will be executed

A few words on style

- Typing **if (cond)** instead of **if(cond)** helps people to differentiate between control structures and function calls faster
- When starting a new block, you should type) { rather than){
- Do not start a new block for a single statement
- Do not put statements and conditions on the same line

```
if(cond){ statement; }   /* bad style */

if (cond) {              /* looks better, still bad style */
    statement;
}

if (cond)
    statement;           /* looks way clearer */
```

More words on style

- if you use a block anywhere in an **if ... else** structure, put all blocks of this structure in braces

```
if (cond)          /* bad style, inconsistent */
    statement;
else {
    statement;
    statement;
}

if (cond) {        /* way better style */
    statement;
} else {
    statement;
    statement;
}
```