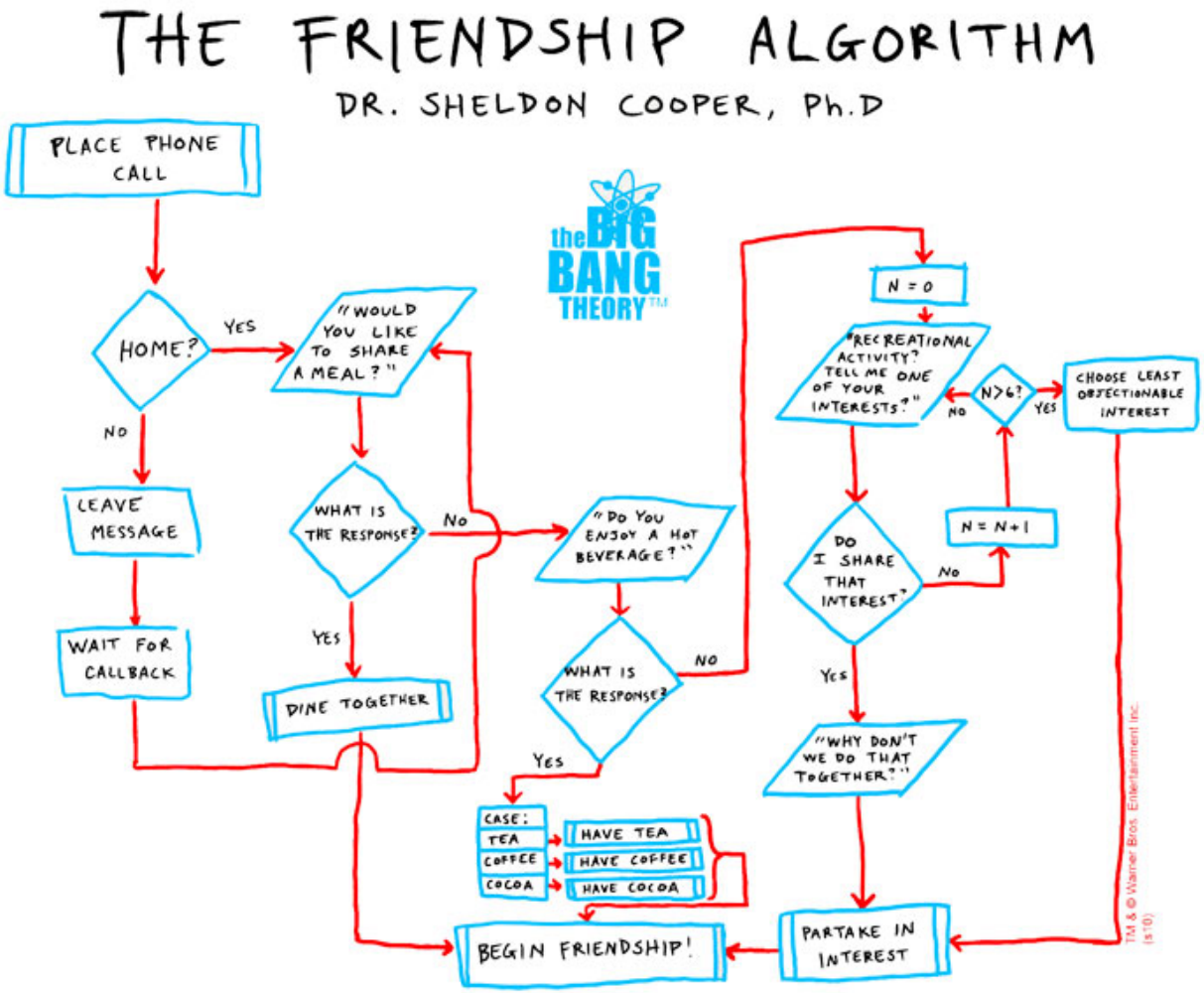
C introduction

Control structures 2

Contents



Take a look at the right part. It is executed up to seven times.

Loops

To repeat statements as long as a certain condition is met, C offers 3 different loops.

```
while (condition)
    statement;
```

```
do
    statement;
while (condition);
```

```
for (initialization; condition; statement)
    statement;
```

For multiple statements again, use braces.

while

The execution of a loop is a continuous alternation between checking if the condition is still met and executing the statement(s).

```
1 int i = 2;
2 while (i > 0)
3     --i;
4 printf("done\n");
```

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1. Check (i $>$ 0) $\rightarrow$ true $\rightarrow$ go to line 3
2. Decrement i $\rightarrow$ i now is 1, go back to line 2
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1. Check (i $>$ 0) $\rightarrow$ true $\rightarrow$ go to line 3
2. Decrement i $\rightarrow$ i now is 1, go back to line 2
3. Check (i $>$ 0) $\rightarrow$ true $\rightarrow$ go to line 3
4. Decrement i $\rightarrow$ i now is 0, go back to line 2

while

The execution of a loop is a continuous alternation between checking if the condition is still met and executing the statement(s).

```
1 int i = 2;
2 while (i > 0)
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```

1. Check (i $>$ 0) $\rightarrow$ true $\rightarrow$ go to line 3
2. Decrement i $\rightarrow$ i now is 1, go back to line 2
3. Check (i $>$ 0) $\rightarrow$ true $\rightarrow$ go to line 3
4. Decrement i $\rightarrow$ i now is 0, go back to line 2
5. Check (i $>$ 0) $\rightarrow$ false $\rightarrow$ go to line 4

while

The execution of a loop is a continuous alternation between checking if the condition is still met and executing the statement(s).

```
1 int i = 2;
2 while (i > 0)
3     --i;
4 printf("done\n");
```

1. Check (i $>$ 0) $\rightarrow$ true $\rightarrow$ go to line 3
2. Decrement i $\rightarrow$ i now is 1, go back to line 2
3. Check (i $>$ 0) $\rightarrow$ true $\rightarrow$ go to line 3
4. Decrement i $\rightarrow$ i now is 0, go back to line 2
5. Check (i $>$ 0) $\rightarrow$ false $\rightarrow$ go to line 4
6. Print done

do...while

The difference between *do...while* and *while* is the order of executing the statement(s) and checking the condition.

The *while* loop begins with checking, while the *do...while* loop begins with executing the statement(s).

```
int i = 3;
do
    --i;
while (i < 1);
```

The Statement(s) in a *do ... while* loop are executed at least once.

for

The For-Loop is comfortable for iterating. It takes three arguments.

- Initialization
- Condition
- Iteration statement

For illustration, consider a program printing the numbers 1 to 10:

```
int i;
for (i = 1; i <= 10; ++i)
    printf("%d\n", i);
```

- *i* is called an *index* iterating from the given start to a given end value
- *i, j, k* are commonly used identifiers for the index

Meanwhile...

Be careful, this

```
while (1 > 0)
    printf("Did you miss me?\n");
```

runs till the end of all days.

∞ loops are common mistakes, and you will experience many of them. Check for conditions that are always true.

for ever

The arguments for the *for loop* are optional. E.g. if you already have defined your iterating variable:

```
int i = 1;
for (; i <= 10; ++i)
    printf("%d\n", i);
```

Or if you have the iteration statement in your loop body:

```
for (i = 1; i <= 10;)
    printf("%d\n", ++i);     /* seems more like a while loop
    */
```

And if you're not passing anything, it runs forever:

```
for (;;)
    printf("I'm still here\n");
```

Note: the semicolons are still there.

Cancelling loops

break

- Ends loop execution
- Moves forward to first statement after loop

continue

- Ends current loop iteration
- Moves forward to next step of loop iteration
  - *while:* Jumps to condition
  - *for:* Jumps to iteration statement

Saving code lines

You can define variables inside the initialization part of a for loop.

```
for (int i = 1; i <= 10; ++i)
    printf("%d\n", i);
```

In that case, the variable is only available inside the for loop (as if it was declared in the body).

```
1 int guess = 0;
2 int solution = 42;
3 for (int i = 1; guess != solution; ++i)
4     scanf("%d", &guess);
5 printf("Tries: %d\n", i);    /* invalid! */
```

This feature was added in the C99 standard.

Compiler options

When calling *gcc*, you can pass several options to it:

option	description
-std=c99	Use C99 as the standard
-o <name>	output file is *name* instead of *a.out*
-Wall	Enable all compiler warnings
-Wextra	Enable even more compiler warnings
-Werror	Treat warnings as errors

Example:

```
$ gcc -std=c99 -o main main.c
```

A few words on style

- Stay consistent after deciding whether to use or not to use braces on a single statement
- If you skip the loop body
  - Leave a comment in your code
  - Use an extra line for the empty statement

```
for (i = 1; i < 9; printf("%d\n", ++i));     /* confusing */

for (i = 1; i < 9; printf("%d\n", ++i))      /* clear */
    ;   /* do nothing */
```