# Mr C is getting dizzy

ESC101: Fundamentals of Computing

Purushottam Kar

# Lab Exam (Sun, 09 Sep)

- Morning exam (Wed, Thu batches)
  - 10:30 AM - 1:30 PM – starts 10:30 AM sharp
  - **CC-01**: B9, {B14 even roll numbers}
  - **CC-02**: B7, B10, B11
  - **CC-03**: B12
  - **MATH-LINUX**: B8, {B14 odd roll numbers}
- Go see your room during this week's lab
- Be there 15 minutes before your exam 10:15AM
- Cannot switch to afternoon session

# Lab Exam (Sun, 09 Sep)

- Afternoon exam (Mon, Tue batches)
  - 2 PM - 5 PM – starts 2 PM sharp
  - **CC-01**: B1, {B2 even roll numbers}
  - **CC-02**: B4, B5, B6
  - **CC-03**: B3
  - **MATH-LINUX**: B13, {B2 odd roll numbers}
- Go see your room during this week's lab
- Be there 15 minutes before your exam 1:45 PM
- Cannot switch to morning session

# Lab Exam (Sun, 09 Sep)

- Syllabus – till loops (no arrays)
- Exam will be like labs
- Marks for passing test cases
- Marks for writing clean indented code, proper variable names, a few comments on what steps are being performed
- Illegible code passing all test cases may get only a fraction of total marks

# Advanced Track

- Offers will be made tonight – based on performance in labs in week 2-5, minor quiz in week 2-4 and major quiz
- No bonus questions counted in deciding AT offers – will be counted when computing final grade
- Students will have 2-3 days to either agree to switch or decline the offer
- Staying silent will mean declining offer

# The for loop




भारतीय प्रौद्योगिकी संस्थान कानपुर
INDIAN INSTITUTE OF TECHNOLOGY KANPUR

# The for loop



## General form of a for loop

# The for loop



General form of a for loop

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for(init_expr; stopping_expr; update_expr){
    statement1;
    statement2;
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statement3;
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**How we usually speak to a human**

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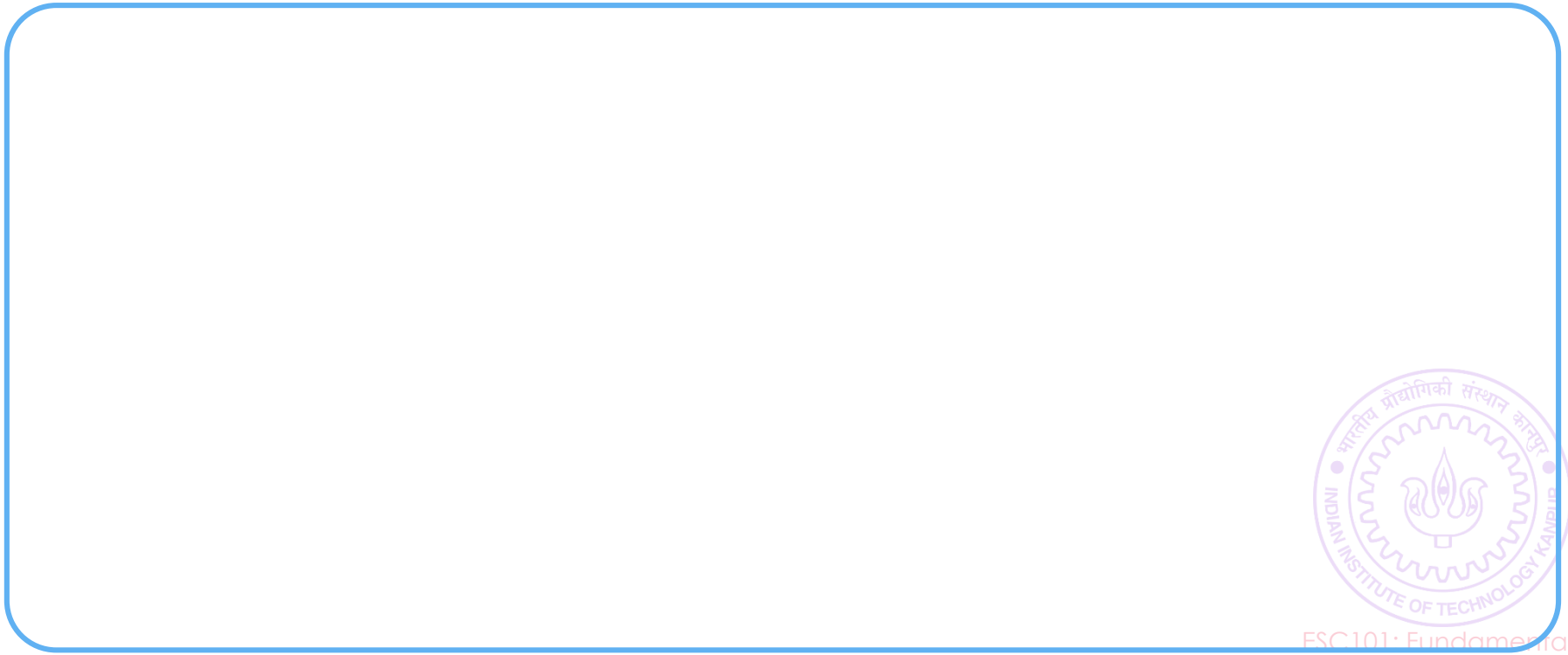

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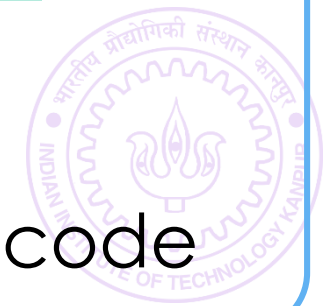

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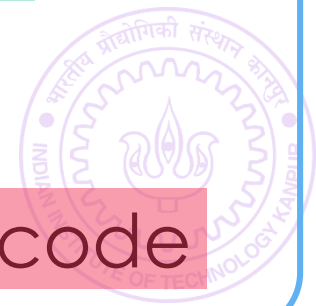

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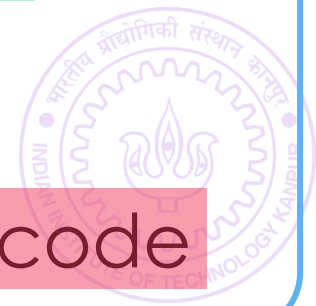

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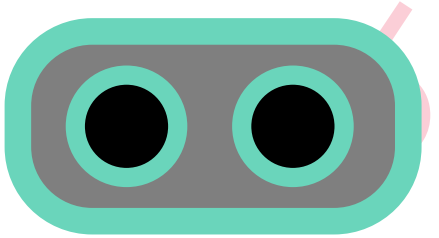

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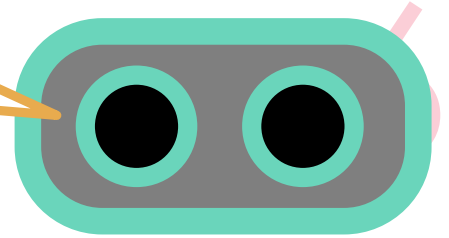
Brackets essential if you want me to do many things while looping



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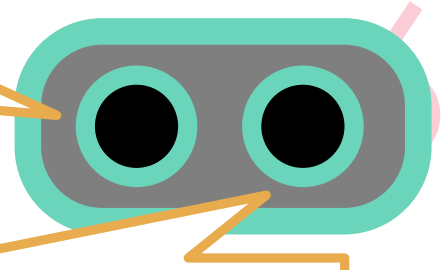

Each time I execute the statements inside the braces – called one *iteration* of the loop

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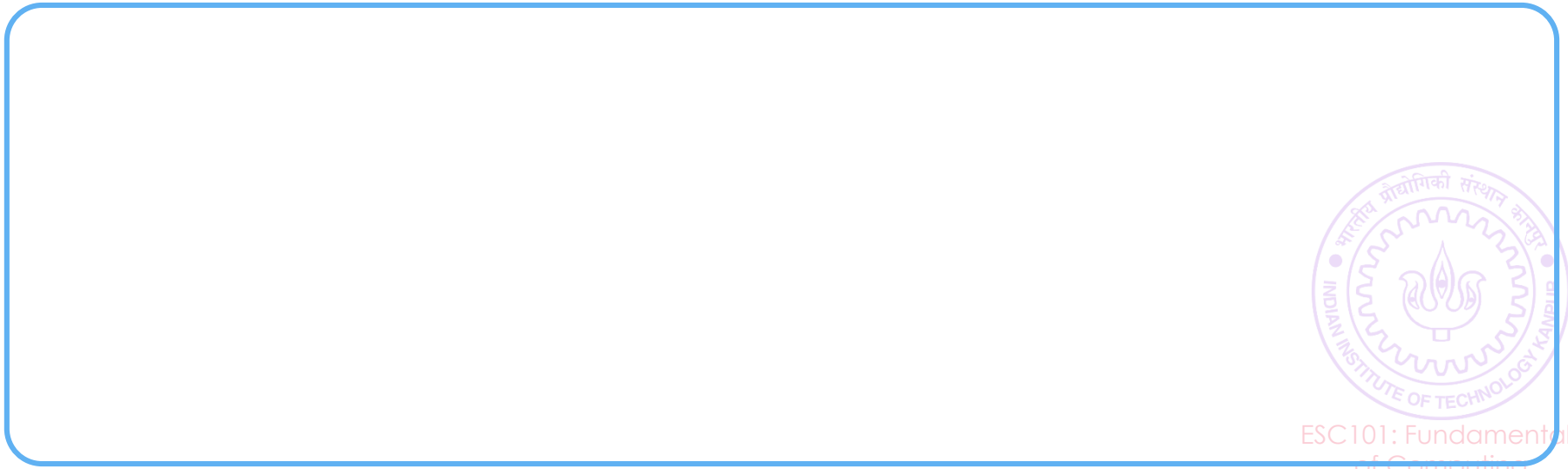

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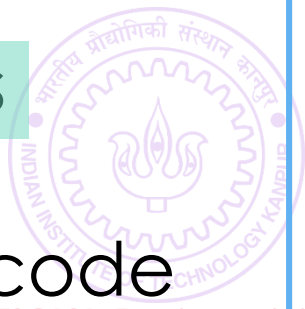

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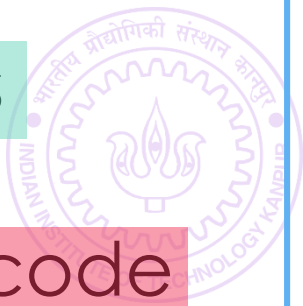

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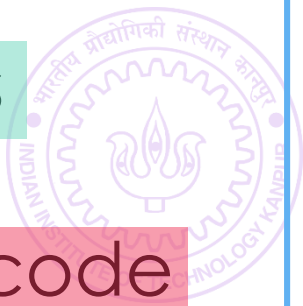

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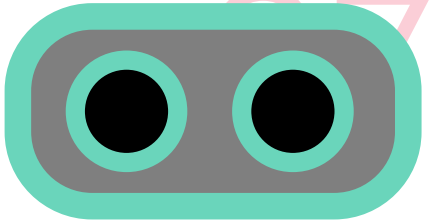

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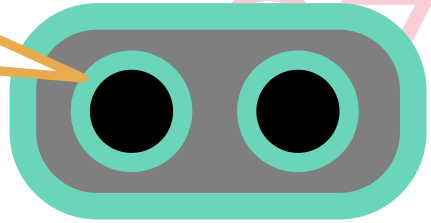

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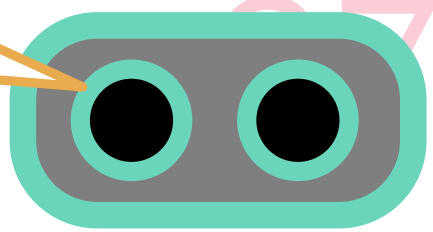

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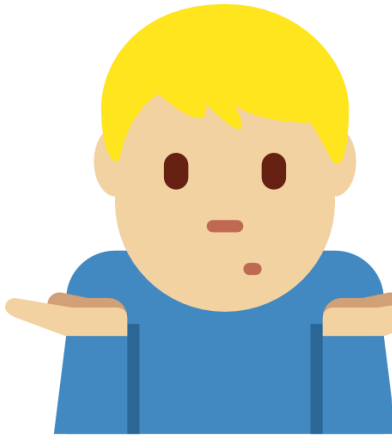

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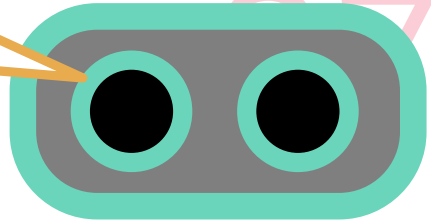
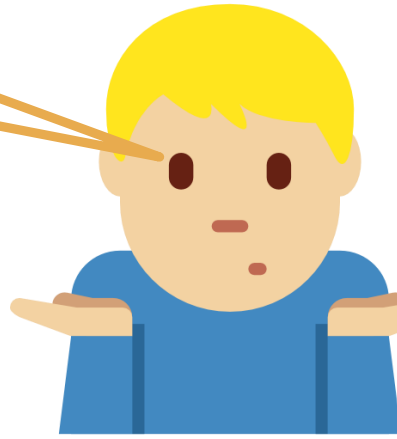


So what is the difference between for and while?



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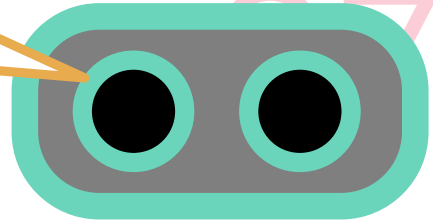

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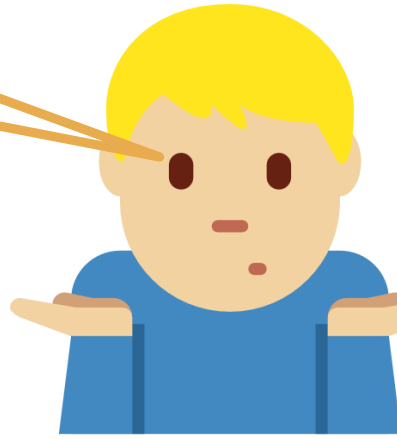

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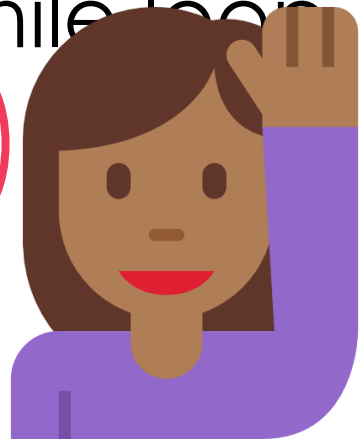

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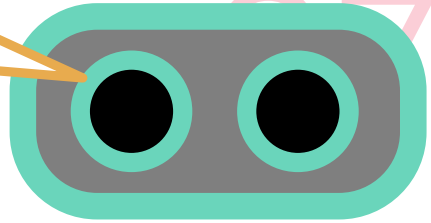

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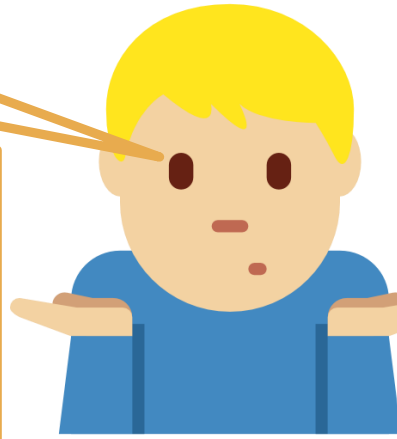

In general not much – it is a matter of style. Use while when you don't know how many iterations will loop run

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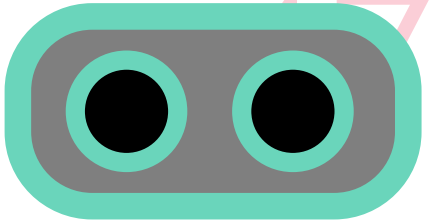

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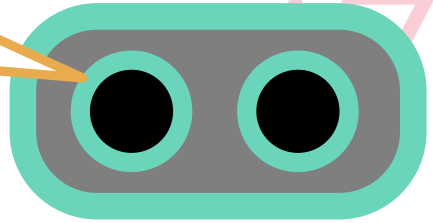
Brackets essential if you want me to do many things while looping



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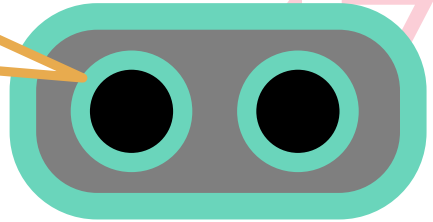

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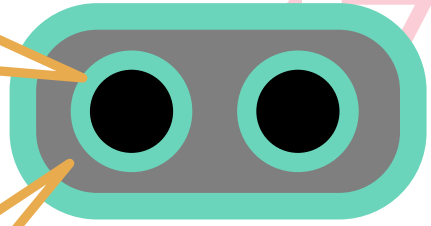

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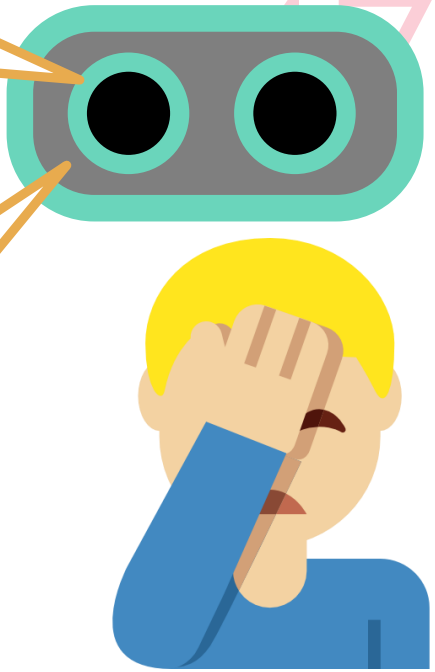

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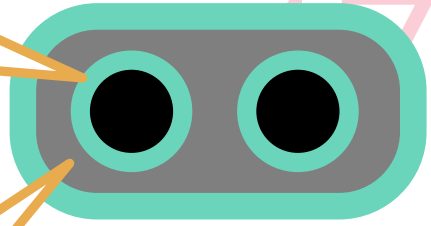

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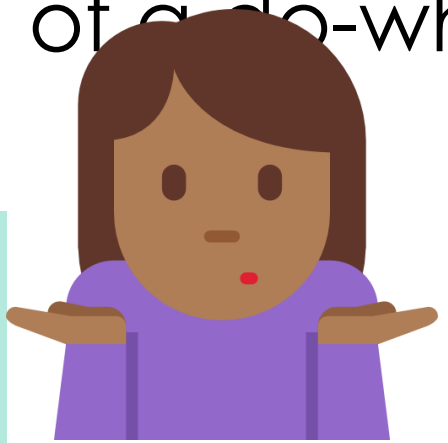

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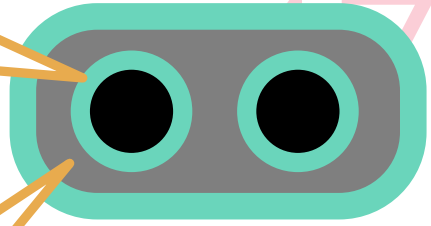

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When to use do-while instead of while?

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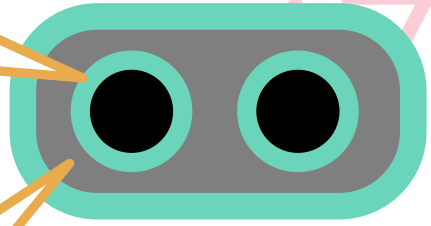

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# The use of do-while

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The do-while loop is executed at least once

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Recall: *read integers till you read the number -1and …*

# The use of do-while



The do-while loop is executed at least once

Recall: *read integers till you read the number -1and …*

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int num, sum = 0;
scanf(“%d”, &num);
while(num != -1){
    sum += num;
    scanf(“%d”, &num);
}
printf("%d",sum);
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# The use of do-while



The do-while loop is executed at least once

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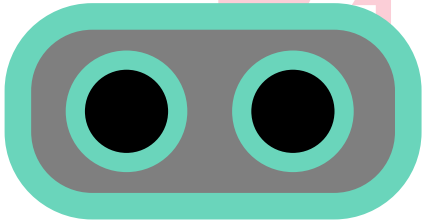

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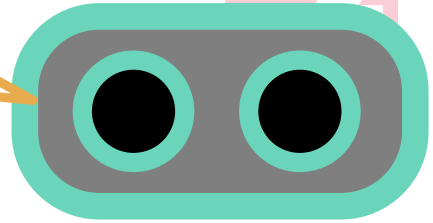

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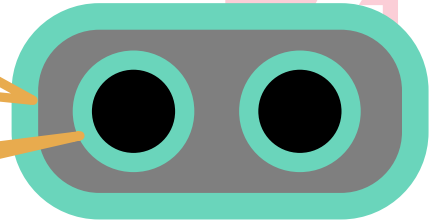

The do-while loop is e

while and do-while equally powerful, sometimes one looks prettier, easier to read than the other

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Take a positive integer n and print the pattern

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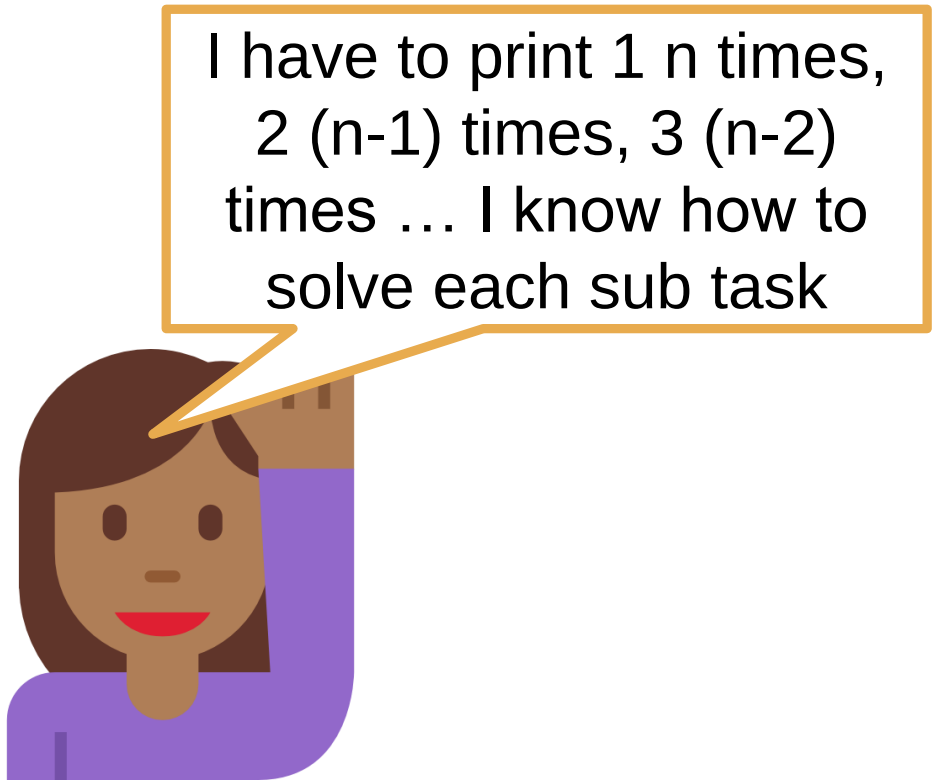

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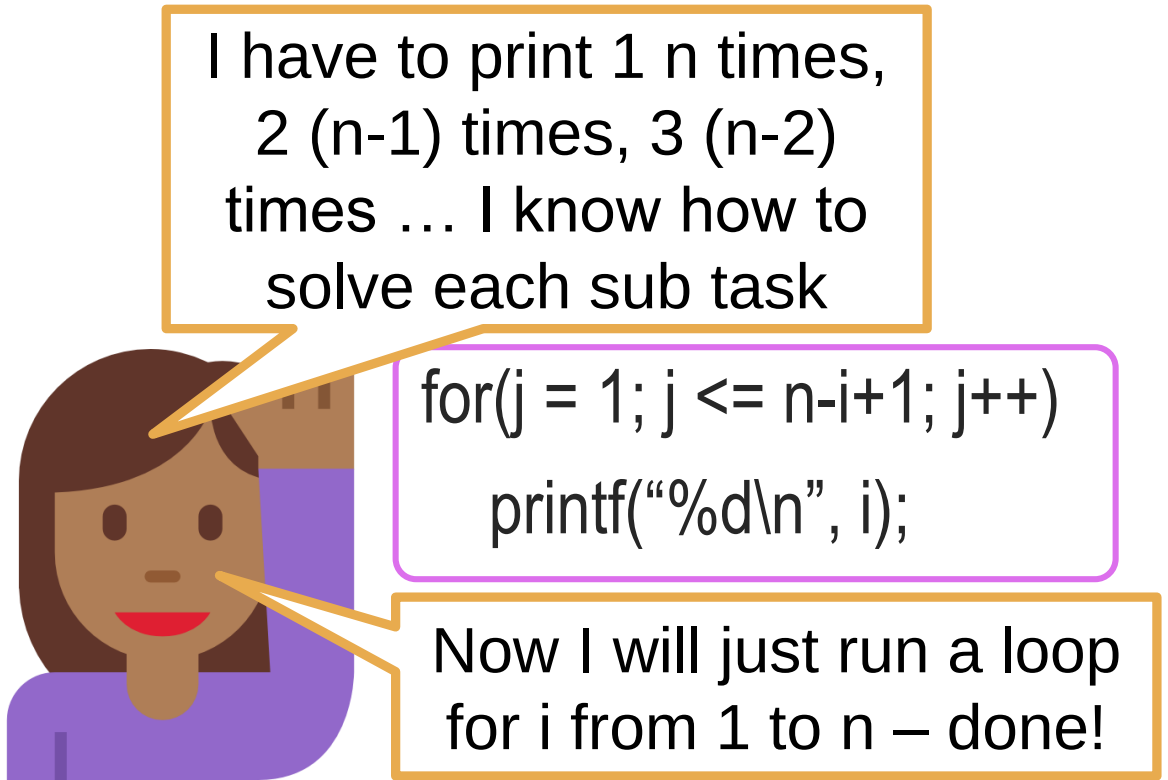

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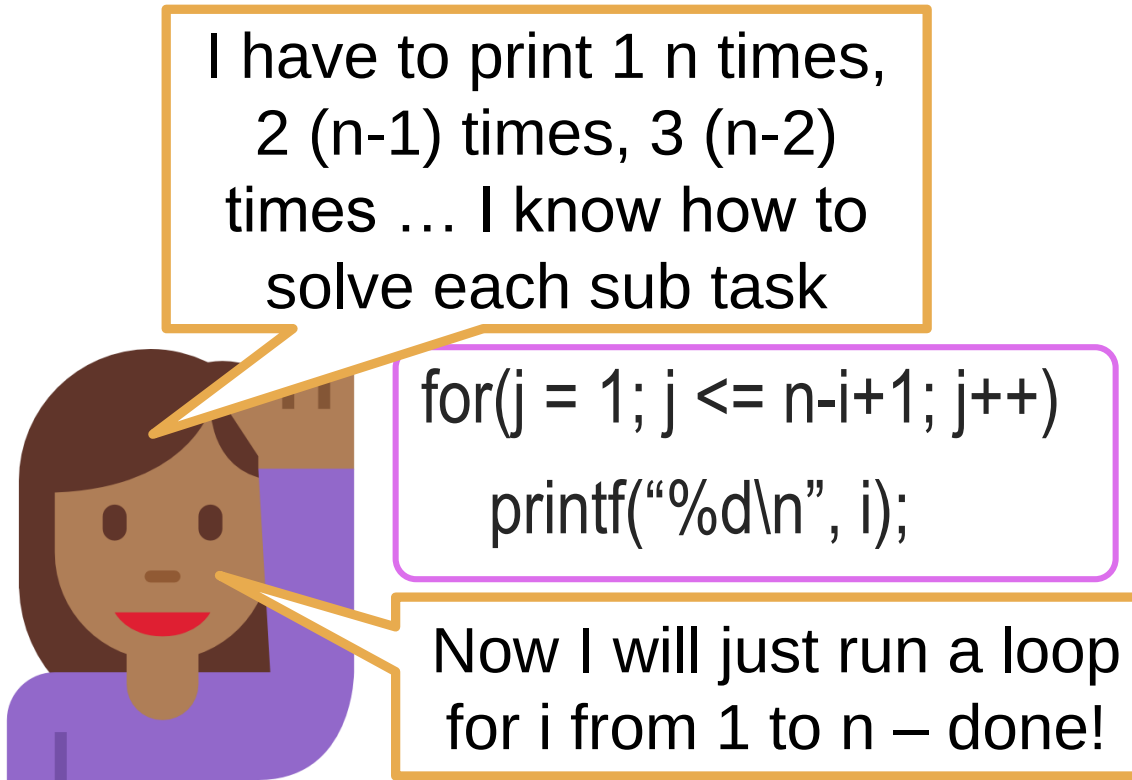


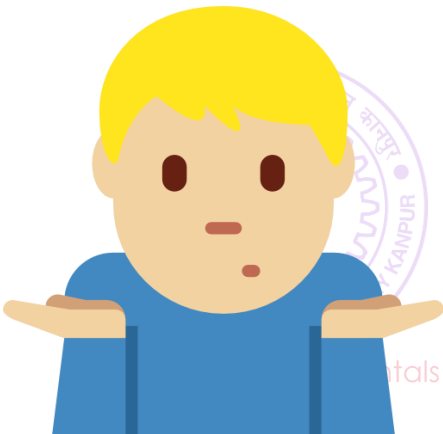

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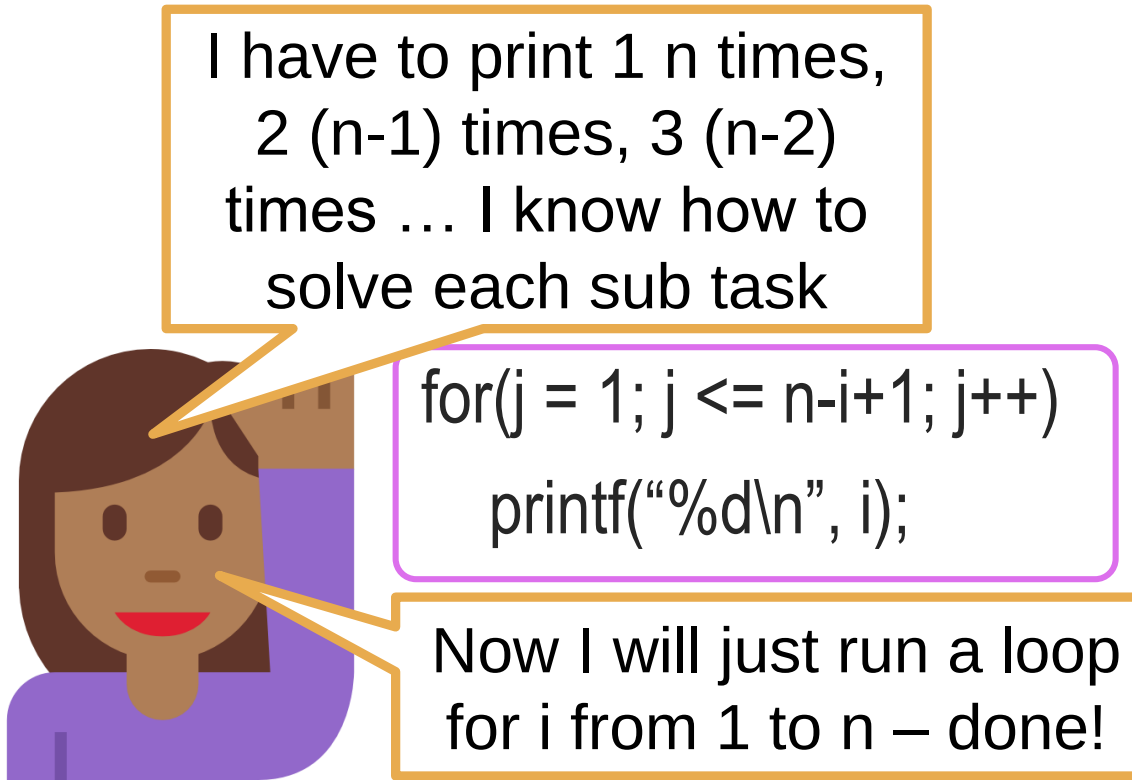


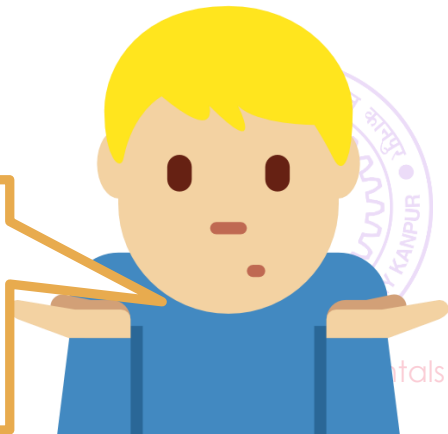

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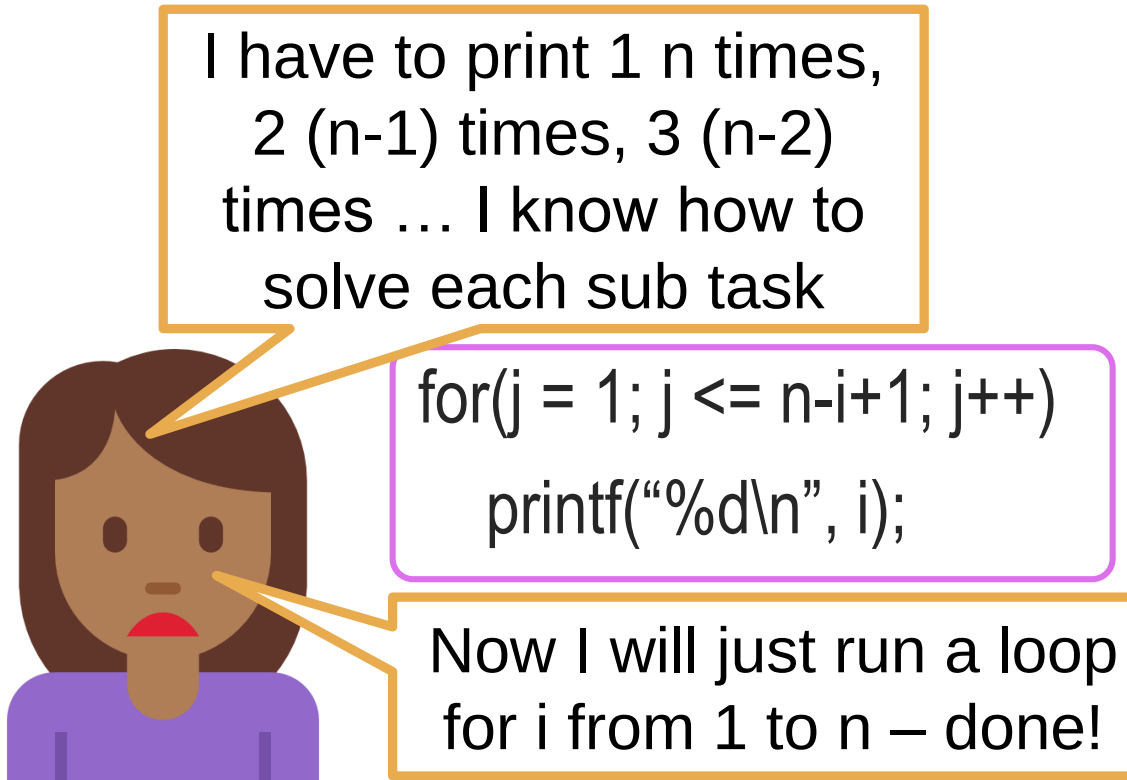


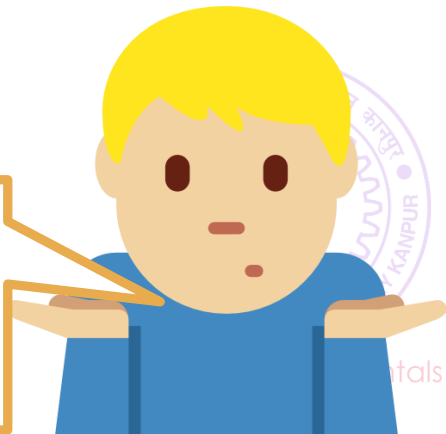

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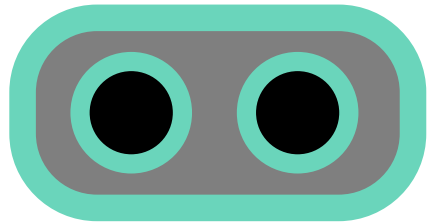

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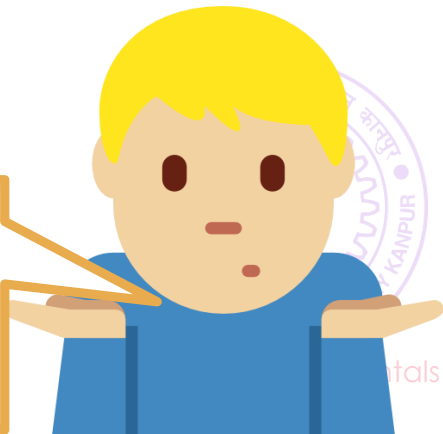

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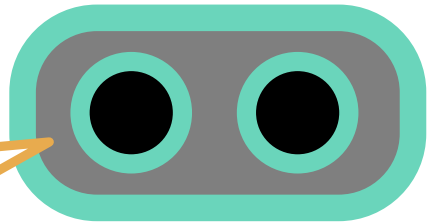

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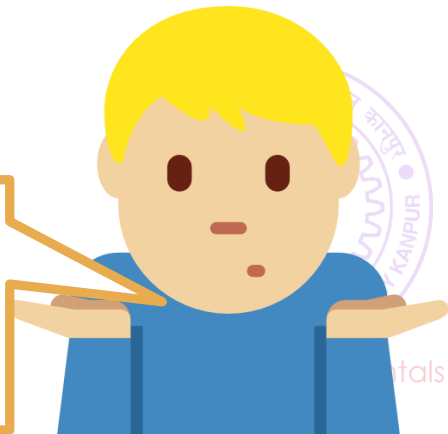

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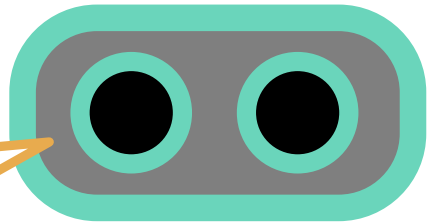

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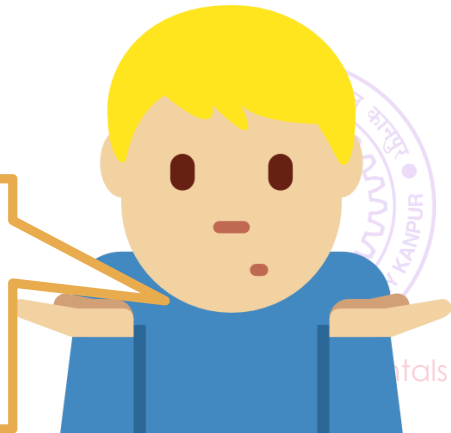

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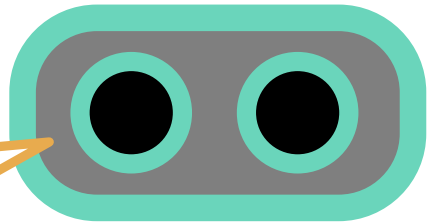


I have to print 1 n times, 2 (n-1) times, 3 (n-2) times … I know how to solve each sub task

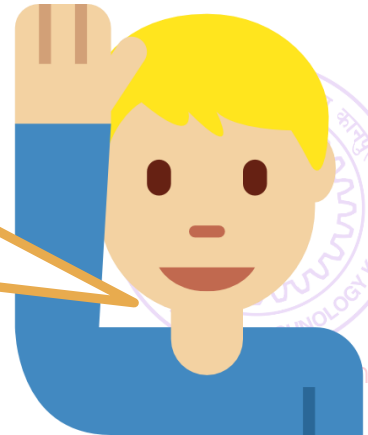
Better way to break up into smaller tasks: I have to print n lines. On line i, need to print digits 1 2 3 … i

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

```
for(j = 1; j <= i; j++)
    printf("%d ", j);
```

Now I will just run a loop for i from 1 to n – done!

Once you have printed all the 1, how will you go back to previous line to start printing 2?



# More tips on using loops

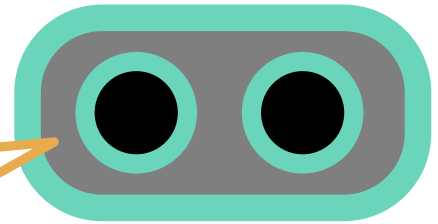


1
1 2
1 2 3
1 2 3 4
...
1 2 3 4 ... n

Take a positive integer n and print the pattern

Step 1: break up task into smaller tasks that are very similar and have to be repeated

May exist more than one way to do so – an art!



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Take care of trailing spaces ☺

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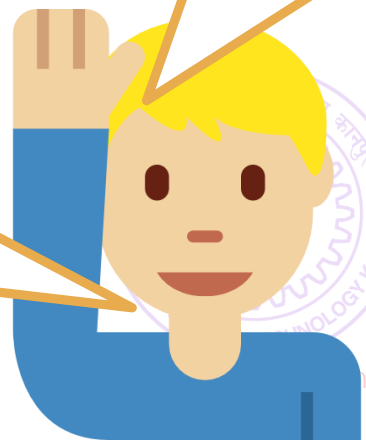

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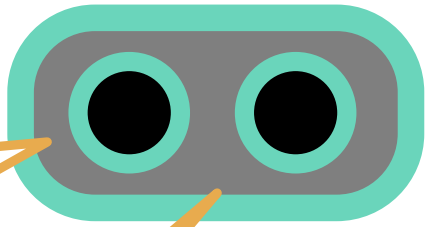

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for(j = 1; j <= i; j++)
    printf("%d ", j);
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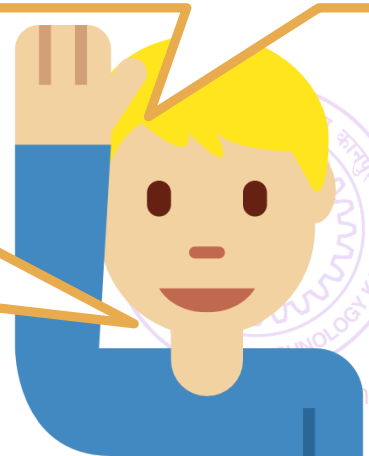
Very Good!

Take care of trailing spaces ☺



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# Use of nested loops

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Don't be afraid of nested loops – they arise in tasks where the smaller tasks themselves require repetition ☺

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Lets solve another problem – take a positive integer n and print the following pattern

# Use of nested loops



Don't be afraid of nested loops – they arise in tasks where the smaller tasks themselves require repetition ☺

Lets solve another problem – take a positive integer n and print the following pattern

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2 3

3 4 5

4 5 6 7

…

n n+1 n+2 n+3 …

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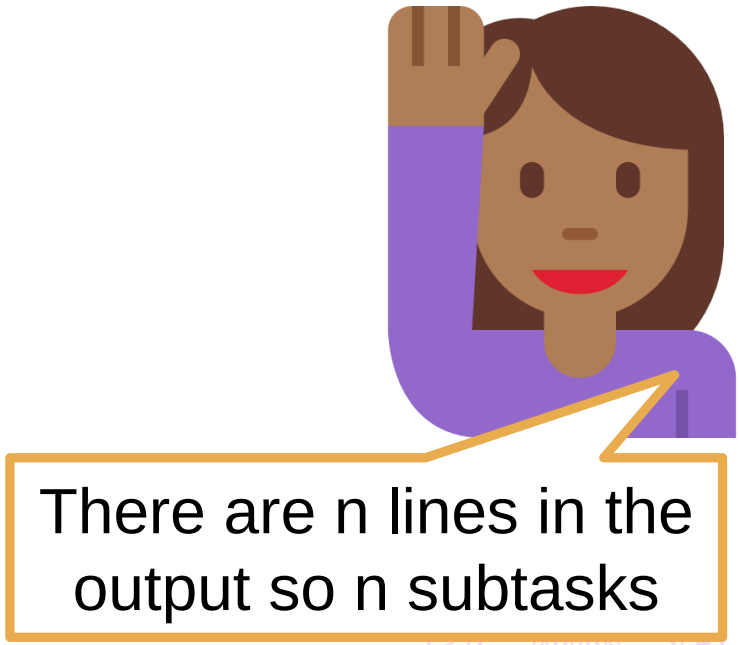

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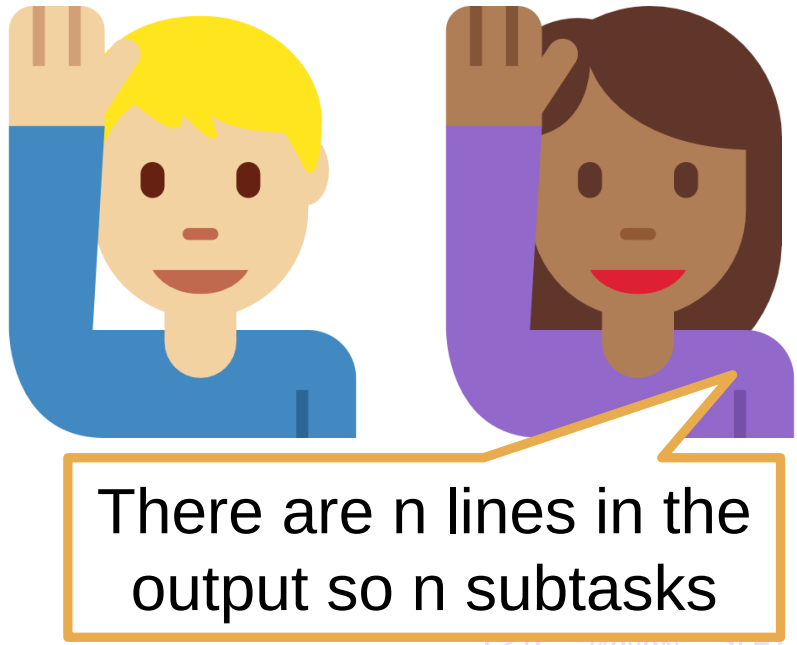

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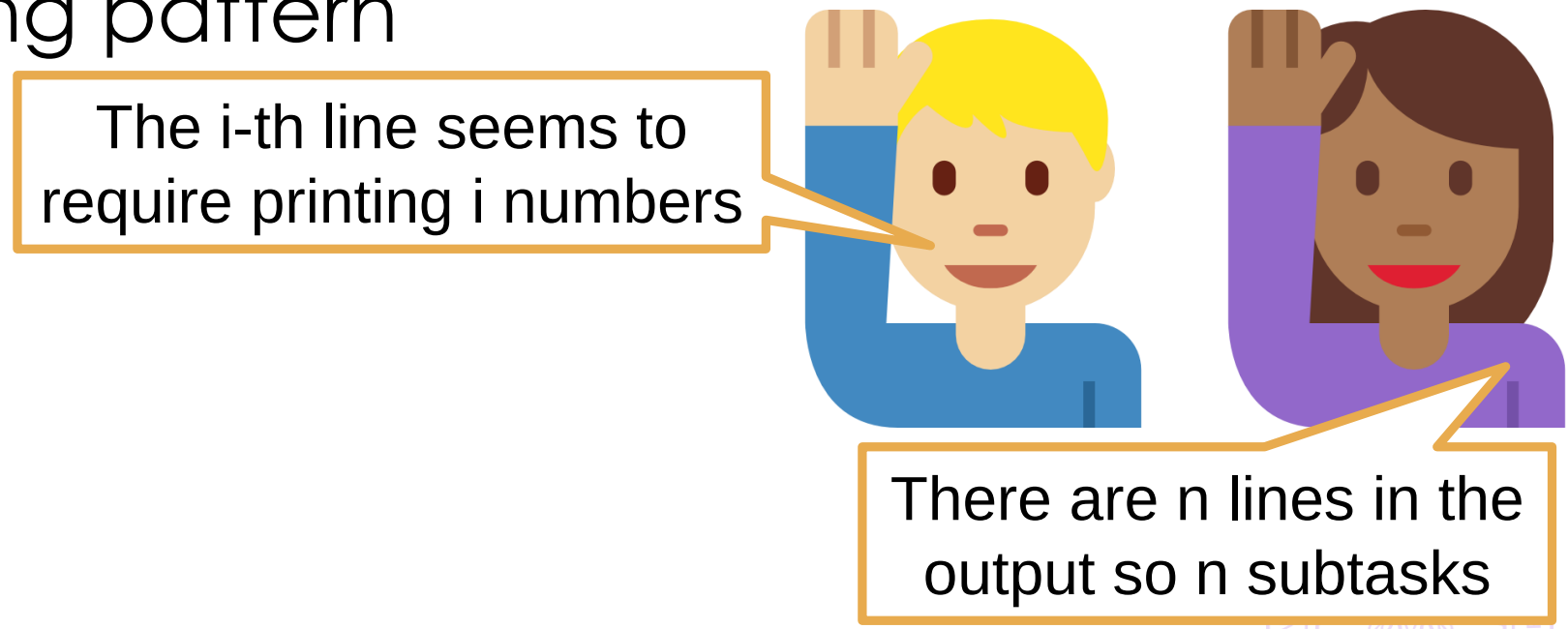

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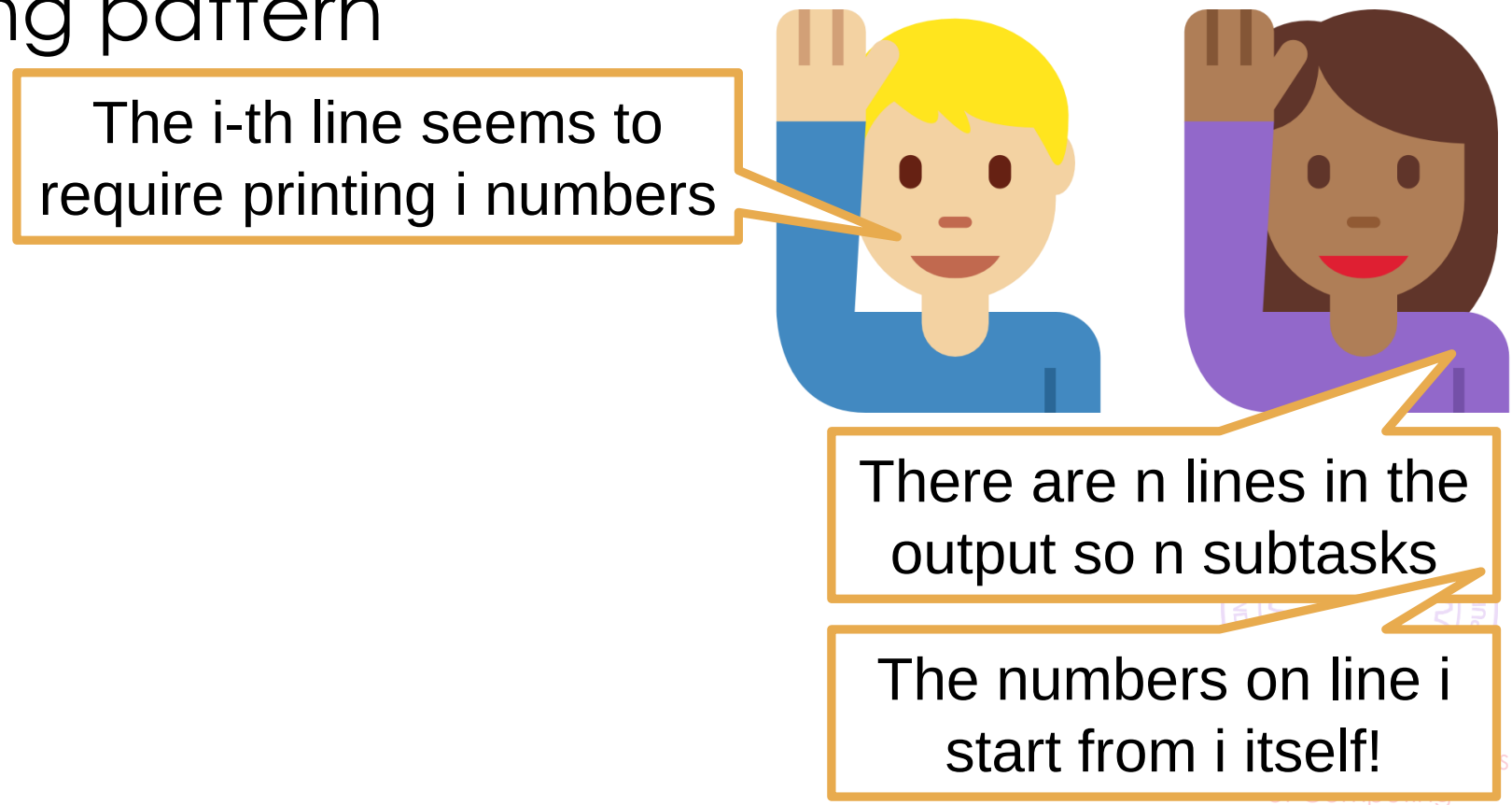

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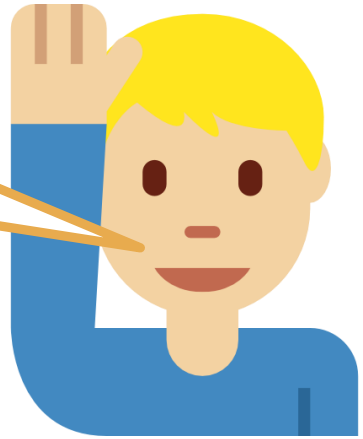
The i-th line seems to require printing i numbers



```
for(j = i; j < i+i; j++)
    printf("%d ", j);
```

There are n lines in the output so n subtasks

The numbers on line i start from i itself!

# Use of nested loops



Don't be afraid of nested loops – they arise in tasks where the smaller tasks themselves require repetition ☺

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}
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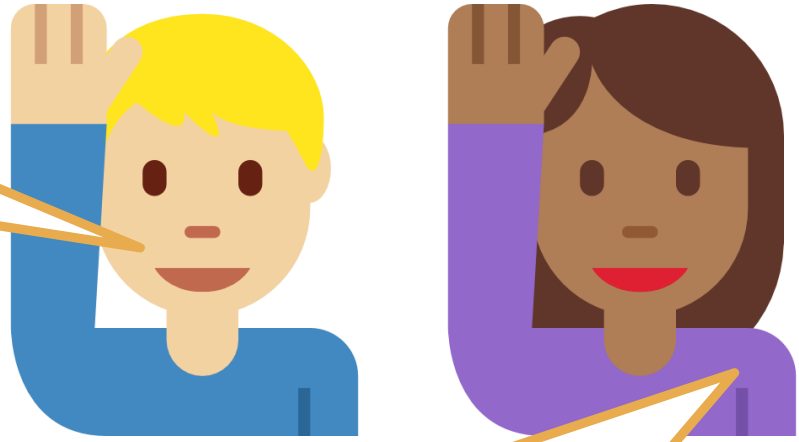

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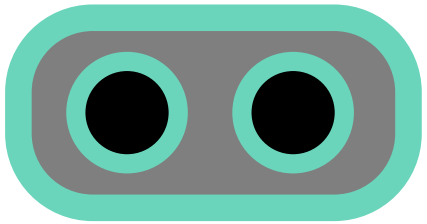

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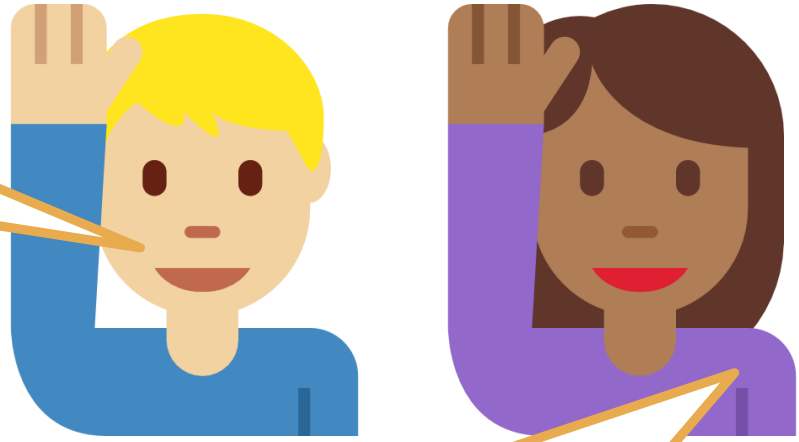

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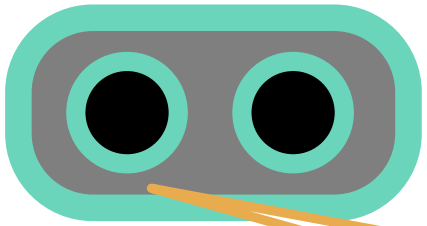

Excellent!

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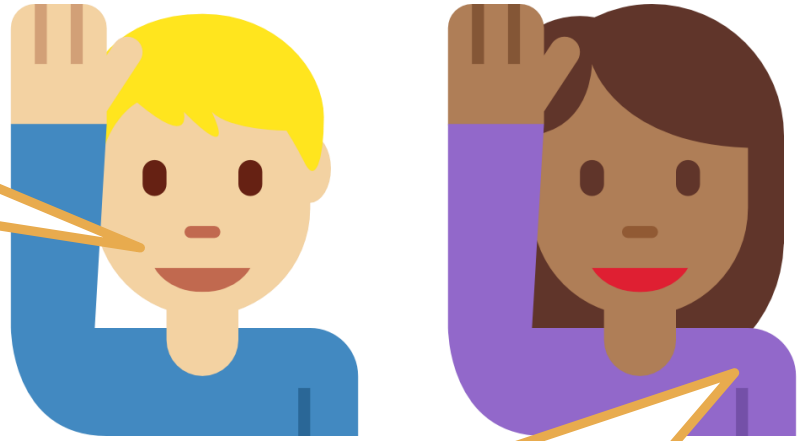

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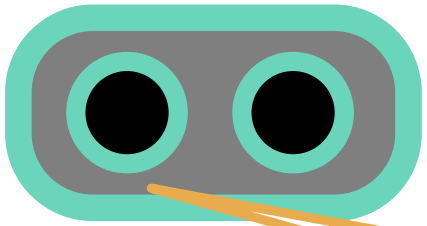

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Excellent!

Don't forget to take care of trailing spaces and trailing new lines

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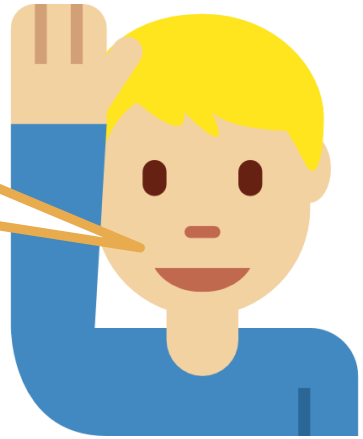

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# Use of nested loops



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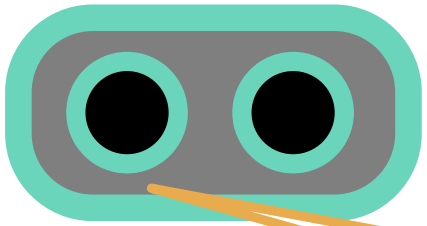
Lets solve another problem – t itive integer n and print the following pattern

We sure will, Mr. C!

The i-th line seems to require printing i numbers



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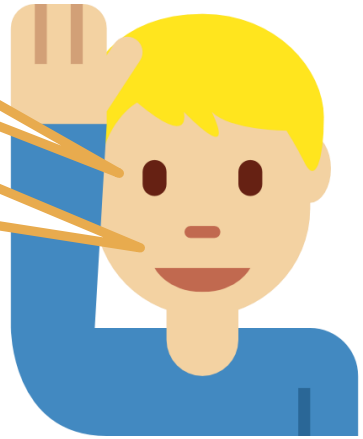

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# Break




भारतीय प्रौद्योगिकी संस्थान कानपुर
INDIAN INSTITUTE OF TECHNOLOGY KANPUR

# Break



Allows us to stop executing a loop and exit immediately

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- Even if stopping condition is still true

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## When to use break

- Avoid if possible
- Can make code error-prone and hard to read
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```
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while(1){
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    if(num == -1) break;
    else sum += num;
}
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If we did not have break, infinite loop!

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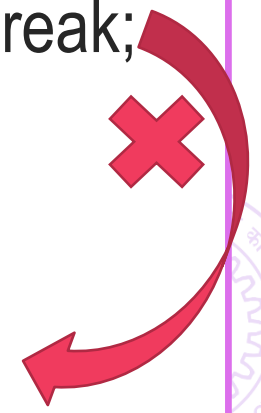

# Fancy For using Break

# Fancy For using Break



```
for(init_expr; stop_expr; upd_expr){
    statement1;
    statement2;
    ...
}
statement3;
statement4;
```

# Fancy For using Break



```
for(init_expr; stop_expr; upd_expr){
    statement1;
    statement2;
    ...
}
statement3;
statement4;
```

```
init_expr;
for(;;){
    if(!(stop_expr)) break;
    statement1;
    statement2;
    ...
    upd_expr;
}
statement3;
statement4;
```

# For ... break

If we did not have break this would have been an infinite loop since no stop_expr

```
for(init_expr; stop_expr; upd_expr){
    statement1;
    statement2;
    ...
}
statement3;
statement4;
```

```
init_expr;
for(;;){
    if(!(stop_expr)) break;
    statement1;
    statement2;
    ...
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statement3;
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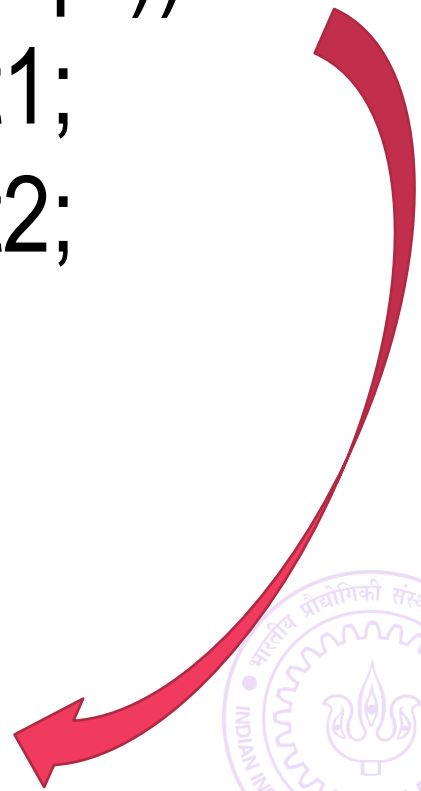
```

# Fo ak

If we did not have break this would have been an infinite loop since no stop_expr

```
for(init_expr; stop_expr; upd_expr){
    statement1;
    statement2;
    ...
}
statement3;
statement4;
```

```
init_expr;
for(;;){
    if(!(stop_expr)) break;
    statement1;
    statement2;
    ...
    upd_expr;
}
statement3;
statement4;
```



# For ... break

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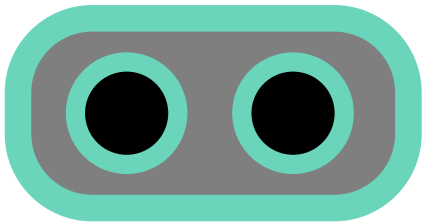

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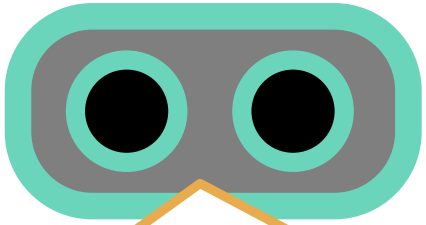

Remember, the order is stop_expr → body → update → stop_expr → …

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init_expr;
for(;;){
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    statement1;
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# Continue




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INDIAN INSTITUTE OF TECHNOLOGY KANPUR

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Allows us to skip the rest of the statements in body of the loop

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Read 100 integers and print sum of only positive numbers

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Read 100 integers and print sum of only positive numbers

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int sum = 0, i, num;
for(i = 1; i <= 100; i++){
    scanf("%d", &num);
    if (num < 0){
        continue;
    }
    sum += num;
}
```

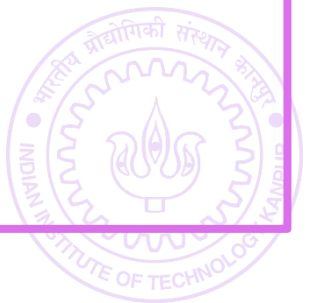

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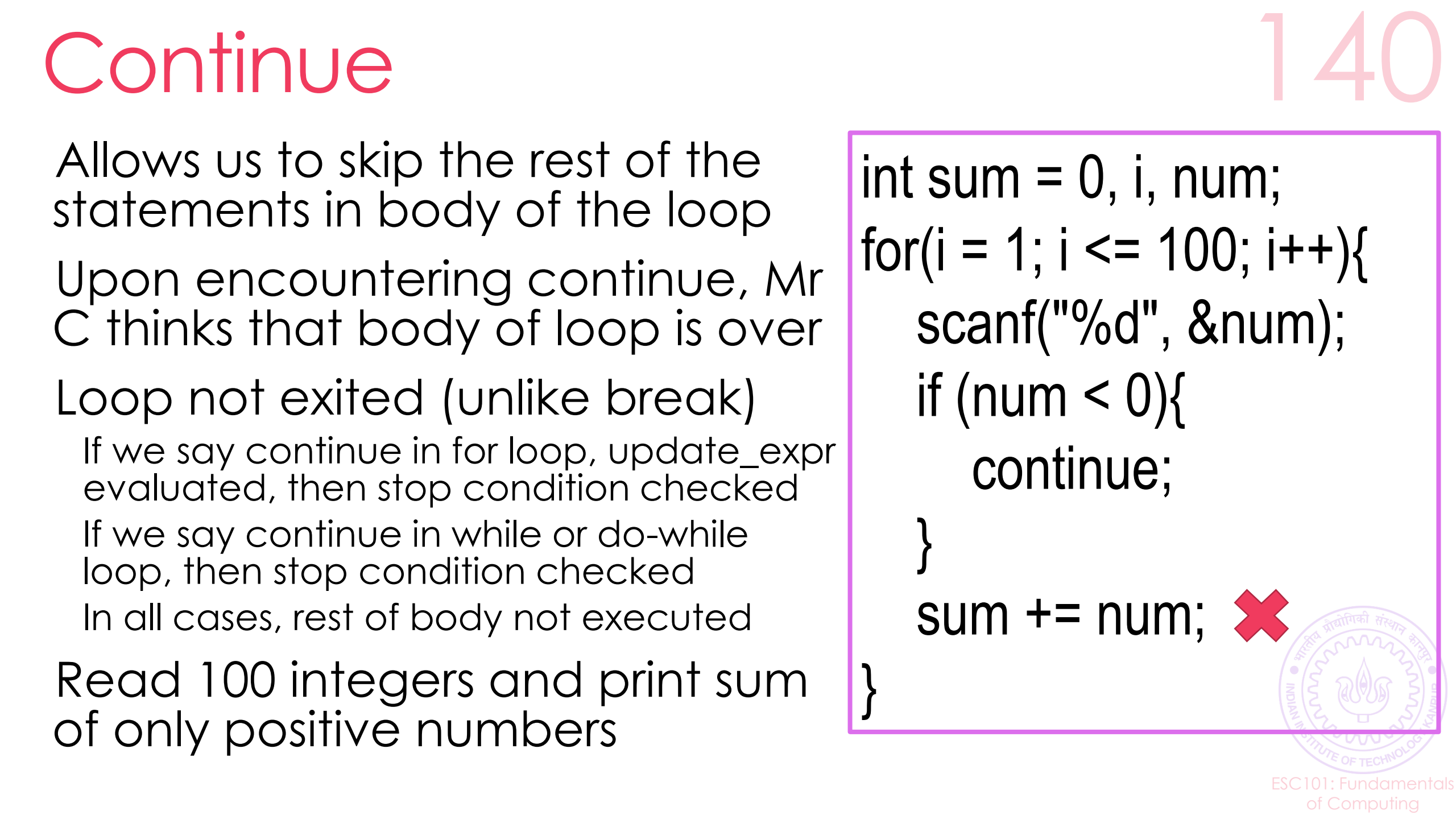

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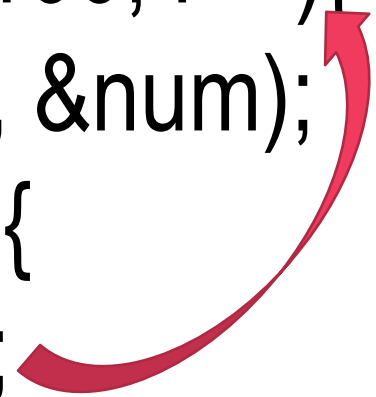

# Careful using break, continue

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If there are nested loops, a break inside the inner loop will apply only to the inner loop

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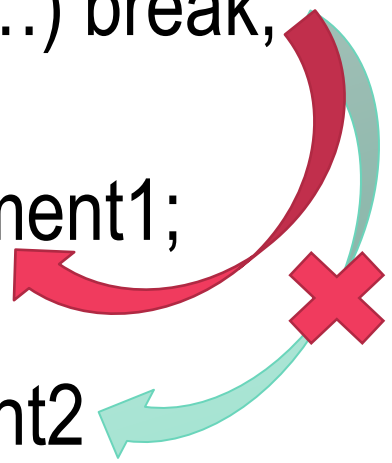

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If there are nested loops, a break inside the inner loop will apply only to the inner loop, same with continue

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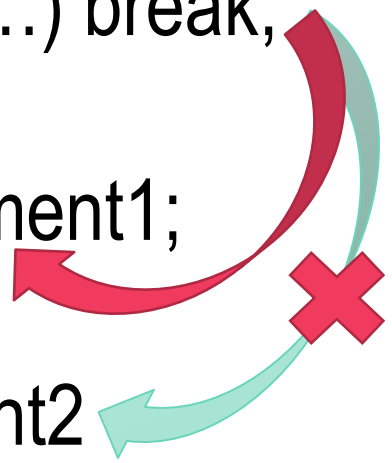

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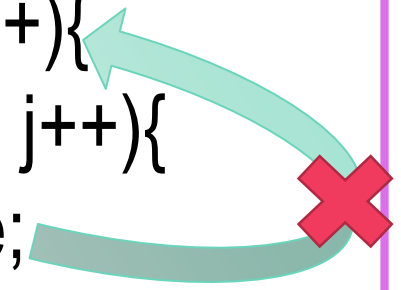

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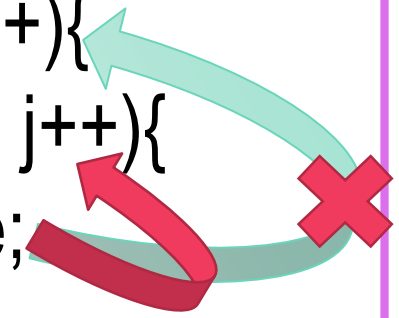

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Be careful not to create an infinite loop using continue if you bypass any update steps.

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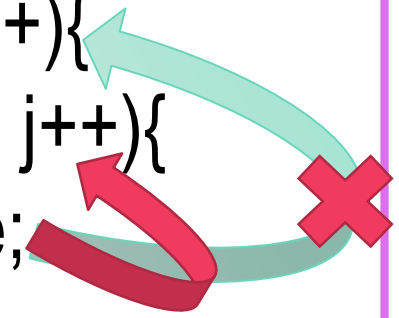

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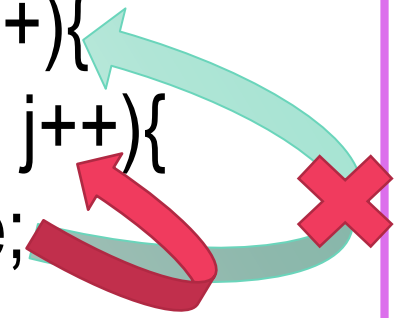

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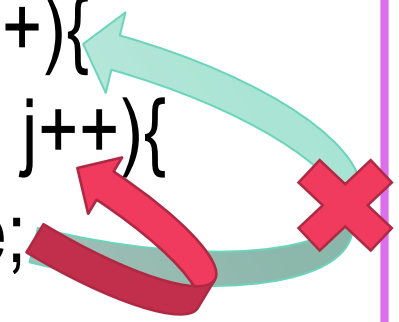

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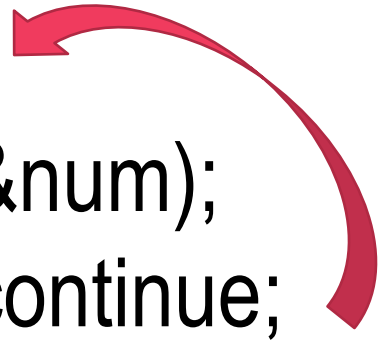

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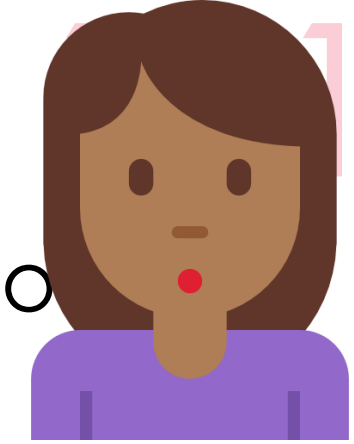

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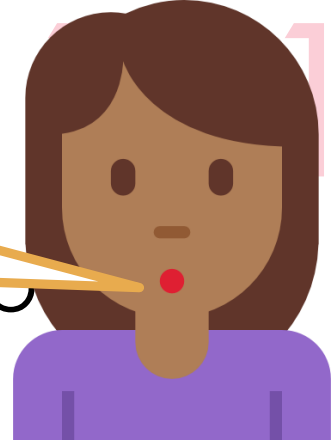
If we have a sequence of 100000 negative numbers, it will read all of them even though we wanted to read only first 100 numbers – continue statement skipping counter update



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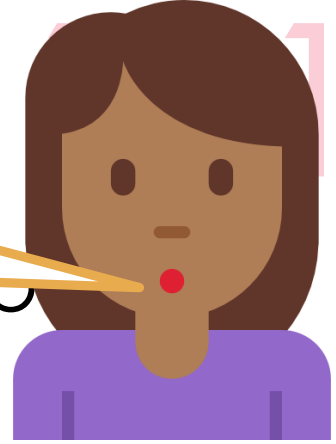

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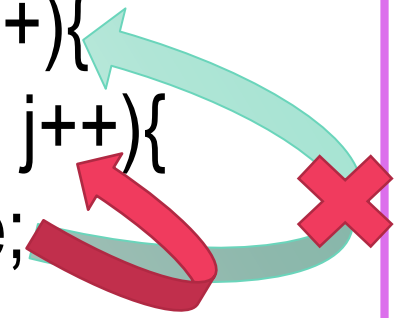

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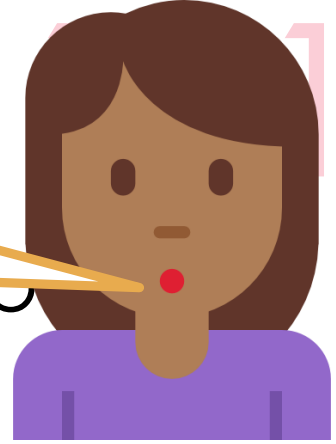

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Much better, always updates counter whether skipping the sum+=num step using continue or not

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If you have 10 break statements inside the same loop body, you will have a hard time figuring out which one caused your loop to end ☹

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Tomorrow: more elegant alternatives to break, continue