Mr C makes a Choice

ESC101: Fundamentals of Computing

Purushottam Kar

Announcements - Lab

- Solutions uploaded to the website
- Grades released after lab over this evening
- No grace marks for “I wrote at least some code” or “just a small calculation mistake”
- Only when autograder makes mistake – regrading
- Recall, useless regrading requests will be penalized

How autograding was done

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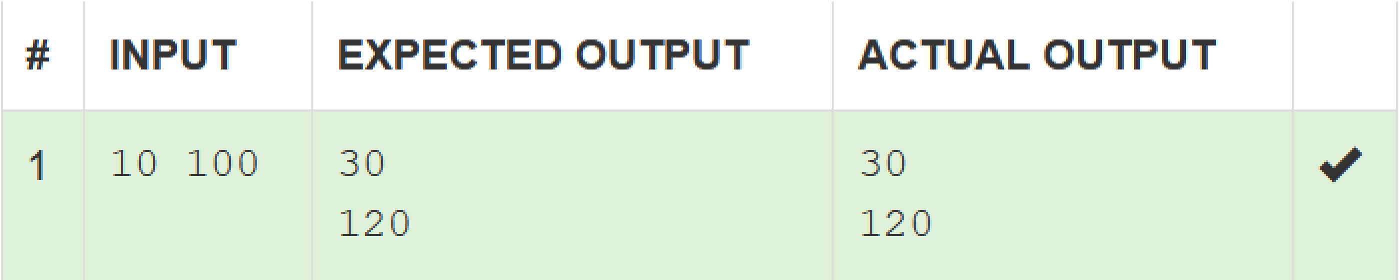

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100% marks, both lines correct

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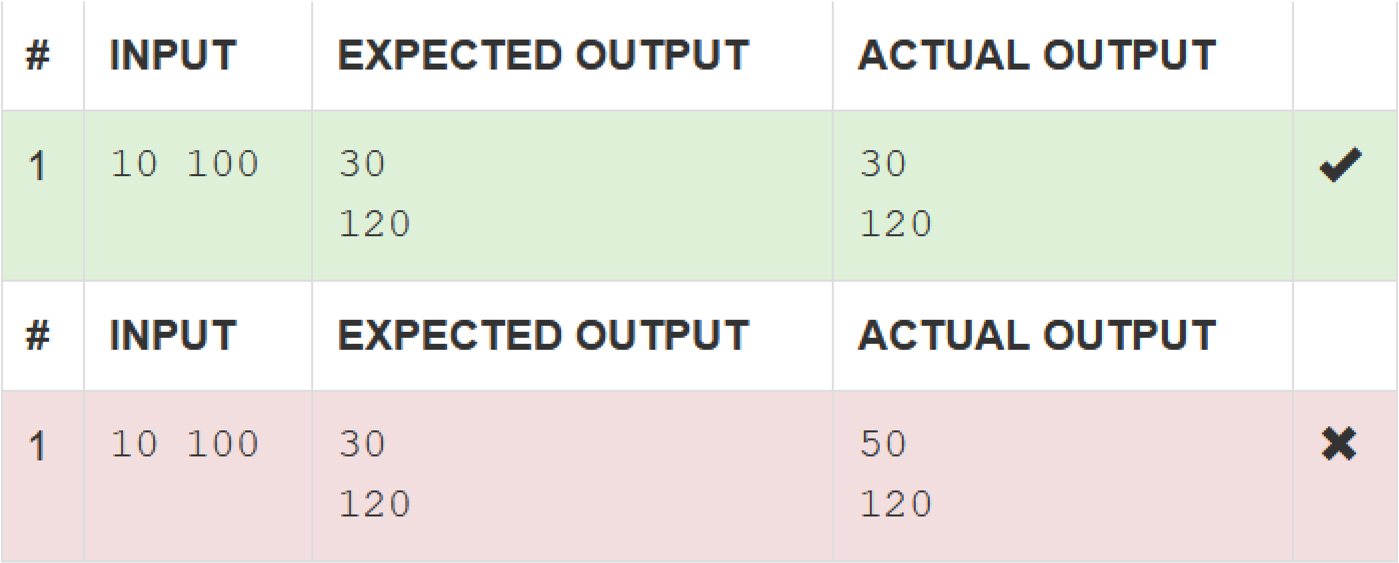

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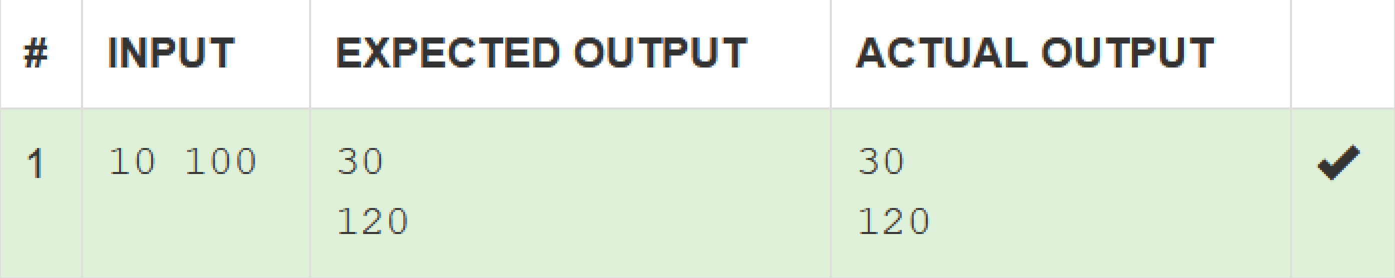

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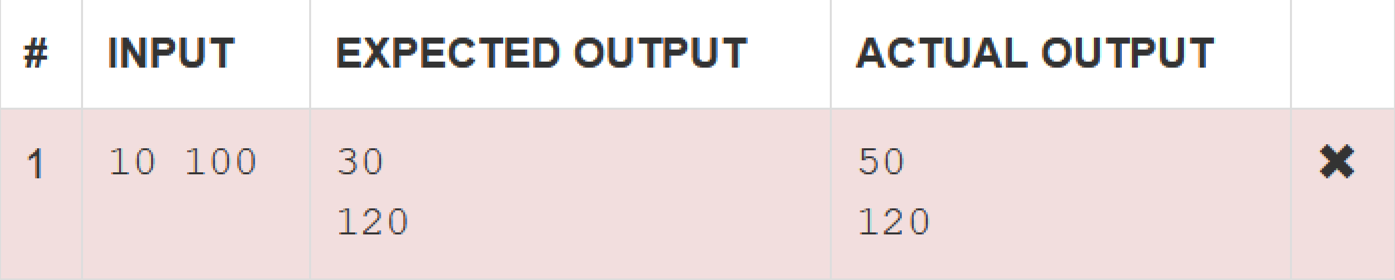

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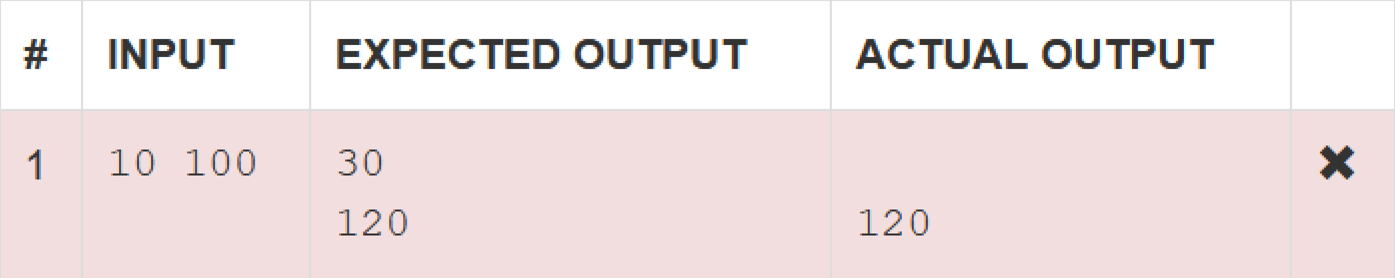

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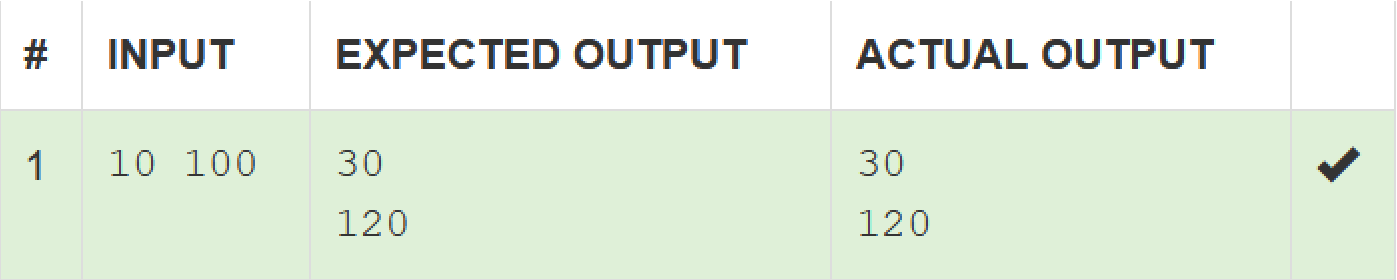

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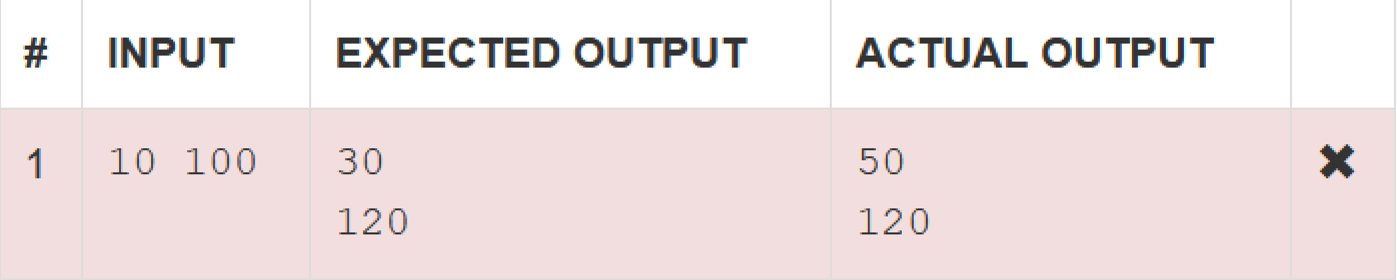

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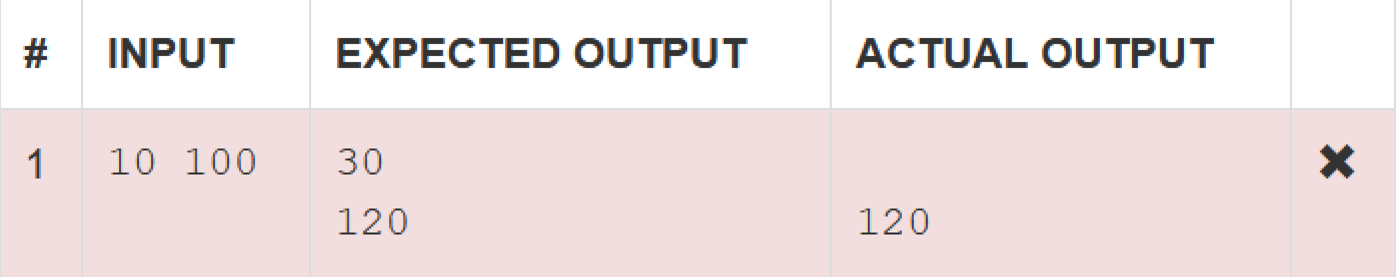

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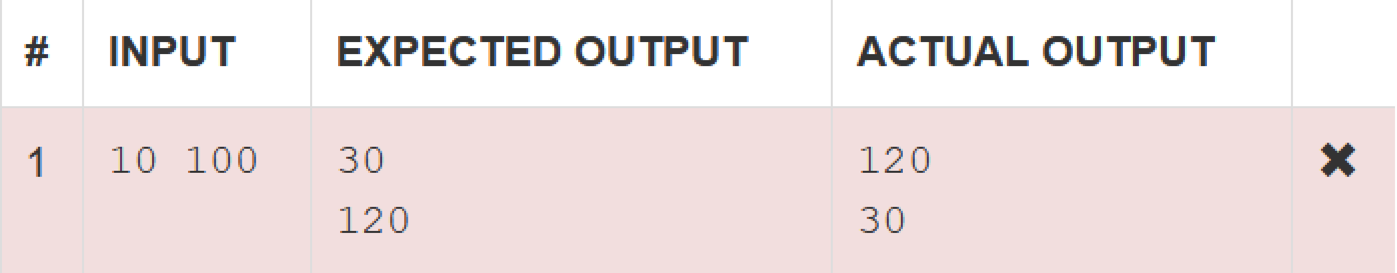

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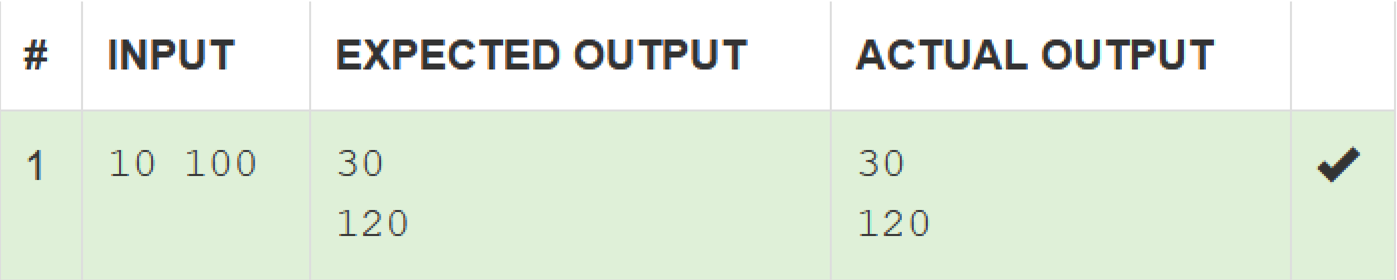

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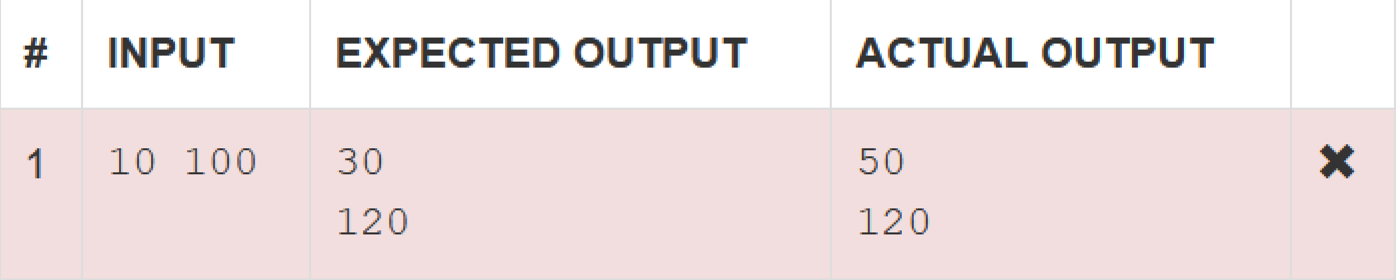

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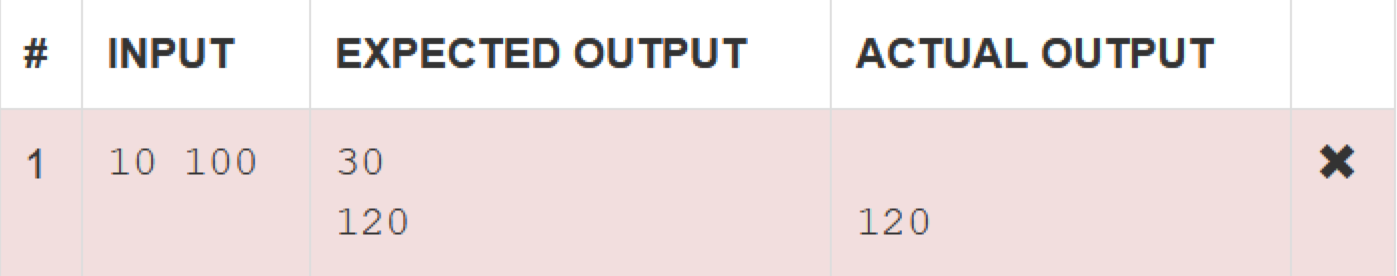

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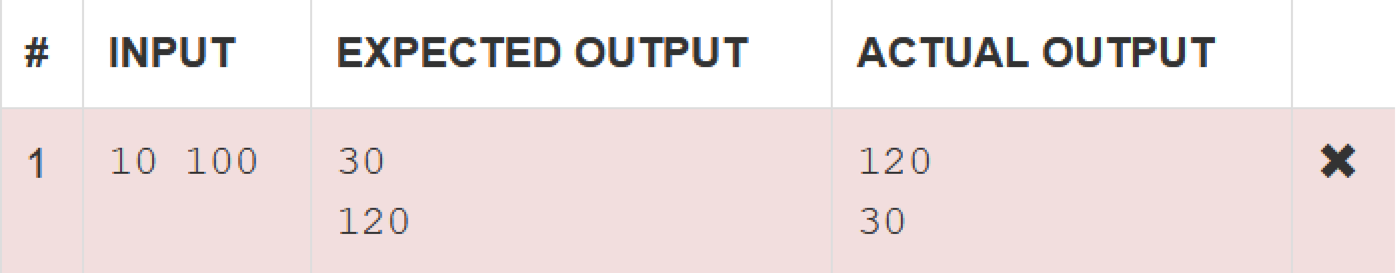

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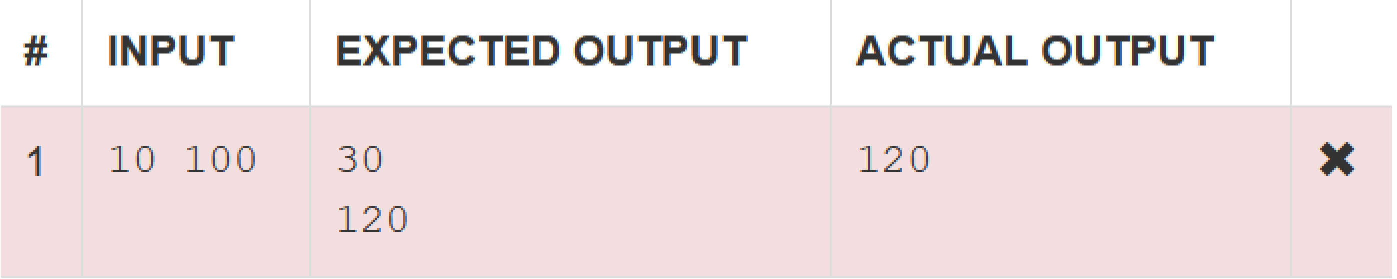

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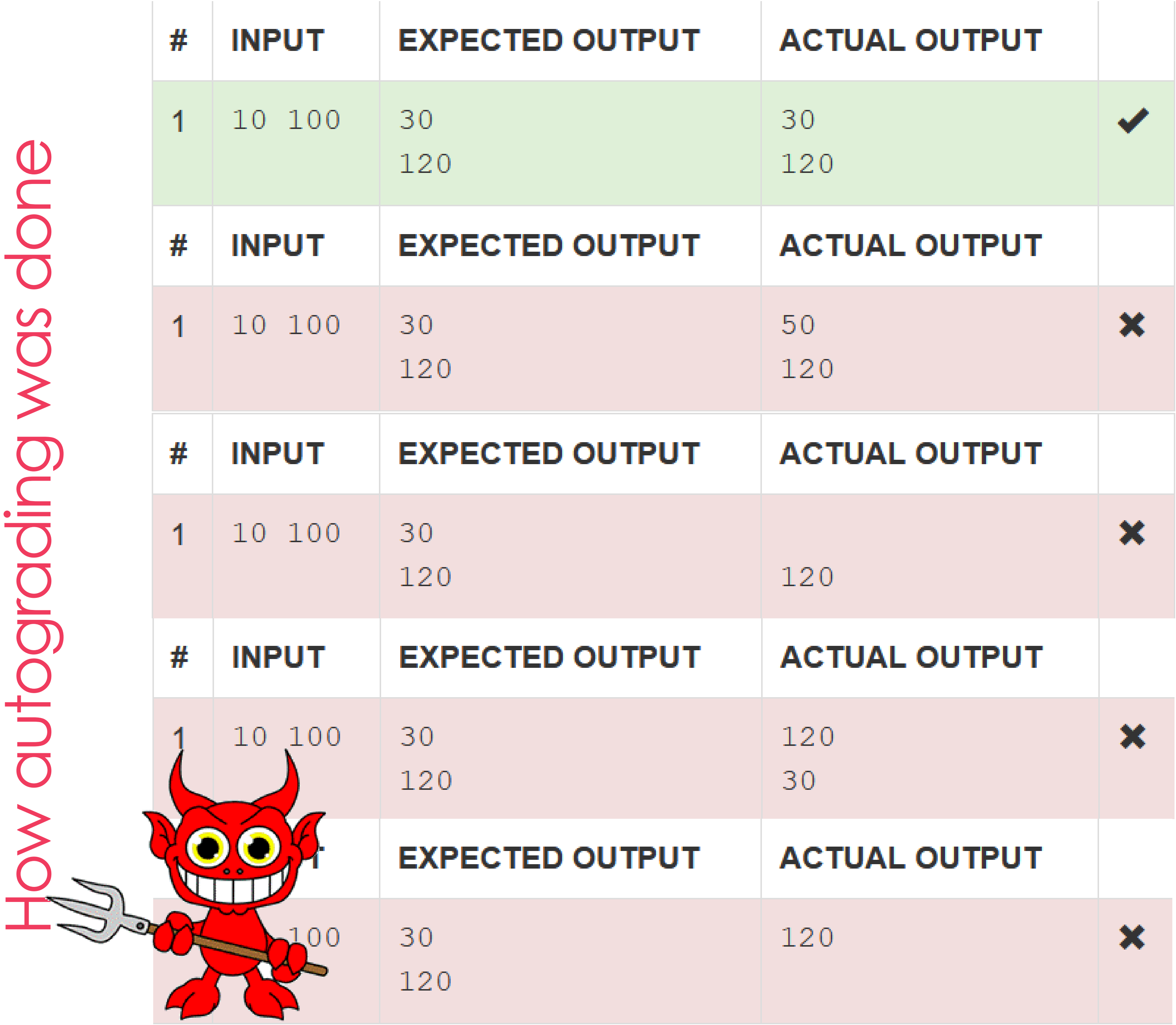

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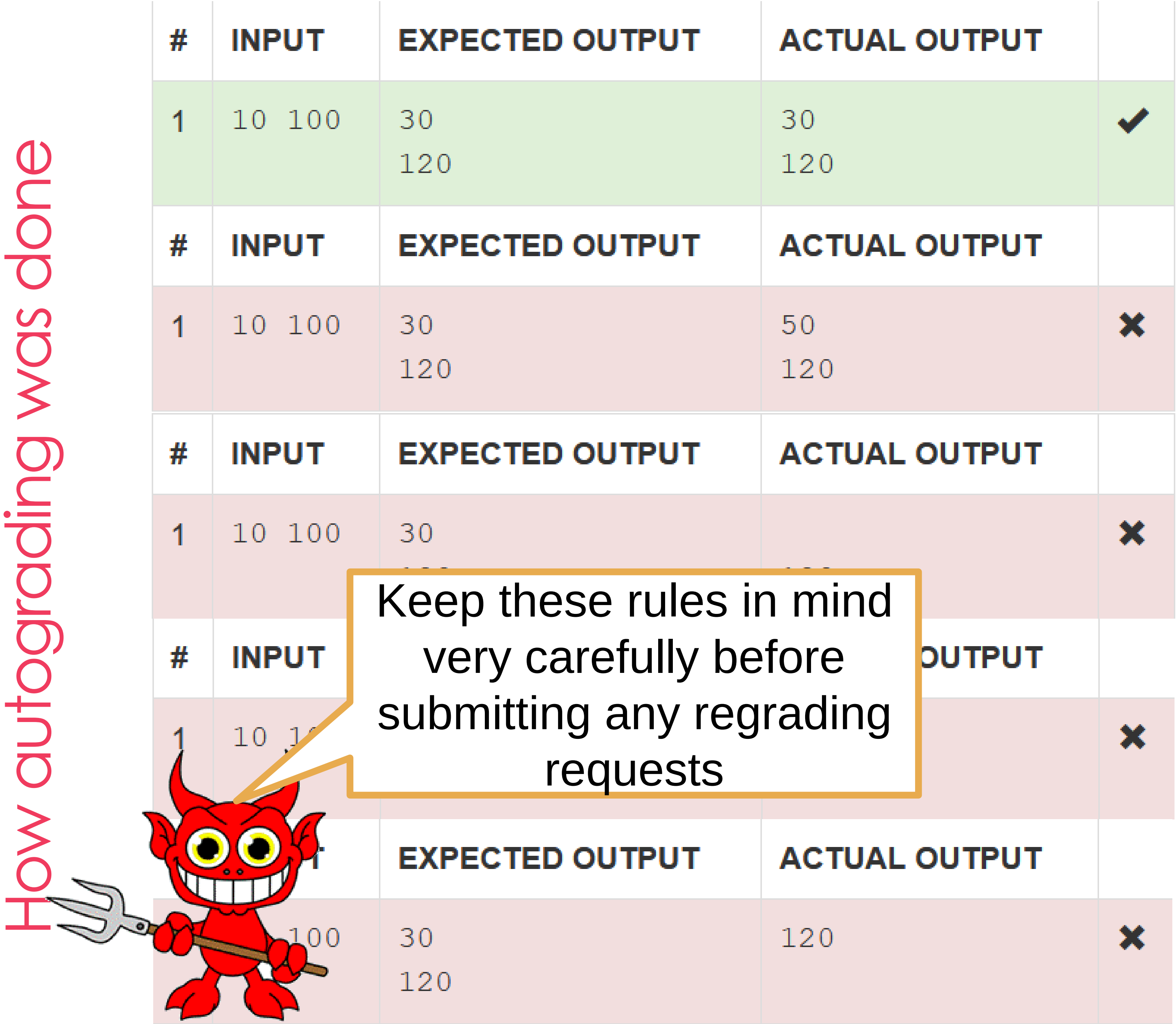

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Keep these rules in mind very carefully before submitting any regrading requests

Announcements – Minor Quiz

- Will be released very soon
- Some delay in setting up Gradescope
- Sorry for the delay

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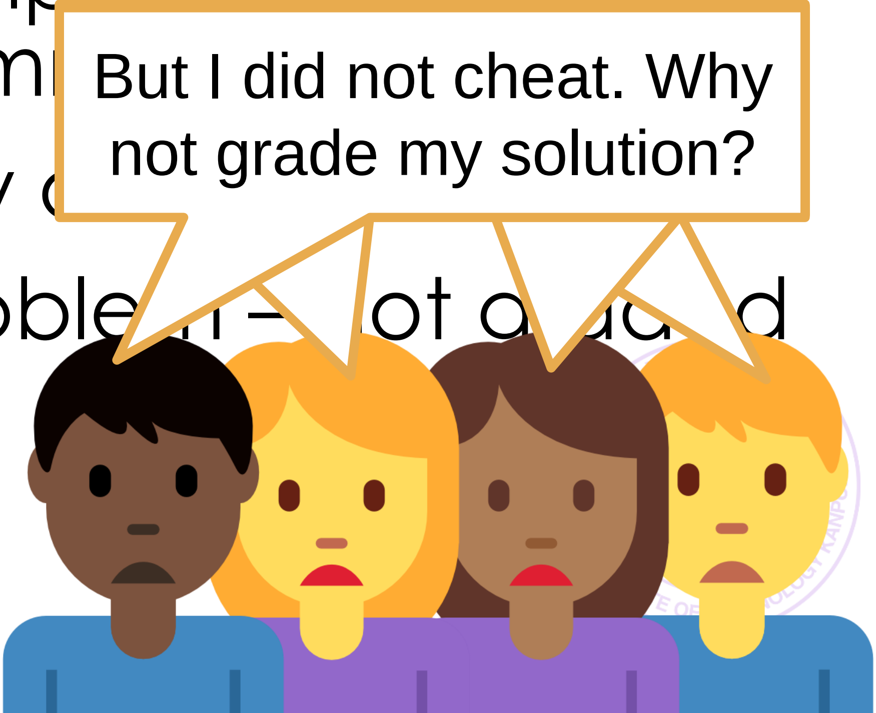

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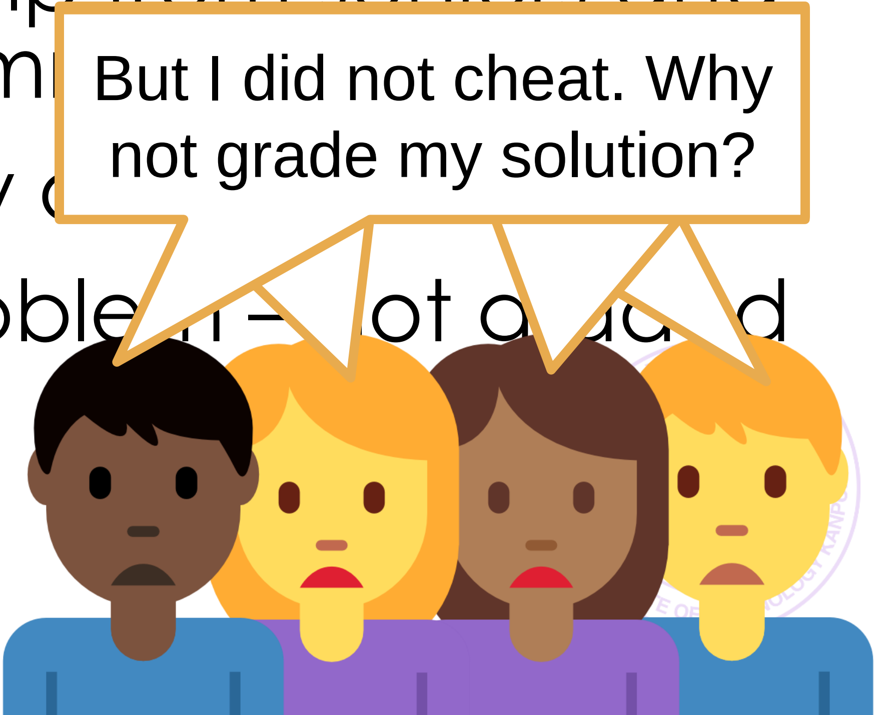

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In June, CBSE question paper got leaked. Only 10-20 students involved in leak but retest was done for all lakhs of students to be fair to all

But I did not cheat. Why not grade my solution?

Error in previous slide (corrected)

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Operator Name	Symbol/Sign	Associativity
Bracket	()	Left
Unary negation	-	Right
Multiplication/division/ remainder	*, /, %	Left
Addition/subtraction	+, -	Left
Assignment	=	Right

Error in previous slide (corrected)

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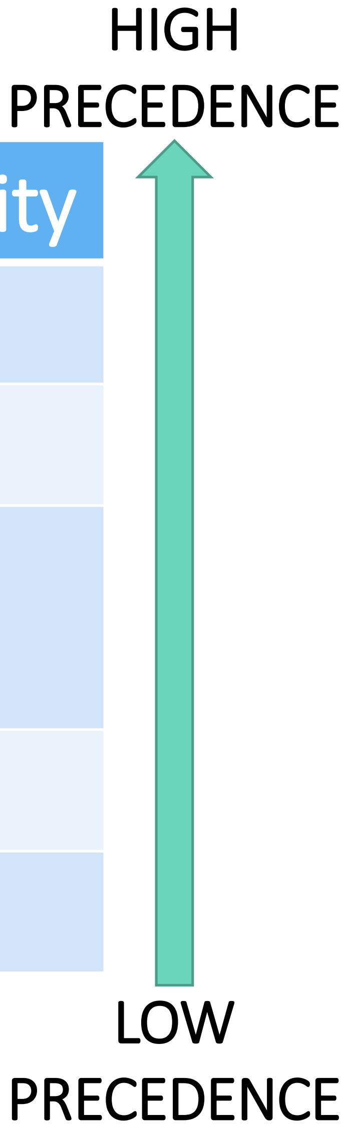
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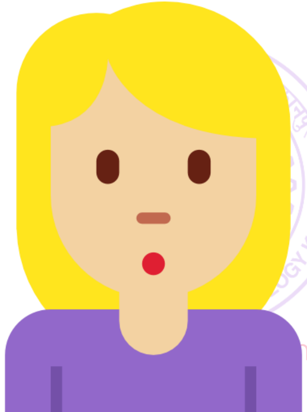

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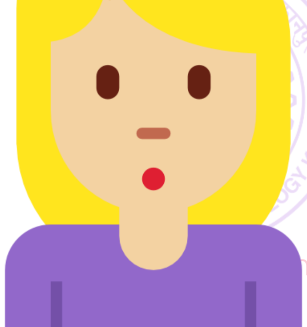
So bracket has higher priority than unary negation



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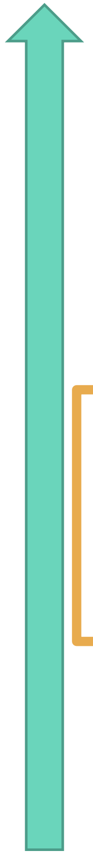

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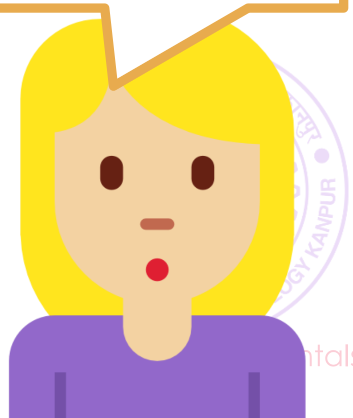

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Sorry about the error

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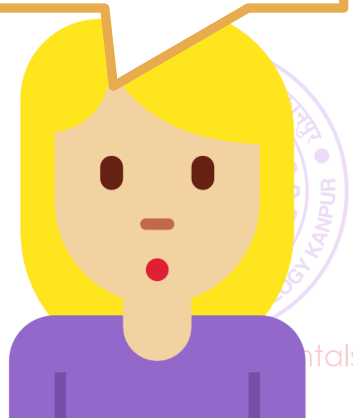

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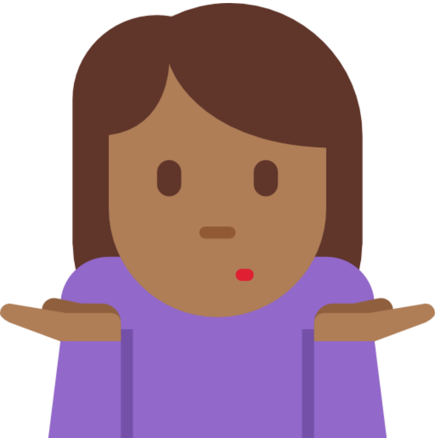

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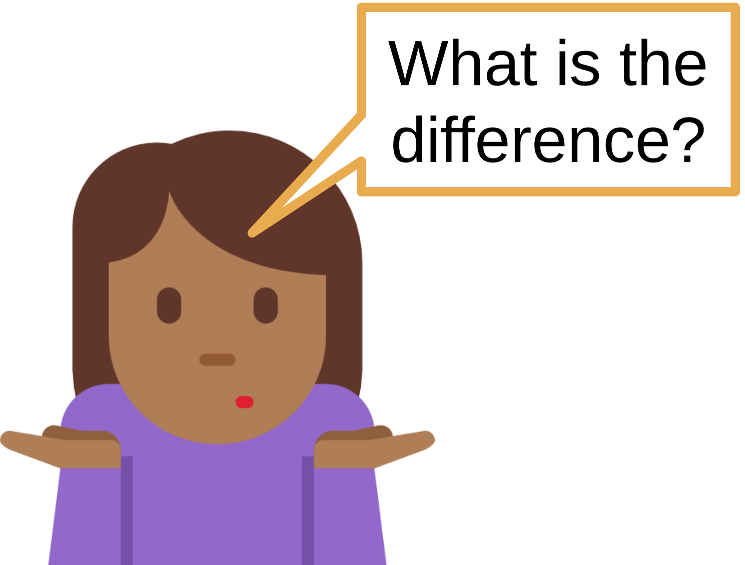

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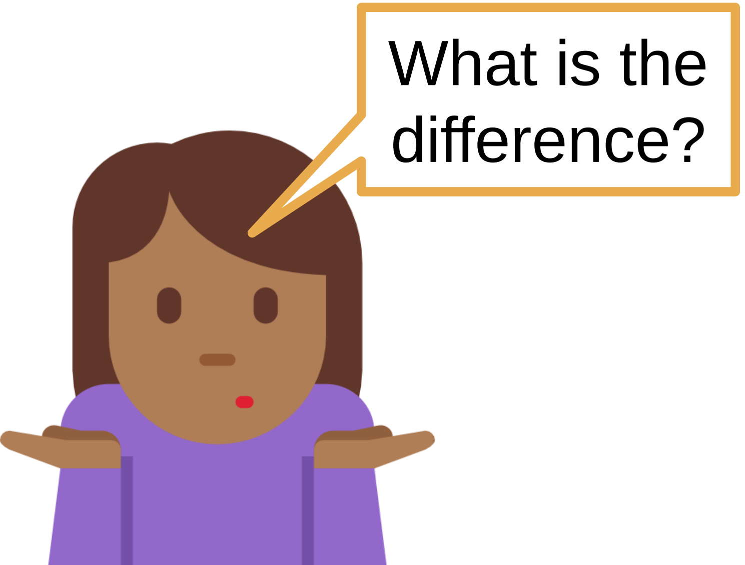

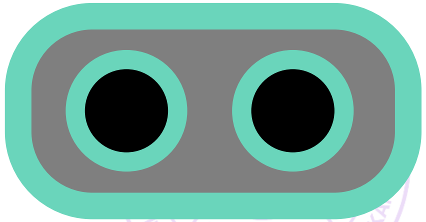

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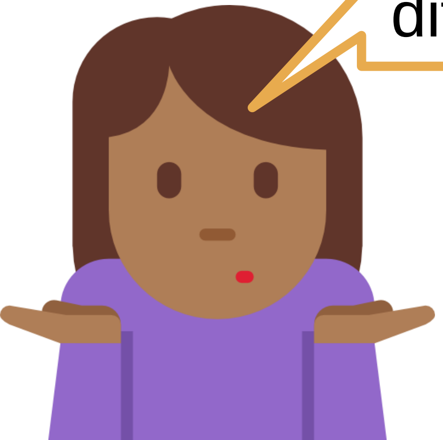

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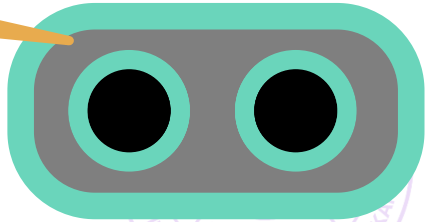

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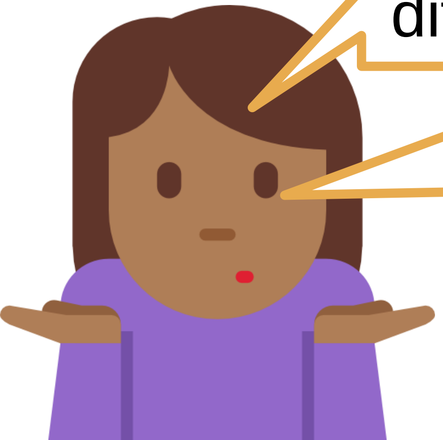

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Range of float is larger. What if I store it as a float?

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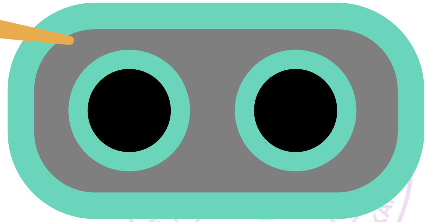

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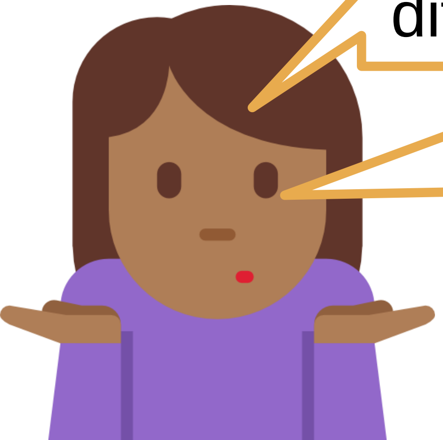

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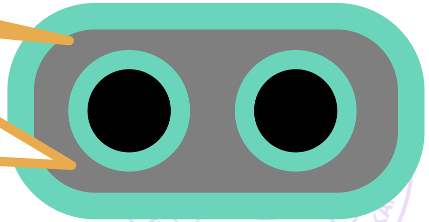

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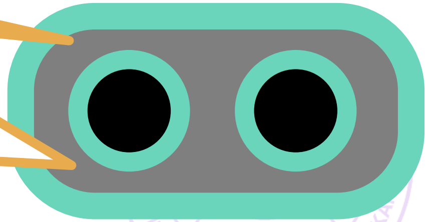

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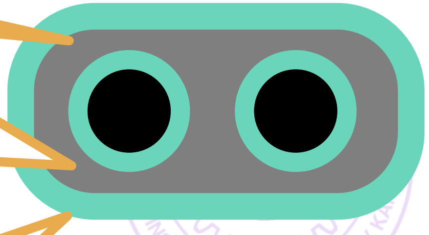

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The number is like 3.2×10^9 and my error was just 26. Don't blame me ☹

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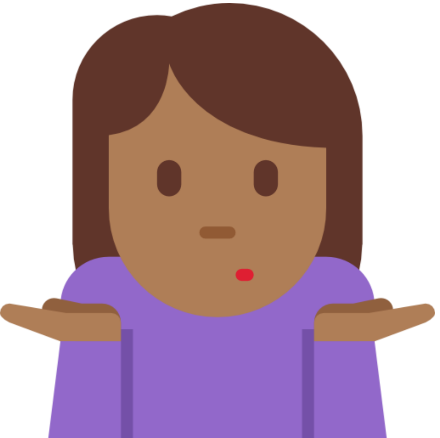

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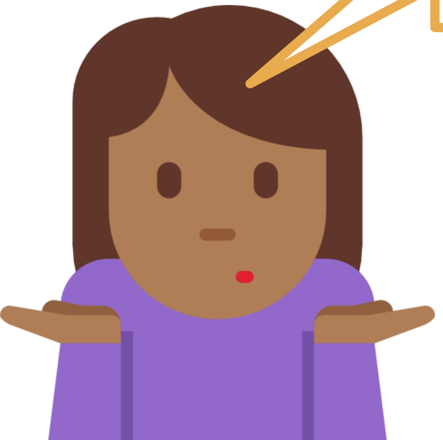

Yeah. Too many digit errors will take place ☹ So What do I do?

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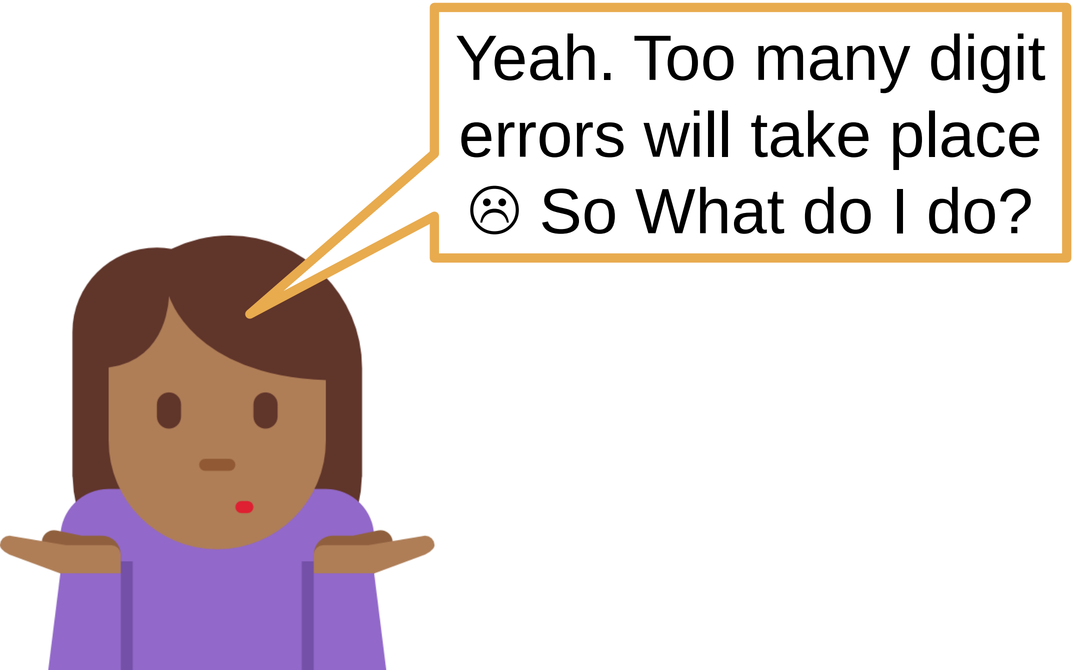
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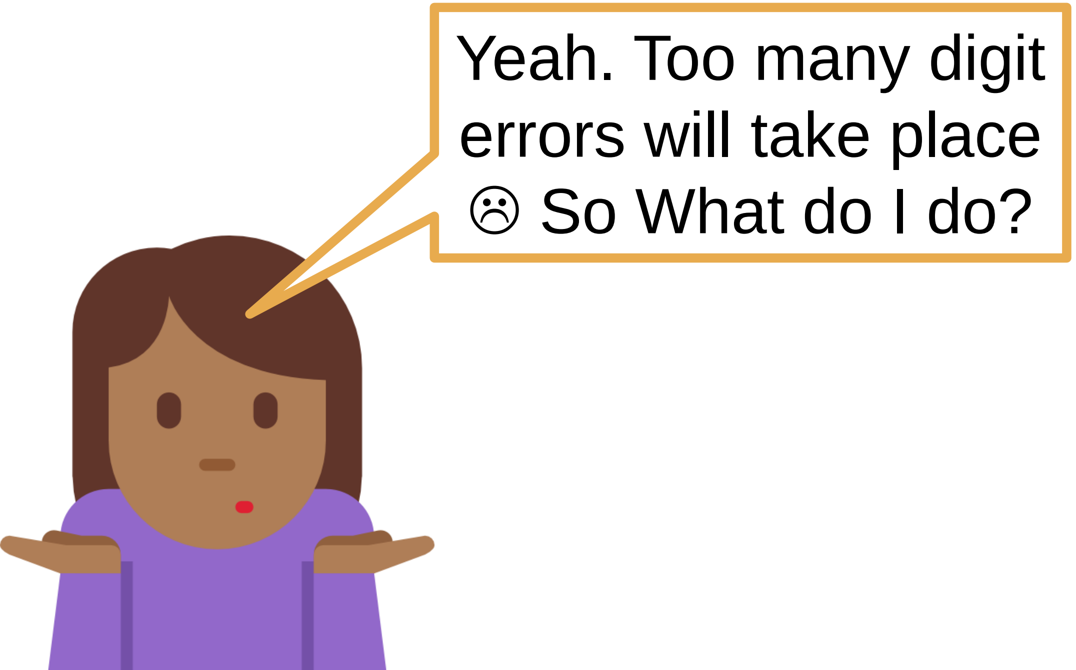
Yeah. Too many digit errors will take place ☹ So What do I do?

A Cute Trick for Higher Precision

Want to read a number like 123456789.987654321?

Don't read it as a float or double or even long double

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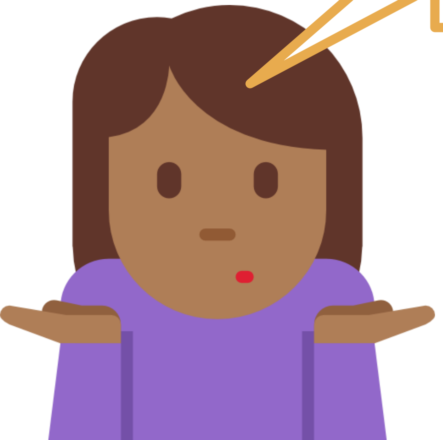

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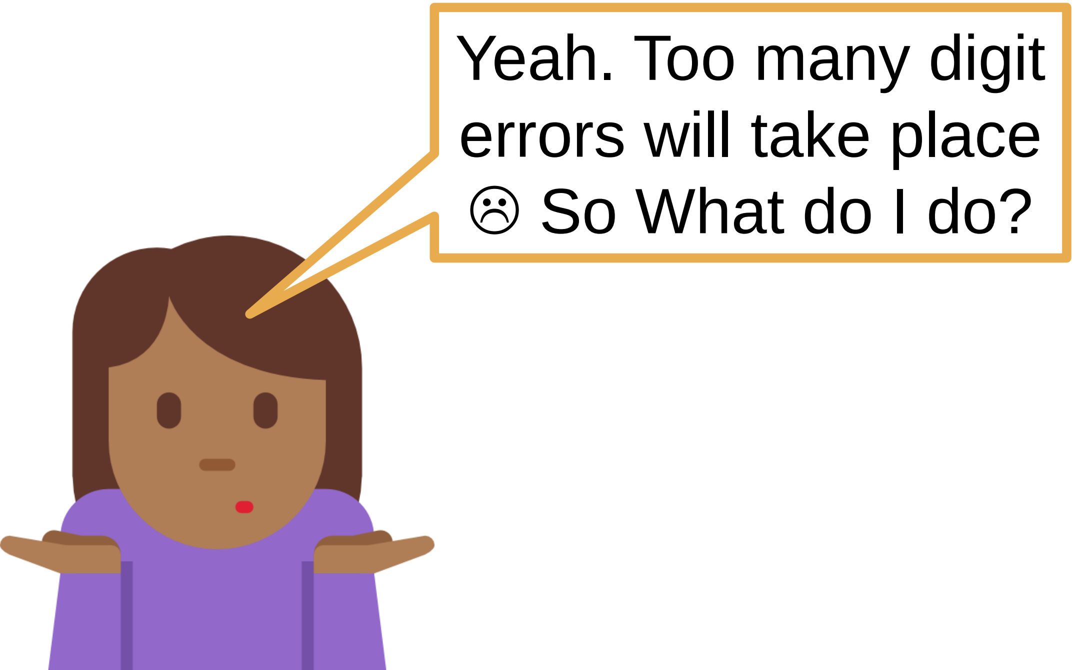
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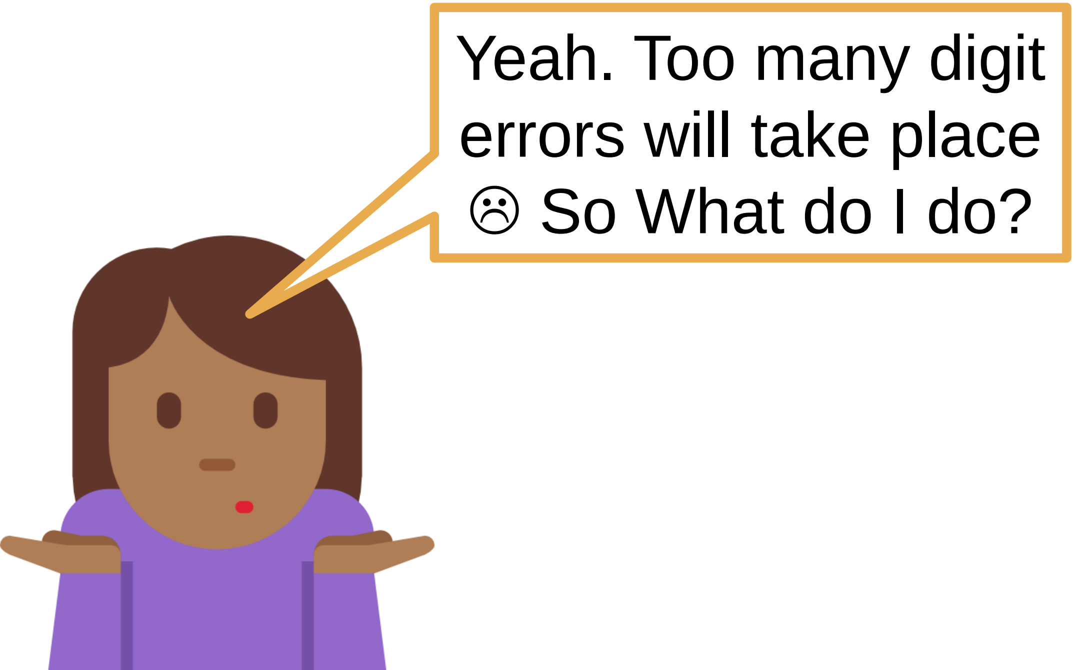
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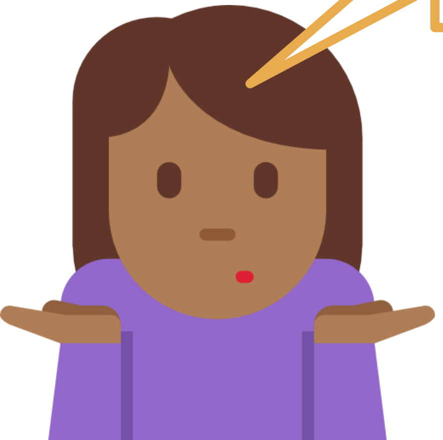

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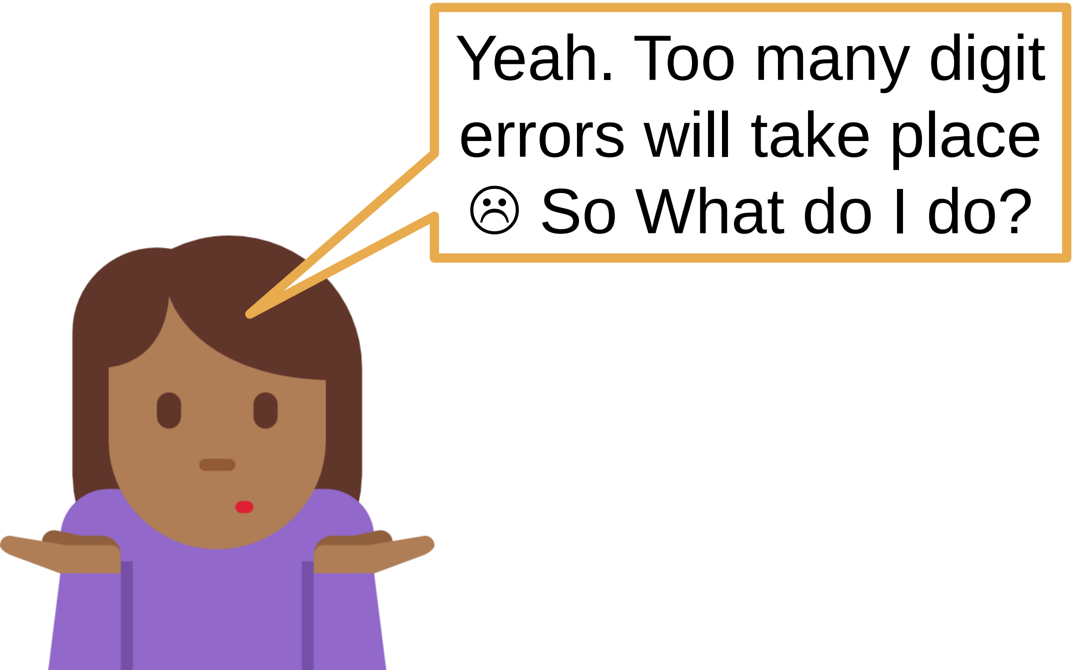
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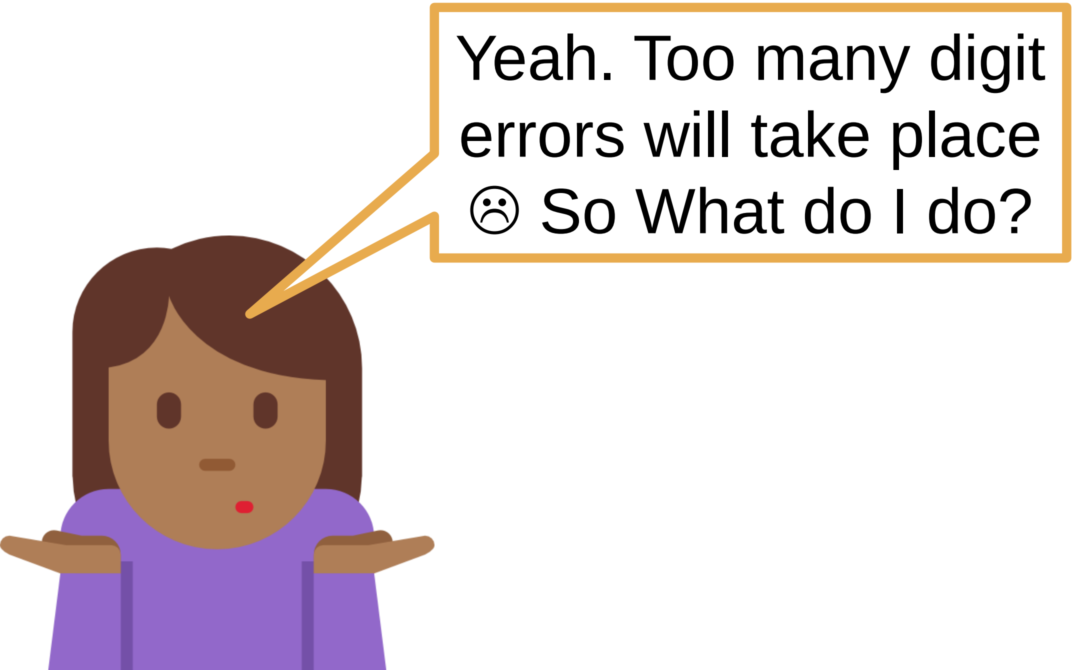
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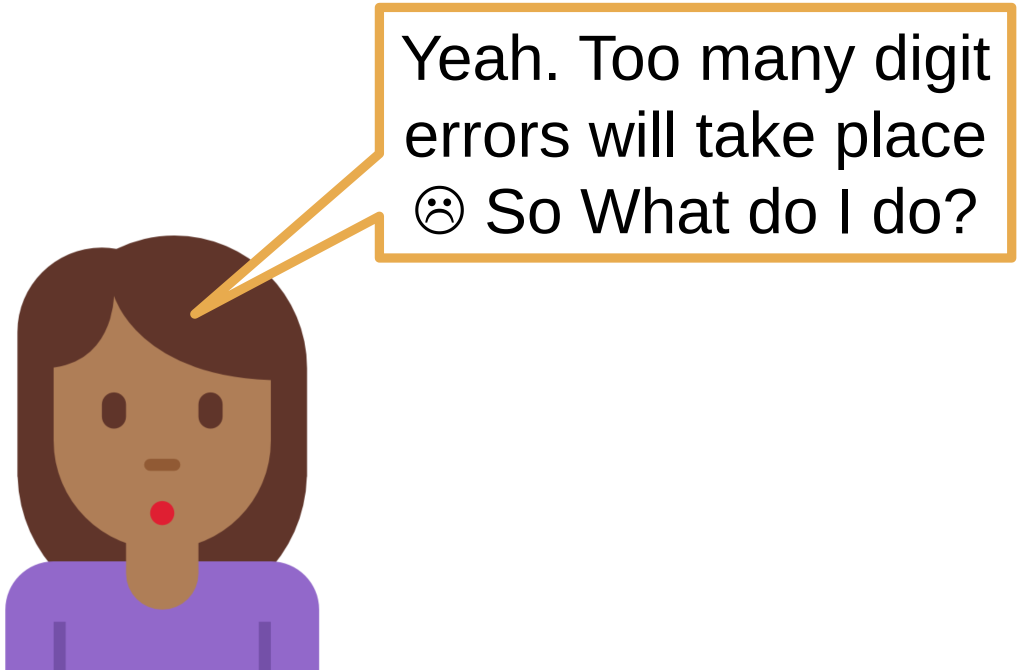
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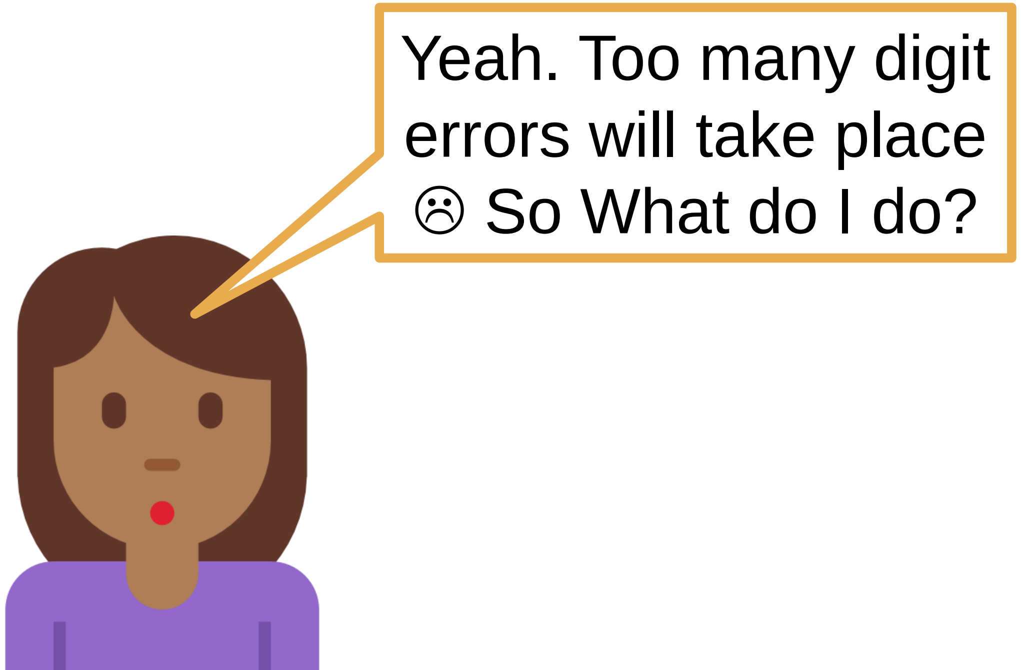
Can use long too!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```

Two New Shortcuts

Two New Shortcuts

Incrementing a variable by one

Two New Shortcuts

Incrementing a variable by one

```
sum = sum + 1;
```

Two New Shortcuts

Incrementing a variable by one

```
sum = sum + 1;
sum++;
```

Two New Shortcuts

Incrementing a variable by one

```
sum = sum + 1;
sum++;
++sum;
```

Two New Shortcuts

Incrementing a variable by one

```
sum = sum + 1;
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```

Decrementing a variable by one

Two New Shortcuts

Incrementing a variable by one

```
sum = sum + 1;
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```

Decrementing a variable by one

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sum = sum – 1;
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Incrementing a variable by one

```
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++sum;
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Decrementing a variable by one

```
sum = sum – 1;
sum--;
--sum;
```

Remember, don’t need to write sum = sum++; or sum = ++sum; sum++; will itself assign the incremented value to the sum variable. Similarly sum--; or –sum;

Two New Shortcuts

Incrementing a variable by one

```
sum = sum + 1;
sum++;
++sum;
```

Decrementing a variable by one

```
sum = sum – 1;
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Post-increment

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```

Post-decrement

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Post-increment

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Post-decrement

Pre-decrement

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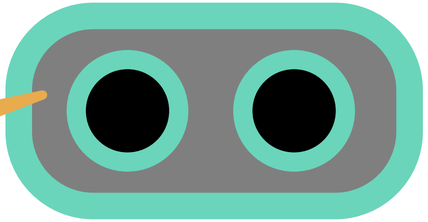
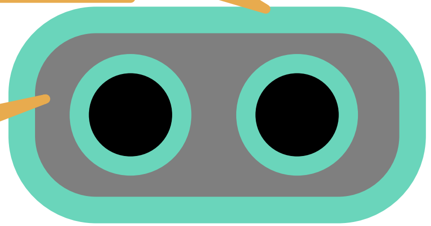


sum++, -- sum etc are valid expressions

Two New Shortcuts



Works only for incrementing or decrementing by one

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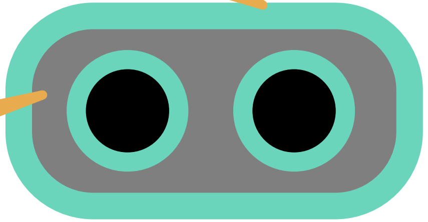

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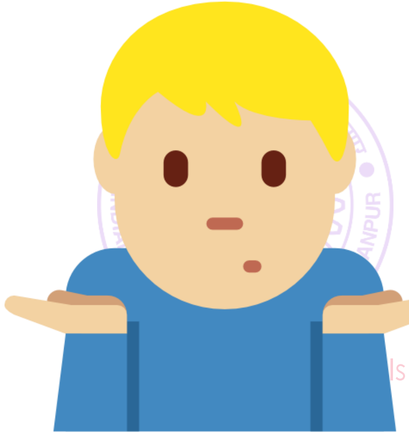
Pre-decrement



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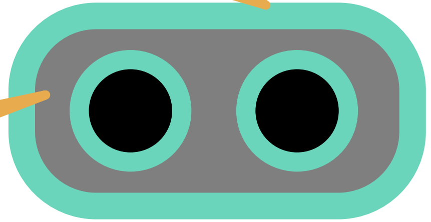

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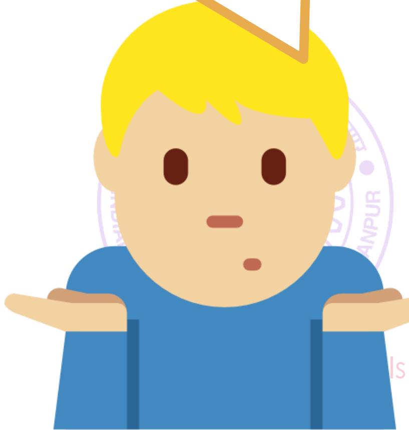
```

Post-decrement

Pre-decrement

What if I want to increment by 2?



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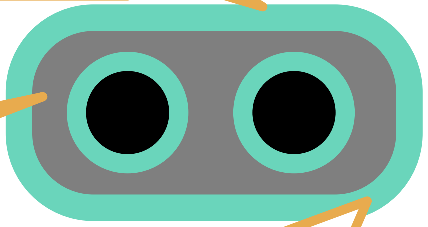

sum++, -- sum etc are valid expressions

There is an entire family of shortcuts

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Post-increment

Pre-increment

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```

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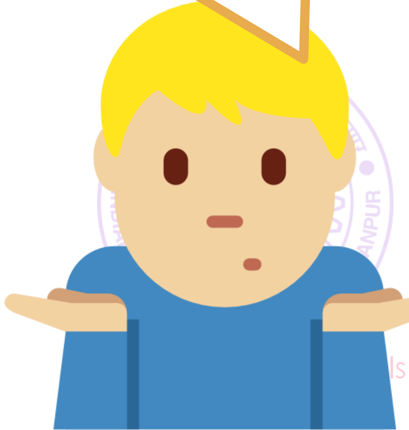

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Incrementing a variable by one

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Post-increment

Pre-increment

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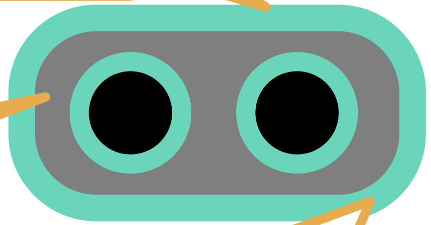


There is an entire family of shortcuts

Next slide ☺

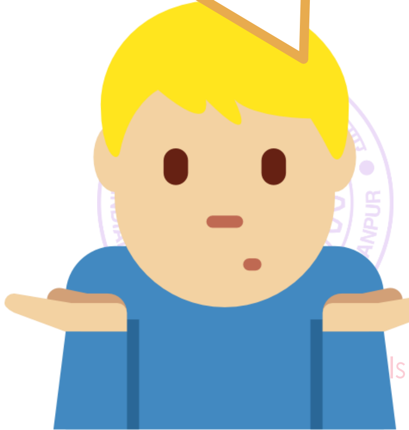
Decrementing a variable by one

```
sum = sum – 1;
sum--;
--sum;
```

Post-decrement

Pre-decrement

What if I want to increment by 2?



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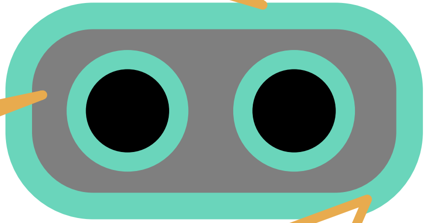

There is an entire family of shortcuts

Next slide ☺

Decrementing a variable by one

```
sum = sum – 1;
sum--;
--sum;
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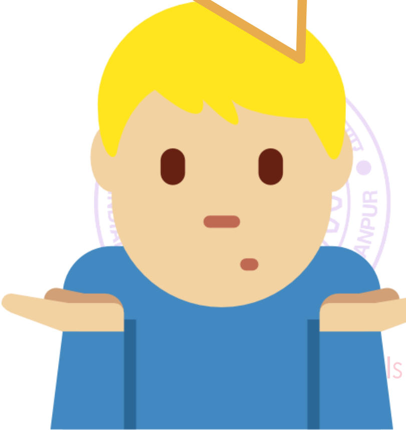
Post-decrement

Pre-decrement

Difference between post and pre?

What if I want to increment by 2?



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Post-increment

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sum = sum – 1;
sum--;
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```
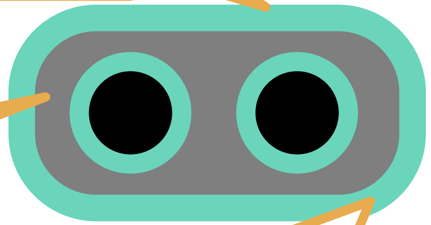

Post-decrement

Pre-decrement

Remember expressions generate values



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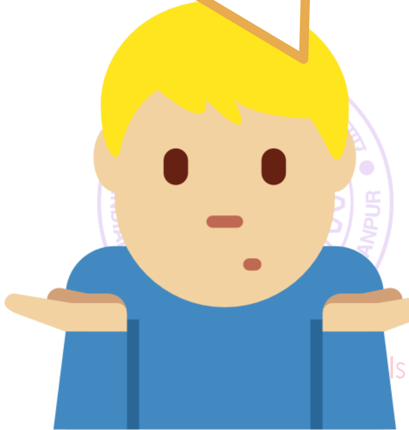
sum++, -- sum etc are valid expressions

There is an entire family of shortcuts

Next slide ☺

Difference between post and pre?

What if I want to increment by 2?



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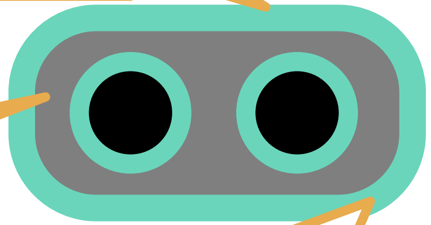

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Next slide ☺

Incrementing a variable by one

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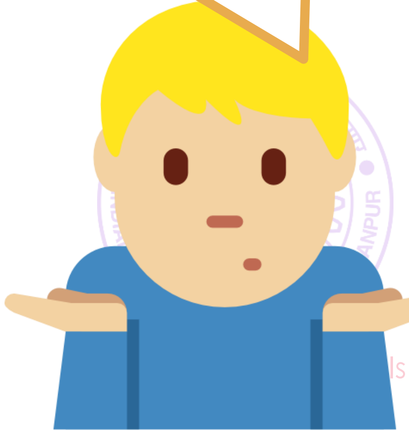
int a = 3, b = 5, c;



Two New Shortcuts

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Incrementing a variable by one

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```

Post-increment

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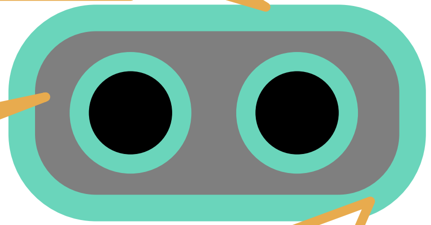


There is an entire family of shortcuts

Next slide ☺

Decrementing a variable by one

```
sum = sum – 1;
sum--;
--sum;
```

Post-decrement

Pre-decrement

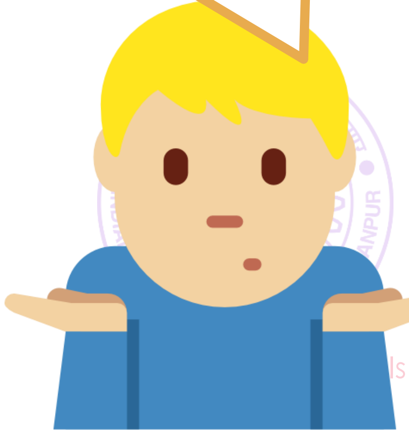
Difference between post and pre?

What if I want to increment by 2?

Remember expressions generate values

```
int a = 3, b = 5, c;
```

a + b generates value 8, and c = 7 generates value 7



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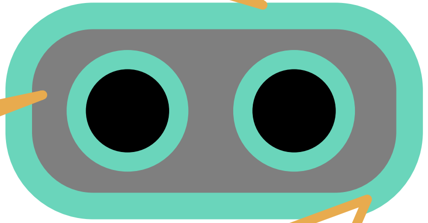

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Incrementing a variable by one

sum = sum + 1;

sum++; Post-increment

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Decrementing a variable by one

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Difference between post and pre?

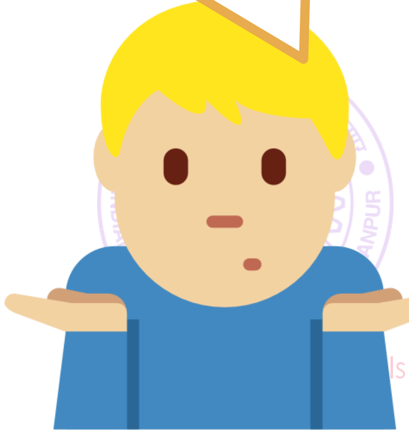
What if I want to increment by 2?

Remember expressions generate values

int a = 3, b = 5, c;

a + b generates value 8, and c = 7 generates value 7

Both a++ and ++a will result in new value of a being 4



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Remember expressions generate values

int a = 3, b = 5, c;

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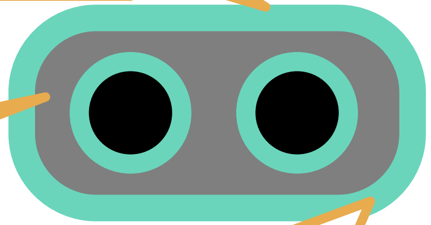
Both a++ and ++a will result in new value of a being 4

But a++ will generate 3 (old value) ++a will generate 4 (new value)



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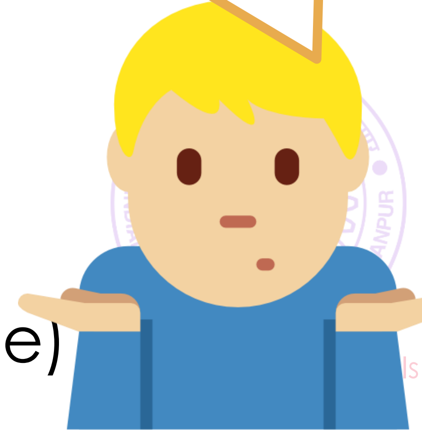
What if I want to increment by 2?



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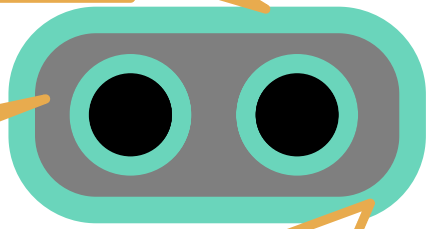

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Incrementing a variable by one

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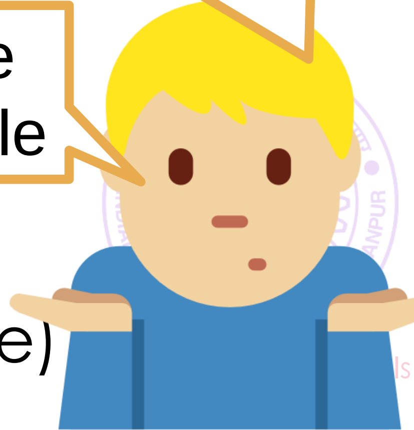
Difference between post and pre?

What if I want to increment by 2?

Show me an example



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a + b generates value 8, and c = 7 generates value 7

Both a++ and ++a will result in new value of a being 4

But a++ will generate 3 (old value) ++a will generate 4 (new value)

Okay … many more new shortcuts

```
a = a + b;
    a += b;
a = a – b;
    a -= b;
a = a * b;
    a *= b;
a = a / b;
    a /= b;
a = a % b;
    a %= b;
```

BODMAS table has new members

BODMAS table has new members

Operator Name	Symbol/Sign	Associativity
Bracket, **Post increment/decrement**	(), **++**, **--**	Left
Unary negation, **Pre increment/decrement**	-, **++**, **--**	Right
Multiplication/division/ remainder	*, /, %	Left
Addition/subtraction	+, -	Left
Assignment, **Compound assignment**	=, **+=**, **-=**, ***=**, **/=**, **%=**	Right

BODMAS table has new members

HIGH PRECEDENCE

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LOW PRECEDENCE

BODMAS table has new members

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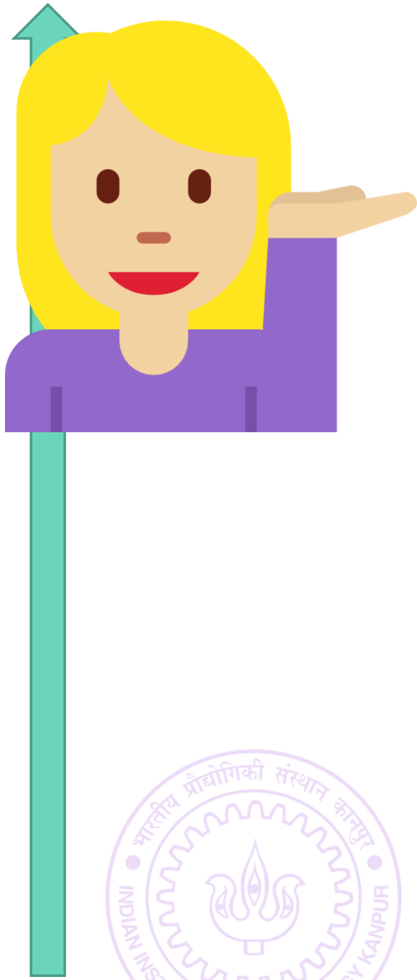

LOW PRECEDENCE

BODMAS table has new members

Write this table down in your notebook. Allowed in labs, quizzes, exams. No need to memorize.

Operator Name		
Bracket, **Post increment/decrement**	(), **++**, **--**	Left
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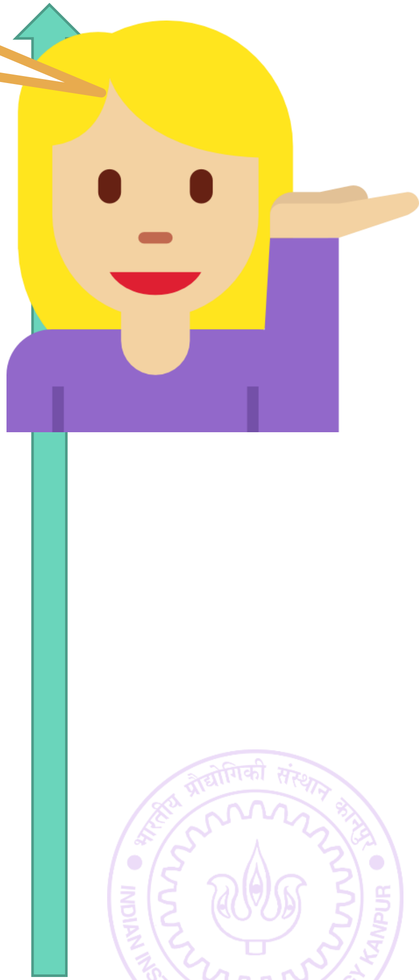
Assignment, **Compound assignment**	=, **+=**, **-=**, ***=**, **/=**, **%=**	Right

HIGH PRECEDENCE



LOW PRECEDENCE

Back to If Statements

- How to write more powerful choices
  - If something happens do this, else do that
  - If this AND this happens do this, else if that OR that happens, do that
- How to avoid common errors

The if statement

The if statement

HOW WE USUALLY SPEAK TO A HUMAN

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HOW WE USUALLY SPEAK TO A HUMAN

Do you speak English?

The if statement

HOW WE USUALLY SPEAK TO A HUMAN

Do you speak English?

Hello

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m is an integer variable.

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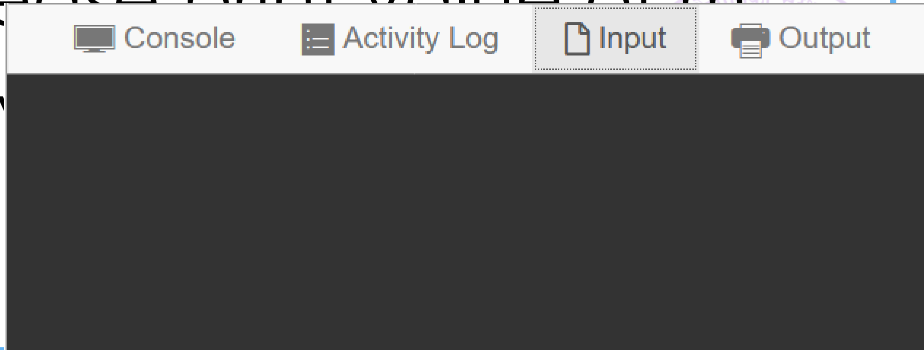

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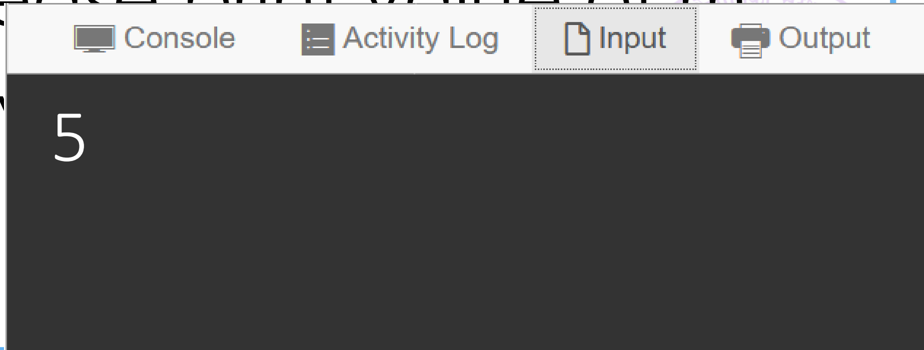

```
5
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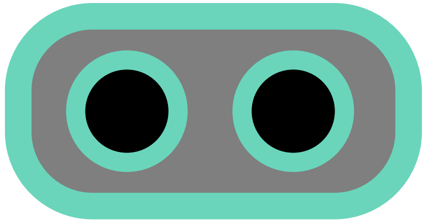

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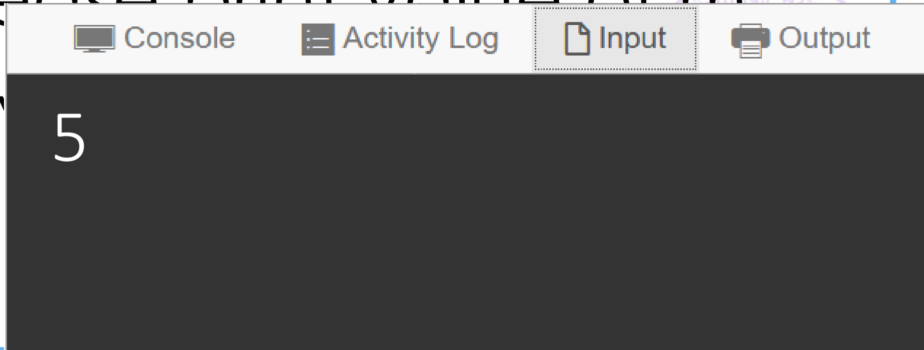

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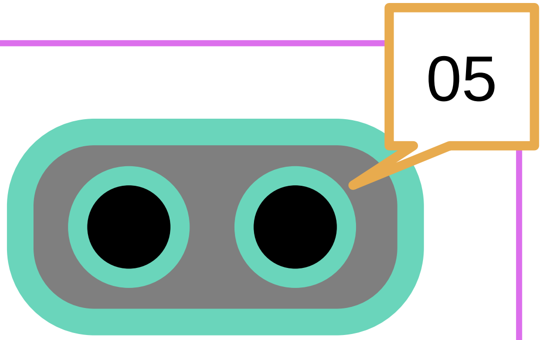
HOW WE MUST SPEAK TO MR. COMPILER



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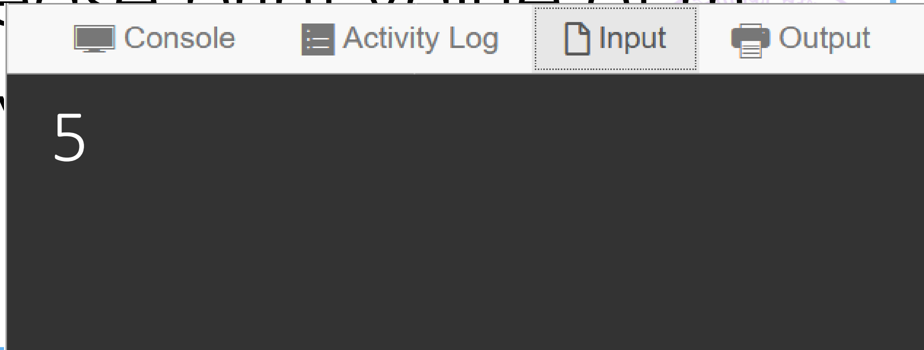

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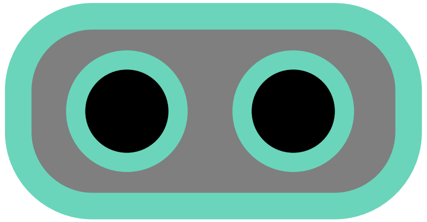

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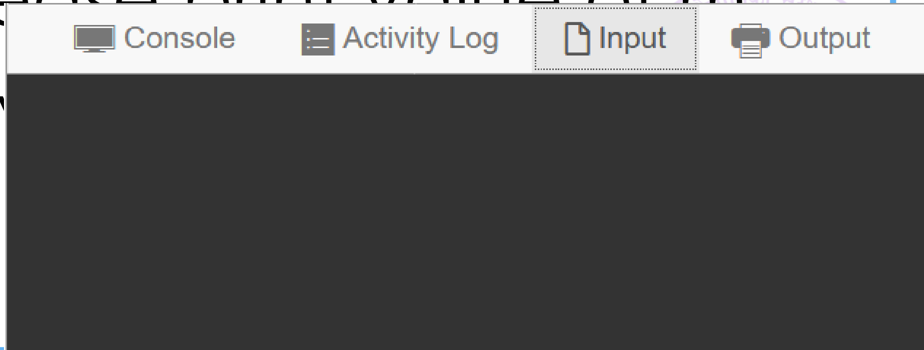

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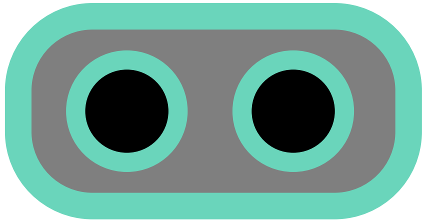

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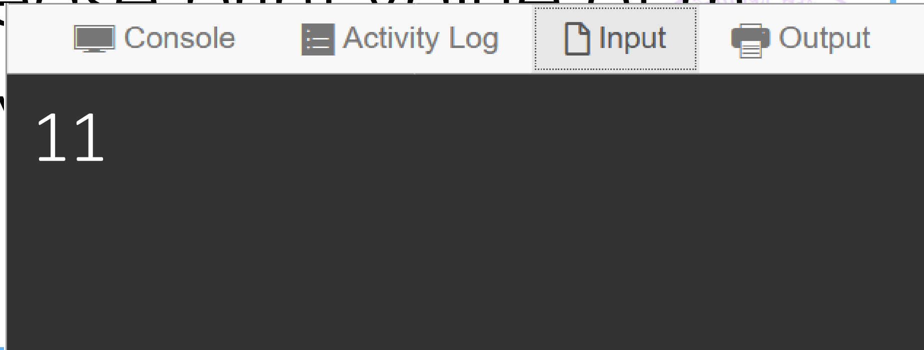
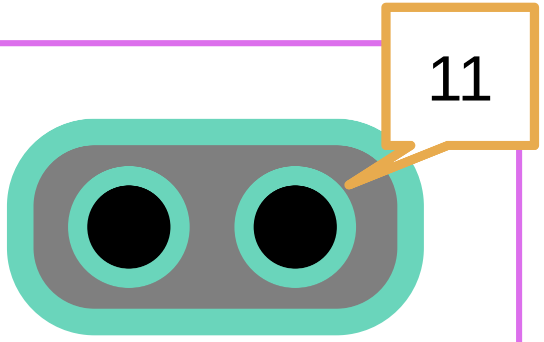


```
11
```

The if statement

HOW WE MUST SPEAK TO MR. COMPILER



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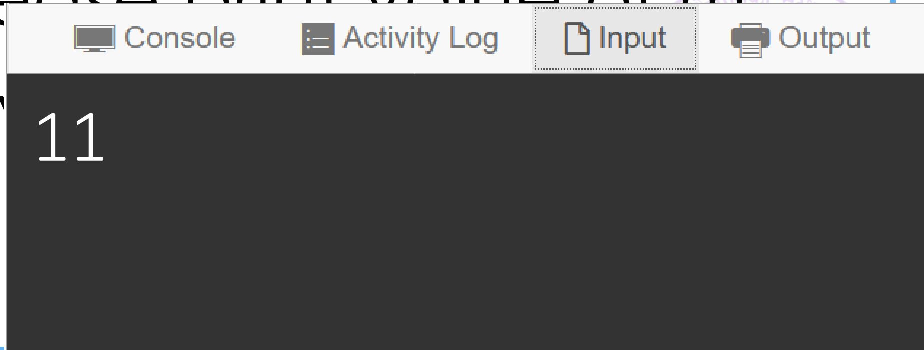

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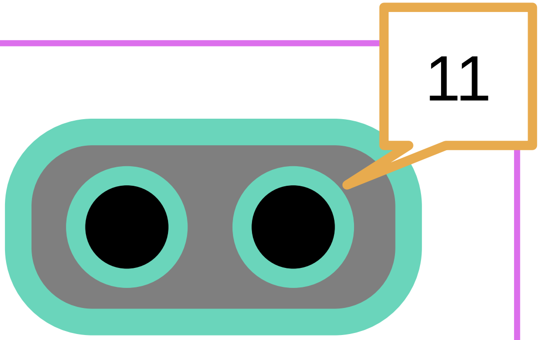

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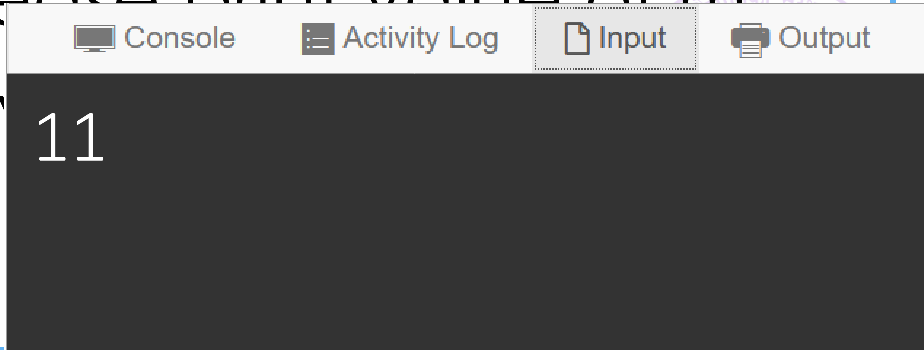

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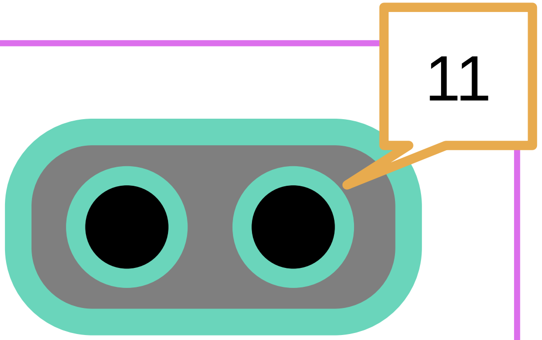

These curly brackets are used to tell Mr. C what all we want him to do if m < 10

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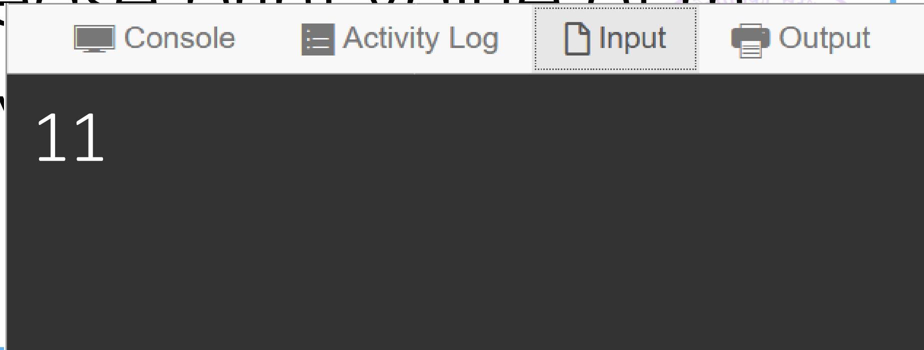

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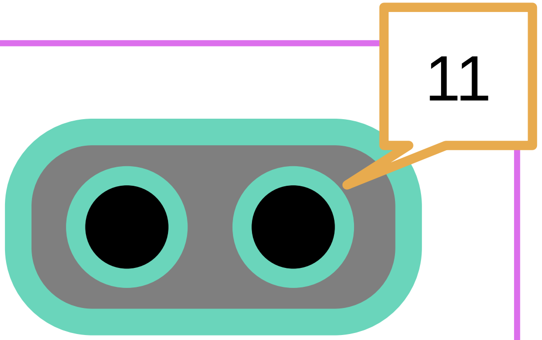

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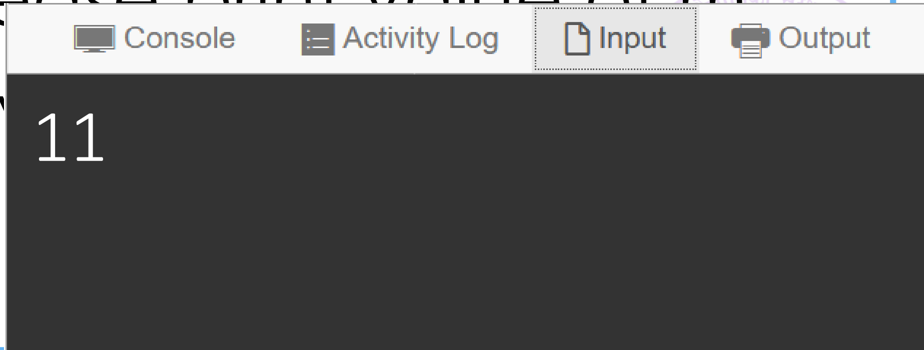

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The if statement

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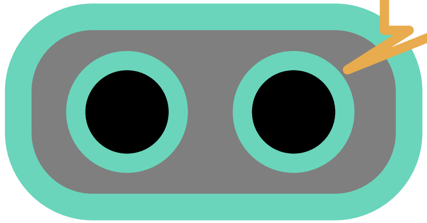

11

```
#include <stdio.h>
int main(){
    int m;
    scanf(“%d”,&m);
    if(m < 10){
        printf(“0”)
    }
    printf(“%d”,m);
}
```

This statement is always executed whether m < 10 or not

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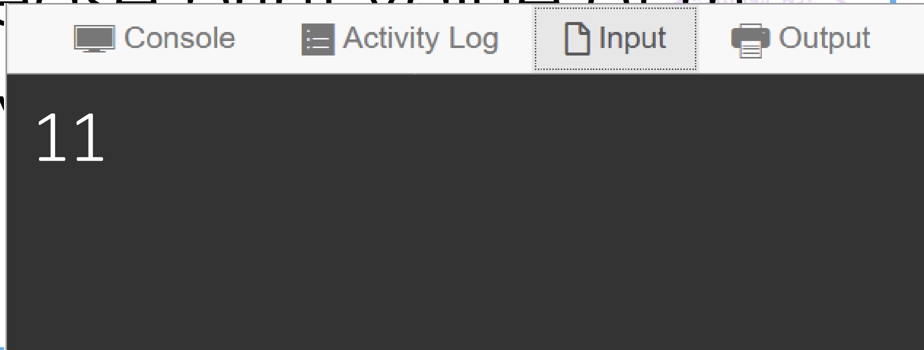

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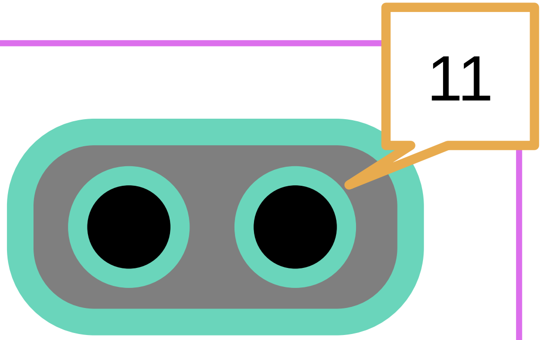

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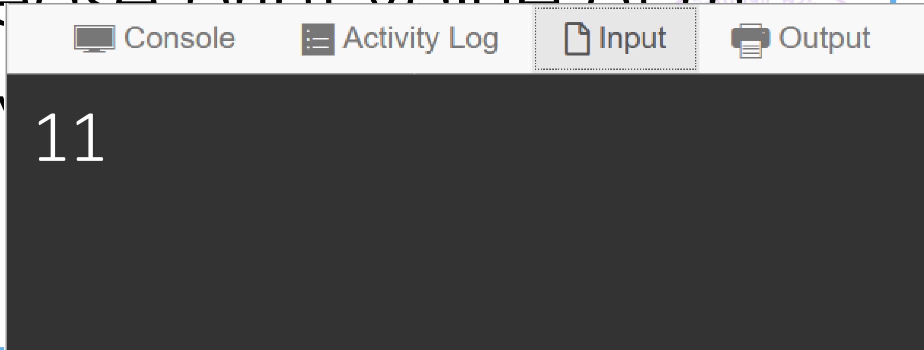

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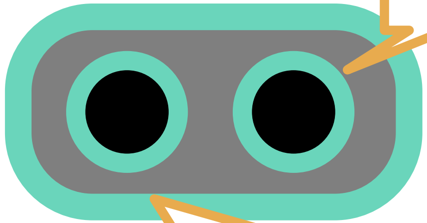

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Brackets essential in case you want me to do many things if m < 10, not just print one 0

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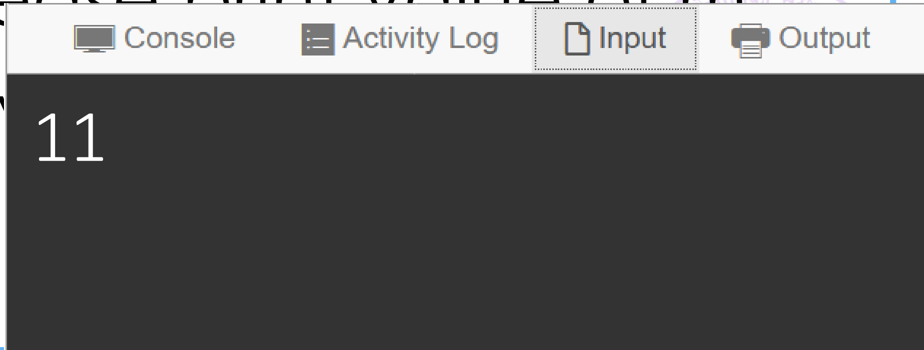

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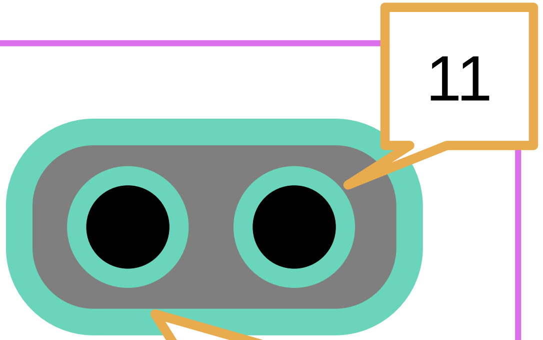

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Missing brackets - common mistake

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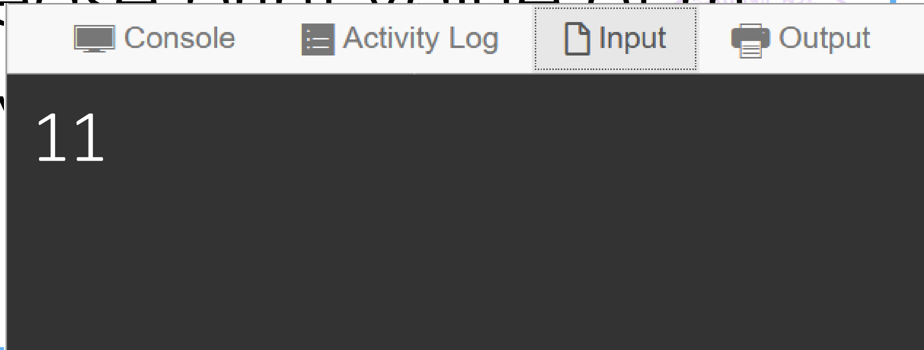

```
11
```

Freedom of Choice

Freedom of Choice

If m is less than 10

Freedom of Choice

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```
    if(m < 10){ ... }
```

Freedom of Choice

If m is less than 10

```
    if(m < 10){ ... }
```

If a is greater than or equal to b + c

Freedom of Choice

If m is less than 10

```
    if(m < 10){ ... }
```

If a is greater than or equal to b + c

```
    if(a >= b+c){ ... }
```

Freedom of Choice

If m is less than 10

```
    if(m < 10){ ... }
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If a is greater than or equal to b + c

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    if(a >= b+c){ ... }
```

If p is equal to q

Freedom of Choice

If m is less than 10

```
if(m < 10){ ... }
```

If a is greater than or equal to b + c

```
if(a >= b+c){ ... }
```

If p is equal to q

```
if(p == q){ ... }
```

Freedom of Choice

If m is less than 10

```
    if(m < 10){ ... }
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If a is greater than or equal to b + c

```
    if(a >= b+c){ ... }
```

If p is equal to q

```
    if(p == q){ ... }
```

If m is not equal to 15

Freedom of Choice

If m is less than 10

```
    if(m < 10){ ... }
```

If a is greater than or equal to b + c

```
    if(a >= b+c){ ... }
```

If p is equal to q

```
    if(p == q){ ... }
```

If m is not equal to 15

```
    if(m != 15){ ... }
```

Freedom of Choice

If m is less than 10

```
if(m < 10){ ... }
```

If a is greater than or equal to b + c

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if(a >= b+c){ ... }
```

If p is equal to q

```
if(p == q){ ... }
```

If m is not equal to 15

```
if(m != 15){ ... }
```

<, <=, >, >=, ==, != 6 new operators for Mr C!

Freedom of Choice

If m is less than 10

```
    if(m < 10){ ... }
```

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    if(p == q){ ... }
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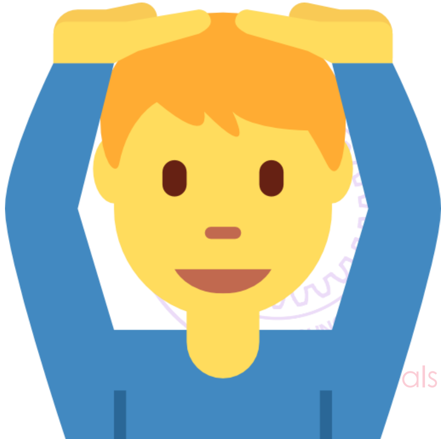

Freedom of Choice

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```
    if(m < 10){ ... }
```

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    if(p == q){ ... }
```

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```
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<, <=, >, >=, ==, != 6 new operators for Mr C!

Freedom of Choice

If m is less than 10

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    if(m < 10){ ... }
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If a is greater than or equal to b + c

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    if(a >= b+c){ ... }
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If p is equal to q

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    if(p == q){ ... }
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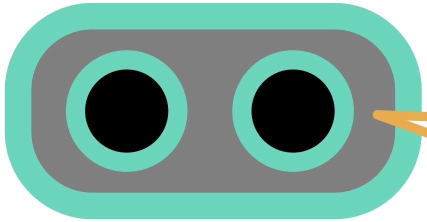

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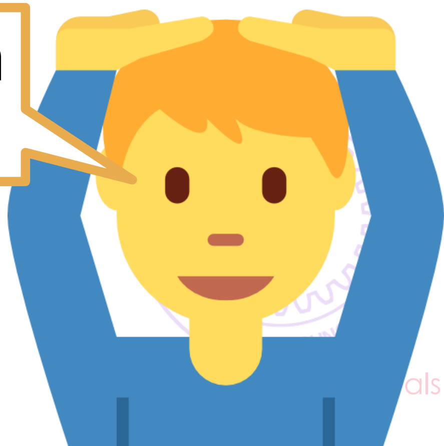

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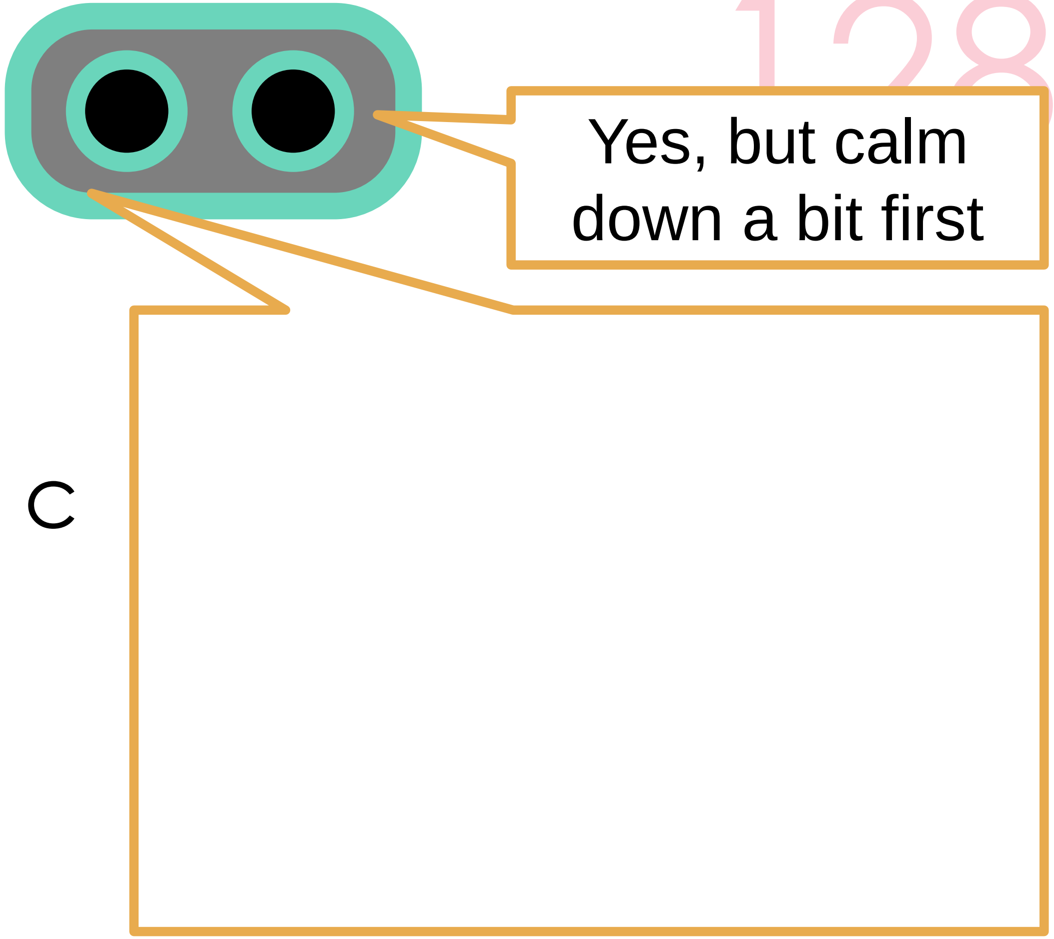

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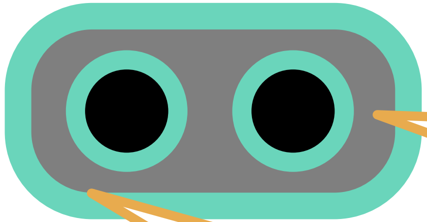

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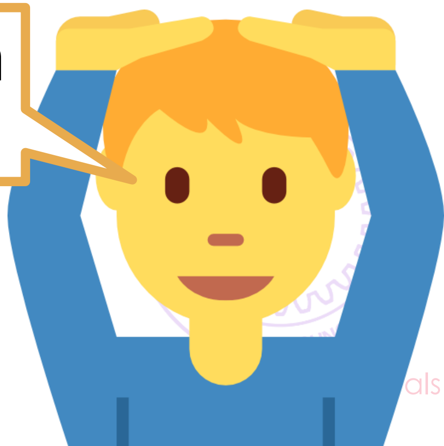

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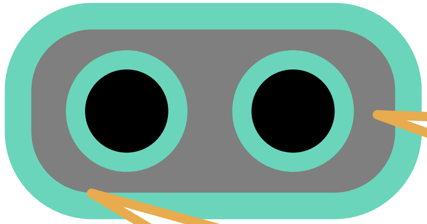

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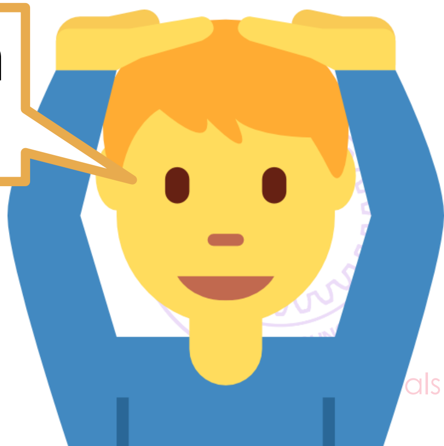

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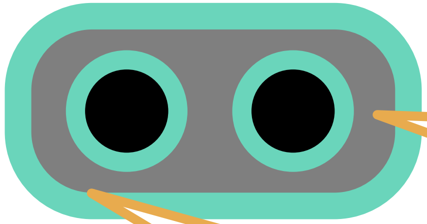

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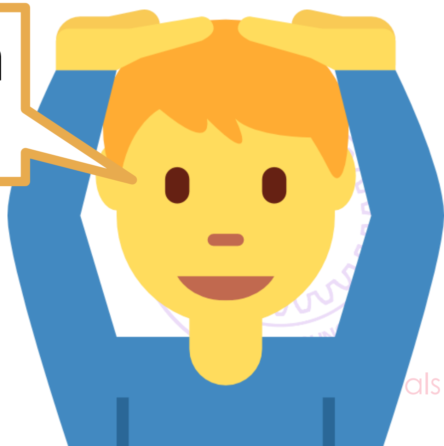

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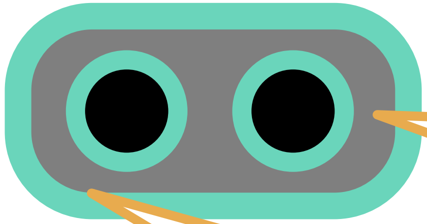

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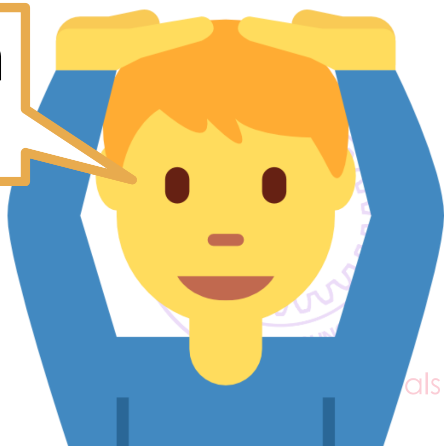

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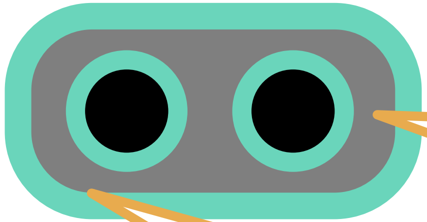

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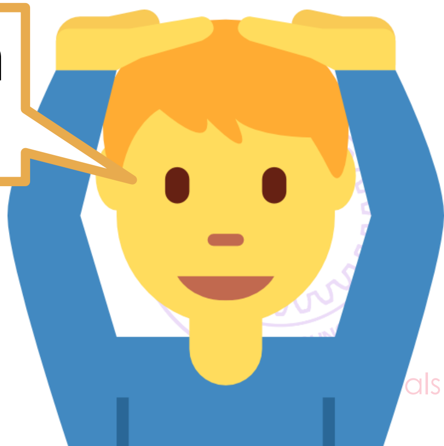

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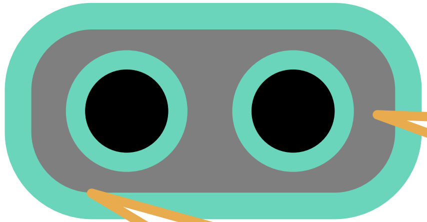

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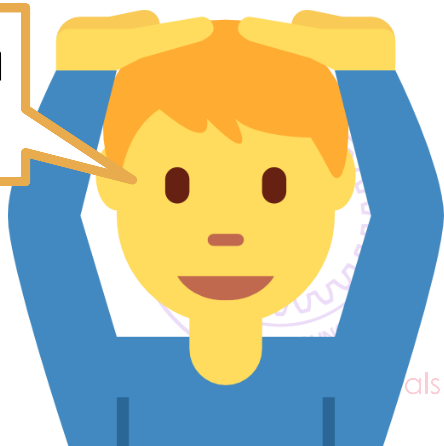

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More powerful conditionals

More powerful conditionals

HOW WE USUALLY SPEAK TO A HUMAN

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More powerful conditionals

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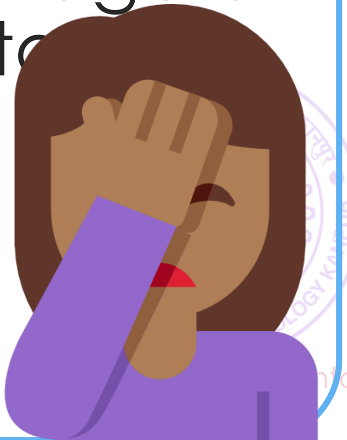

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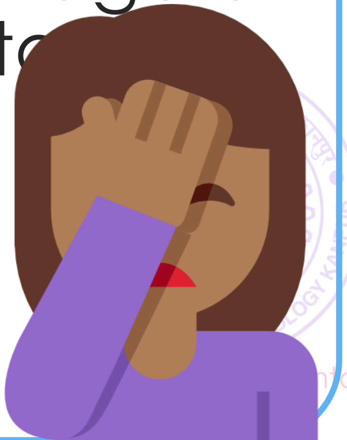

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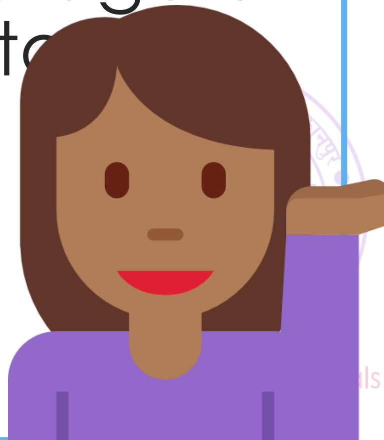

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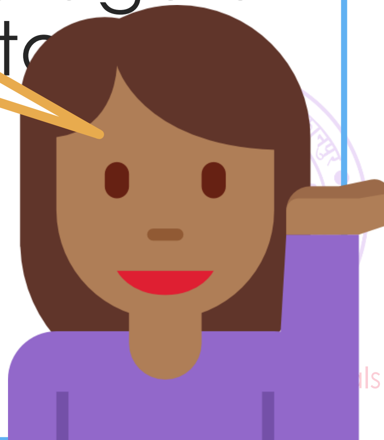

Artists sometimes differ on what is prettier

Even more powerful conditionals

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}else{



}
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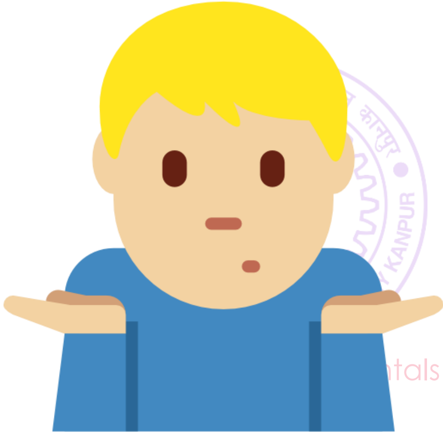

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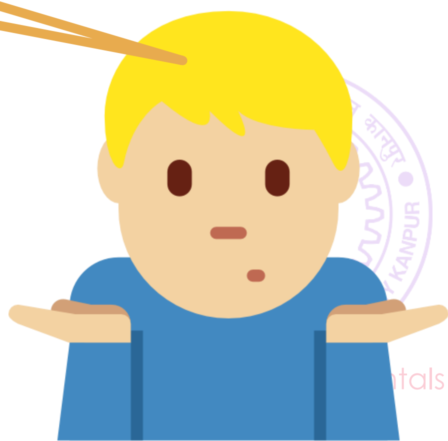

What all can I put inside these curly brackets

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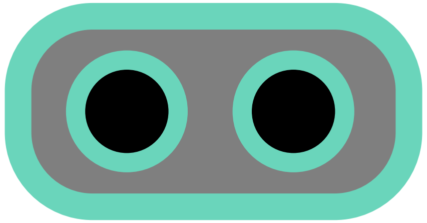
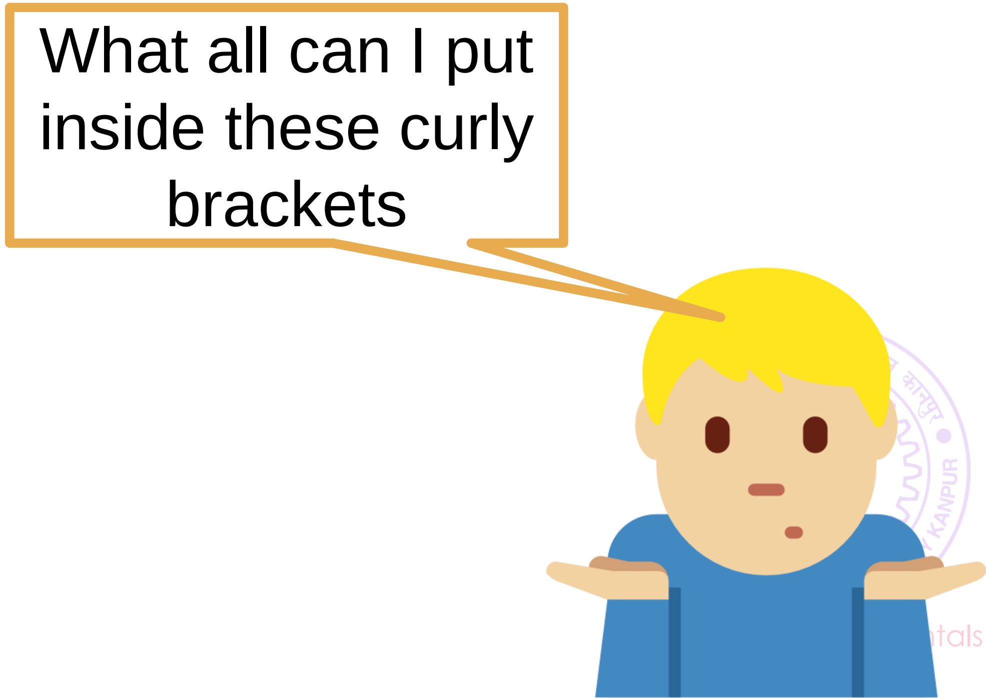
```





Even more powerful conditionals

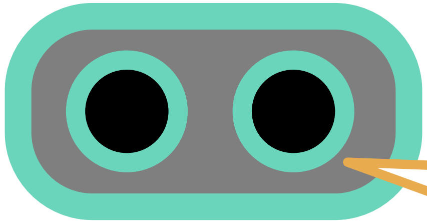
```
if((a + b)/2.0 < 0.5){



}else{

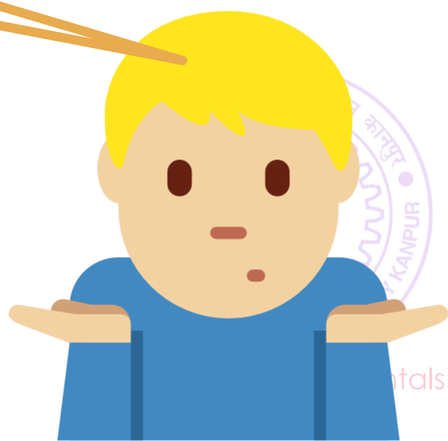


}
```



Any number of statements!

What all can I put inside these curly brackets



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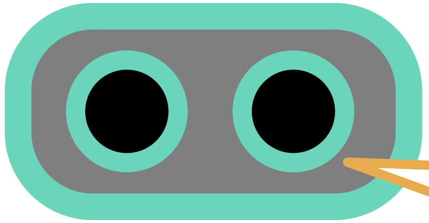

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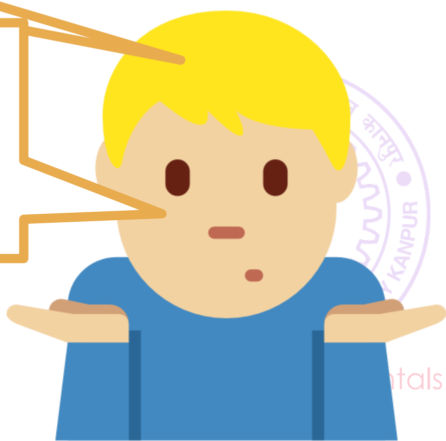

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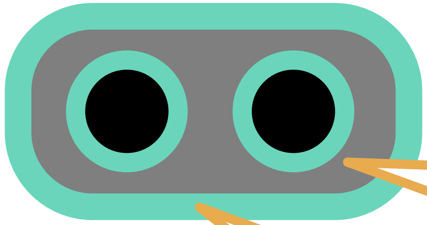

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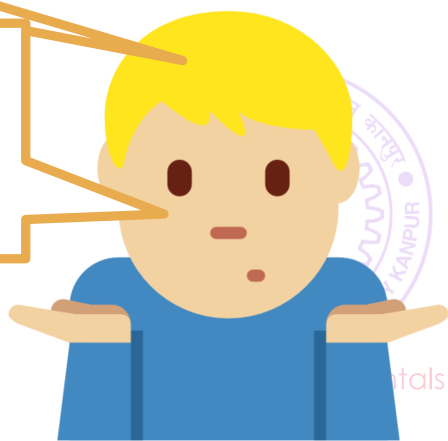
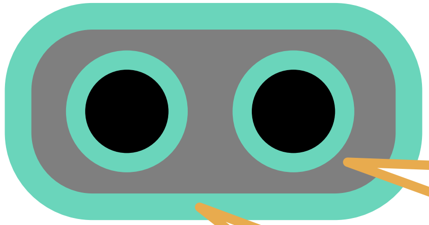


Even more powerful conditionals

```
if((a + b)/2.0 < 0.5){
        if((a + b)/2.0 < 0.25){
            printf("Very small");
        }else{
            printf("Small");
        }
}else{


}
```



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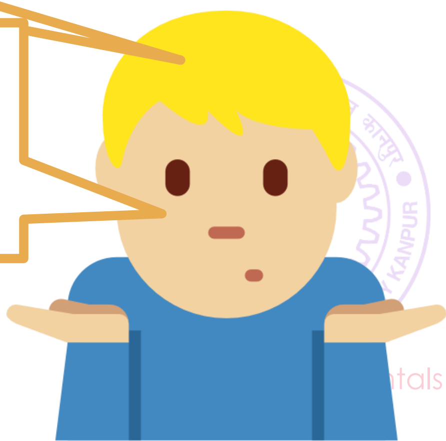

Even more powerful conditionals

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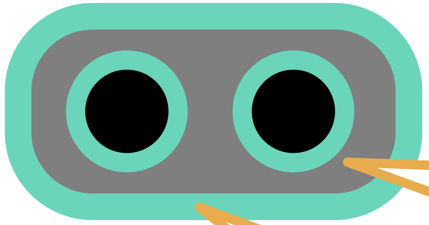

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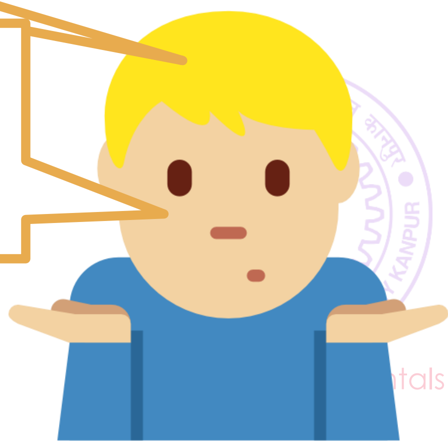

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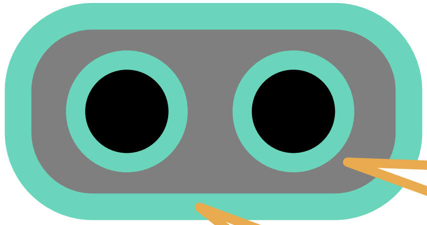
Only < 0.5



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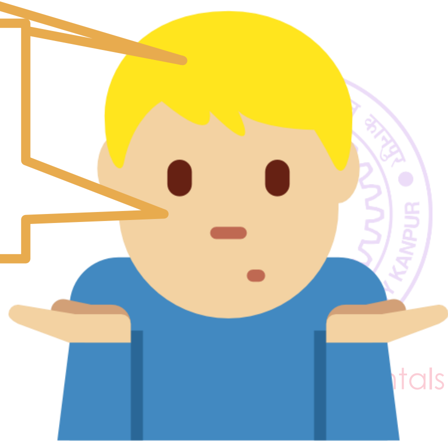

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Only < 0.5

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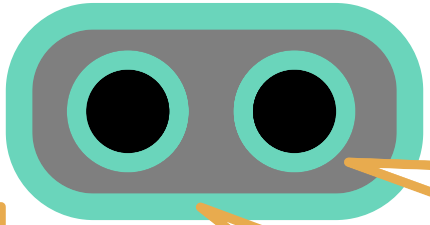

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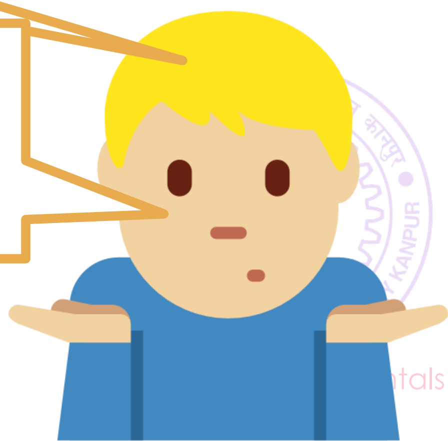

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Only < 0.5

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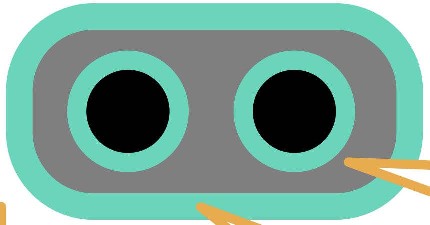

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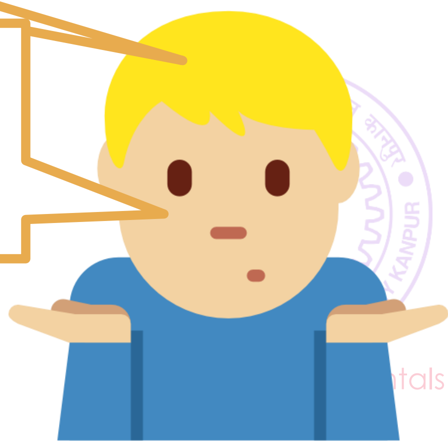

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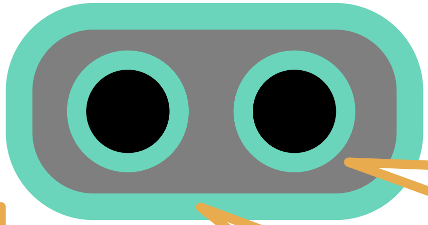

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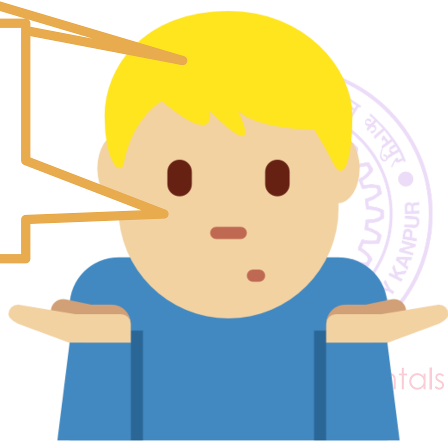

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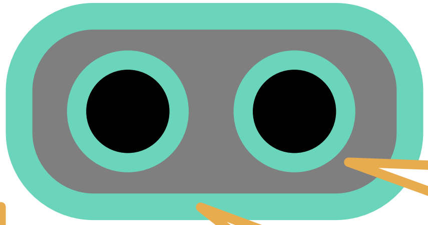
>= 0.5 as well as > 0.75



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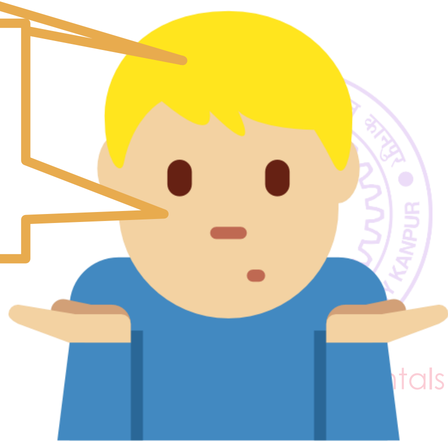

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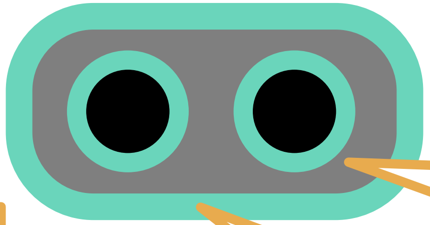

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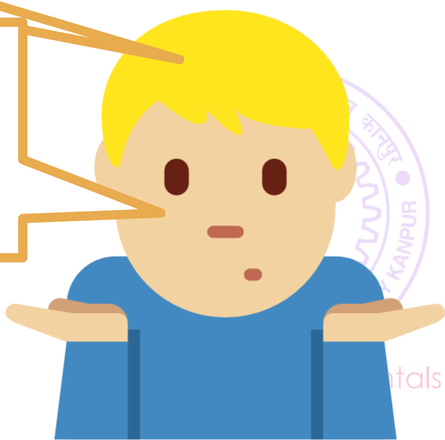

The Goldilocks Challenge

The Goldilocks Challenge

Write a program to take a temperature and print

The Goldilocks Challenge

Write a program to take a temperature and print

Too Cold if temperature is below 22

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Write a program to take a temperature and print

- Too Cold if temperature is below 22
- Just Right if between 22 and 27

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if(temp < 22){
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if(temp < 22){
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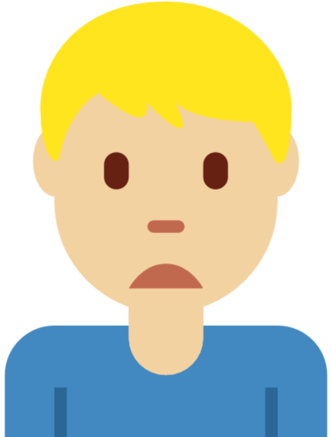

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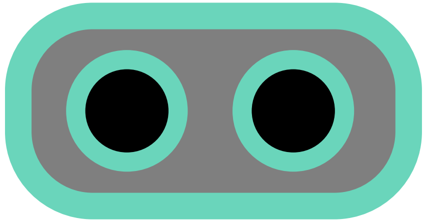

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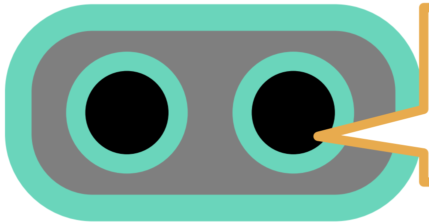
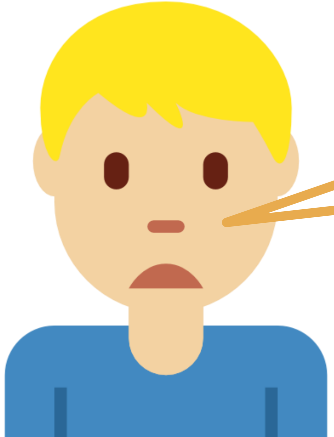


Remember, expressions generate values



What just happened?

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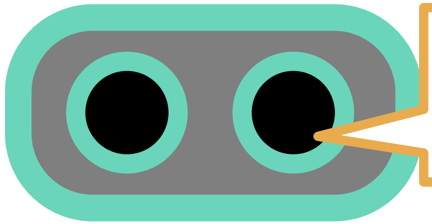

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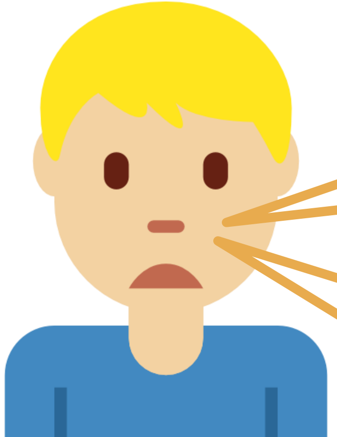

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What value does temp < 22 generate?

The Goldilocks Challenge

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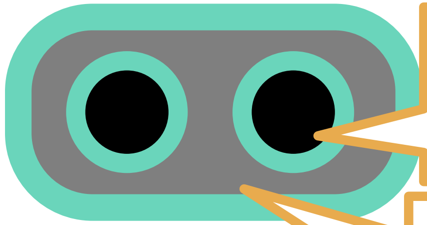
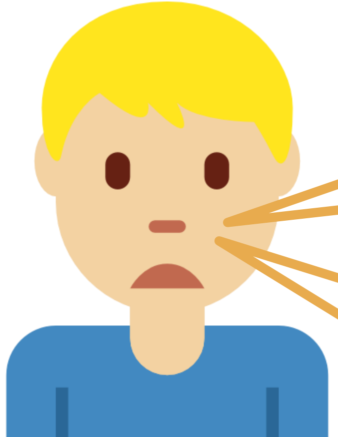


Remember, expressions generate values

If temp is less than 22, it generates value 1. If temp is greater than or equal to 22, it generates value 0



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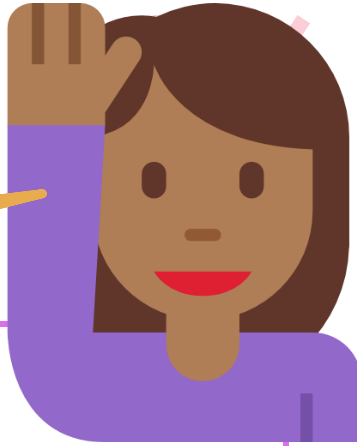
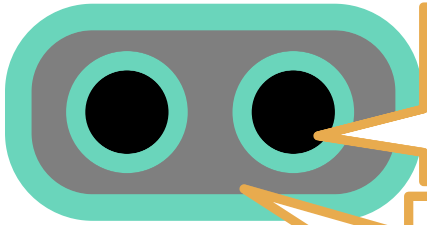


Mr C considers 0 to be FALSE and 1 (or anything non-zero) to be TRUE

```
    printf(“Too Cold”);
}else{
    if (22 <= temp <= 27){
        printf(“Just Right”);
    }else{
        printf(“Too Hot”);
    }
}
```



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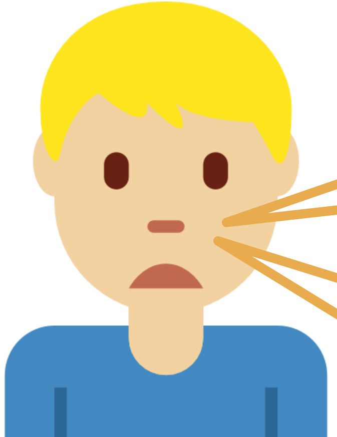

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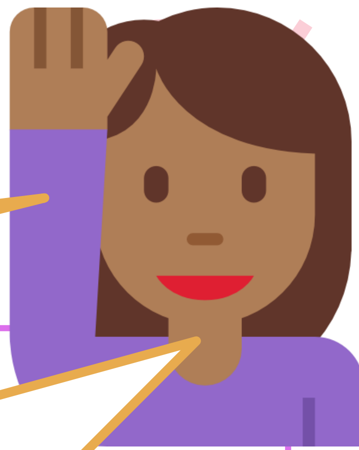
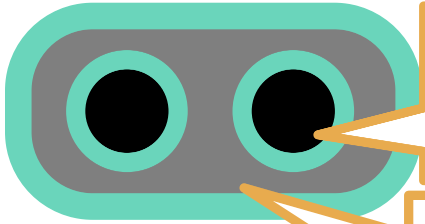


Mr C considers 0 to be FALSE and 1 (or anything non-zero) to be TRUE

If the expression inside if(…) evaluates to 1 or something non-zero, Mr C executes the if part. If the expression evaluates to 0, Mr C executes the else part



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```

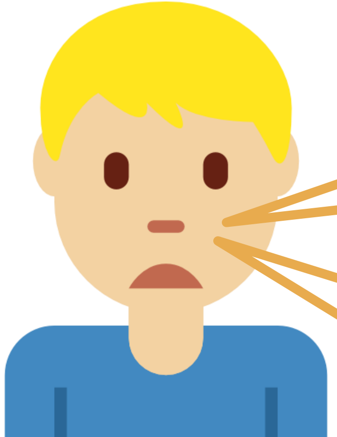

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Complex Relational Expressions

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<, <=, ==, >, >=, != are called *relational operators*

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22 <= temp <= 27 became ((22 <= temp) <= 27)

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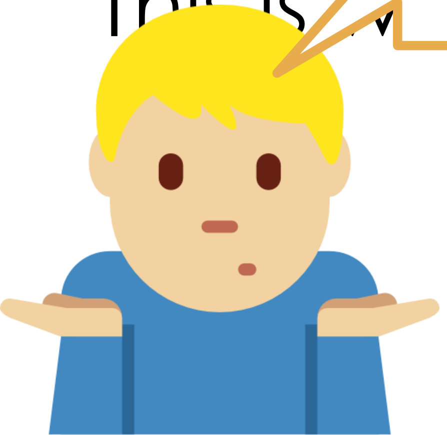

So how do I get Mr C to do something when temperature is between 22 and 27?

Logical Operators

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Used to create powerful conditions and choices

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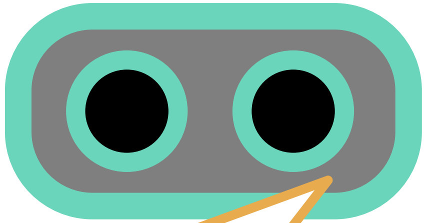

Bracket yourself to avoid errors and confusion

Logical Operators

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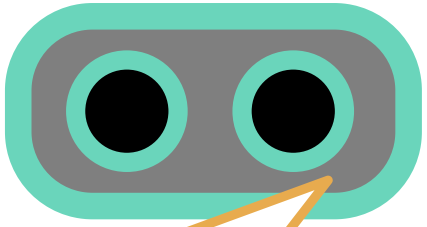

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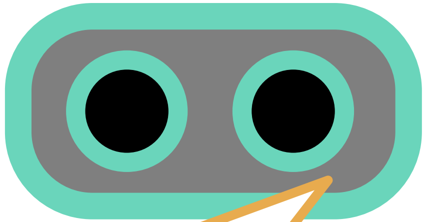

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If you don't put brackets, Mr C will put brackets according to his table

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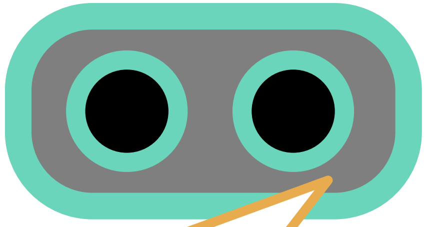

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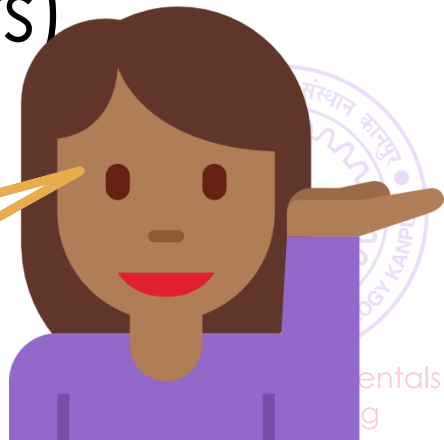
Lets show them the new table



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