Teaching Kids to Code with Minecraft

Learning and having fun.

(15 Apr 2025)

Course Content

👉Why Use Minecraft for Teaching Coding?

Minecraft: A Powerful Educational Tool

Minecraft is more than just a game—it's a learning platform that helps students develop:

✔ Problem-solving skills – Encourages logical thinking

✔ Creativity – Students build and experiment in an open world

✔ Programming fundamentals – Teaches coding through a hands-on approach

✔ Engagement – Kids love Minecraft, making learning exciting and fun

📌 This course provides a structured approach to teaching coding, ensuring students grasp key concepts through theory, hands-on exercises, quizzes, and independent activities.

Course Information

Quick Start

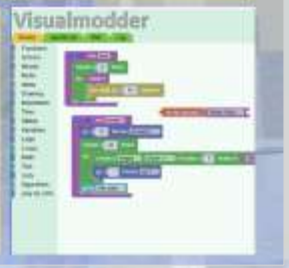
1

Let's have an immediate result!

The Coding Editor

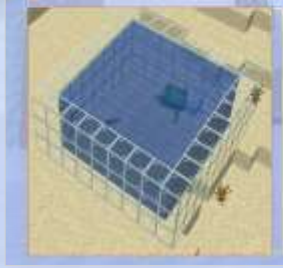
2

A quick overview of the coding editor



Iteration with Simple Loops

3

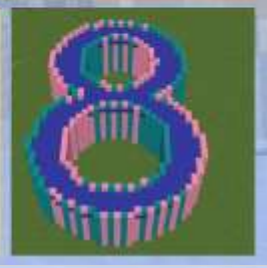


Learn to use the basic repeat command

Combining Blocks

4

Create beautiful structures by combining blocks



Course Information

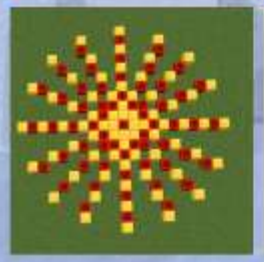
Moving in the world

5

Learn how to control the robot position

Horizontal Rotation

6



Amazing structures created with simple rotations

Vertical Rotation

7

Amazing structures created with simple rotations

Functions

8

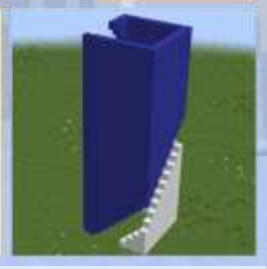
Organize code into functions

Course Information

Variables

9

Understand what variables are and why we need them



Counting Loops

10

Learn to use the "for" loop

Logic and Conditionals

11

"If .. then .. Else" and random numbers

Complex Shapes

12

Create non-geometric shapes

What You Need to Get Started

- ✅ Minecraft Java Edition – Each student needs a license if they don’t already own it
- ✅ Access to the VisualModder online server – No software installation required
- ✅ 1 to 3 students per session – Ideal for small-group teaching
- ✅ A basic understanding of computers – No prior coding knowledge necessary

💡 With these simple requirements, teachers can immediately start delivering coding lessons in an interactive and engaging way.

How VisualModder Works

Simplifying Coding with a Visual Interface

◈ What is VisualModder? A online editor that allows students to code using a block-based, drag-and-drop system within Minecraft.

Why use it?

✔ Removes the complexity of syntax errors with block coding

✔ Provides instant feedback within Minecraft

✔ Teaches fundamental coding logic in an accessible way

📌 Students will start with simple commands and gradually move toward more advanced coding projects, all within the Minecraft world!

◈ If you have a maximum of 3 students and don't need a personal server, you can use the server at www.visualmodder.org at no cost. Otherwise you can download the free plugin and deploy it on your own Minecraft Server.

Lesson types

Step-by-Step Learning Path

📚 Theory Introduction – Slides explain coding concepts in a simple and visual way

⚡ Guided Exercises – Students follow along and build their first programs

💡 Quizzes – Quick tests to reinforce understanding

🚀 Independent Challenges – Open-ended projects to encourage creativity

📌 By the end of the course, students will have created and run their first Minecraft program, building a customizable tower with different block types.

Start Teaching Today!

Empower Students Through Coding

🚀 Follow the slides to introduce coding concepts gradually

🛠️ Use VisualModder for hands-on, interactive learning

📚 Encourage students to experiment and explore beyond the exercises

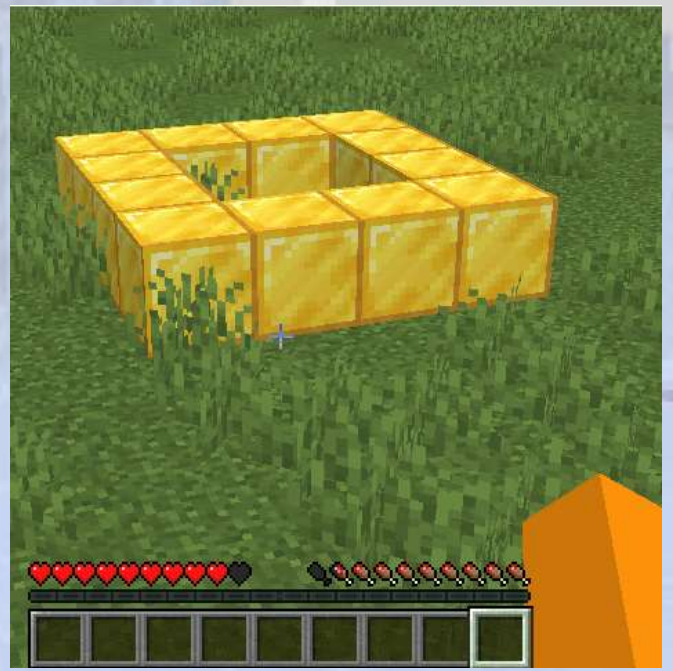
💡 Leverage quizzes and independent projects to solidify learning

📌 This PowerPoint is designed to be a complete teaching tool, providing everything needed to guide students from beginners to confident coders within Minecraft.

💬 Ready to begin? Let’s dive into the first lesson!

Quick Start

Let's have an immediate result!



Quick Start

🔍 Section Overview

This section introduces students to the fundamental tools, servers, and basic commands necessary for coding in Minecraft.

🎯 Objectives

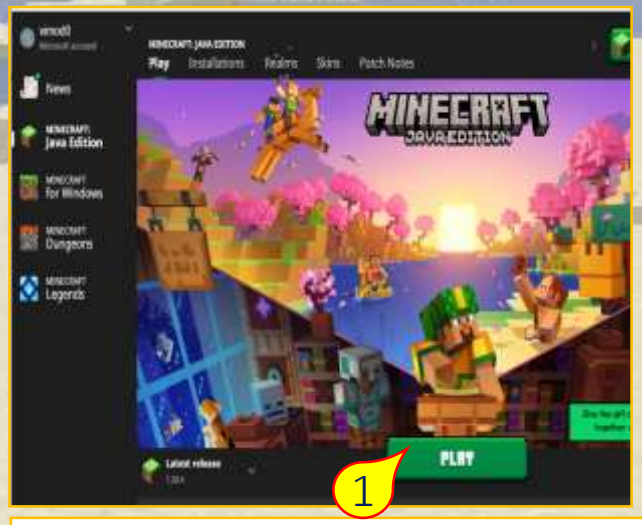
The main goal is to ignite students' interest in coding and provide them with an early sense of achievement, encouraging a passion for programming.

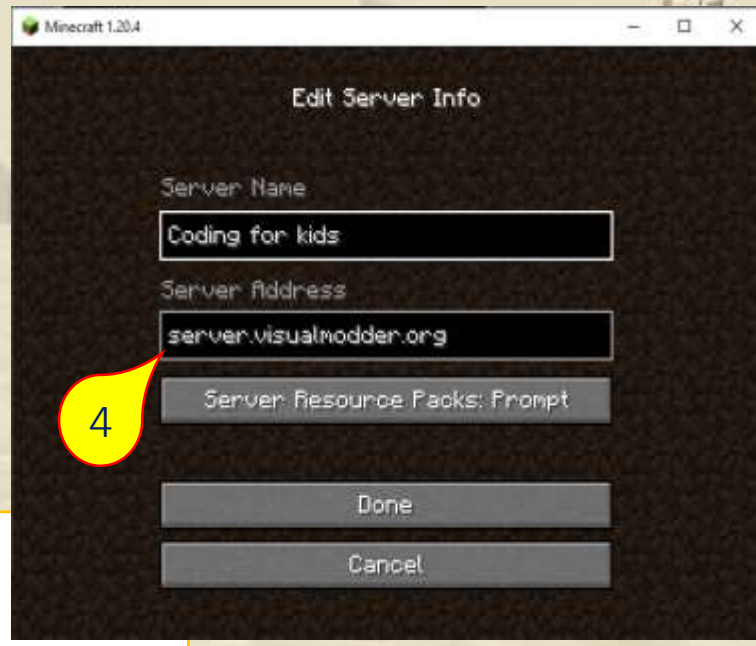
👌 Expected Outcomes

By the end of this section, students will have successfully created and executed their first Minecraft program, which generates a customizable tower using different block types.

Step 1: Connect to the Minecraft Server

Step-by-step guide to joining the Minecraft server





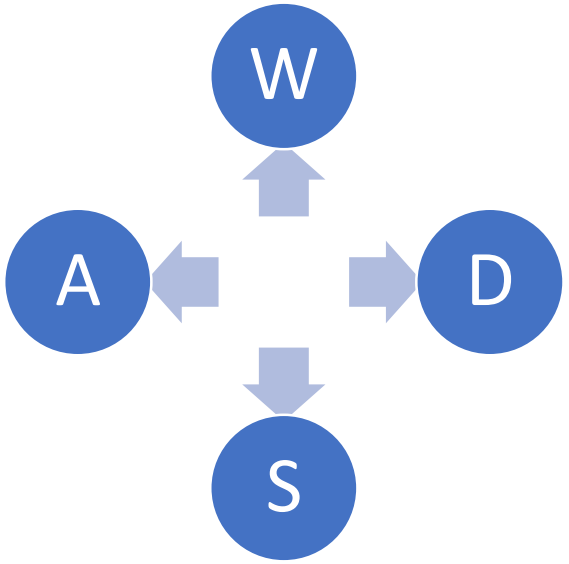
1. Start Java Minecraft
2. Start the game in “multiplayer” mode
3. Add a new server
4. Enter “server.visualmodder.org” and press done
5. Now you can join the server and start playing

Step 1: Connect to the Minecraft Server

Now you should be able to move around in the Minecraft world.

Here are some basics:

Movement



Additional keys:

Jump: press space bar

Fly: double click space bar

Inventory: click letter E

Commands: click symbol “/” or “–”

Step 2: Create your first program

Open the visualmodder.org webpage and click on the “CODE EDITOR” button

Step 2: Create your first program

This is the empty page of the program editor.

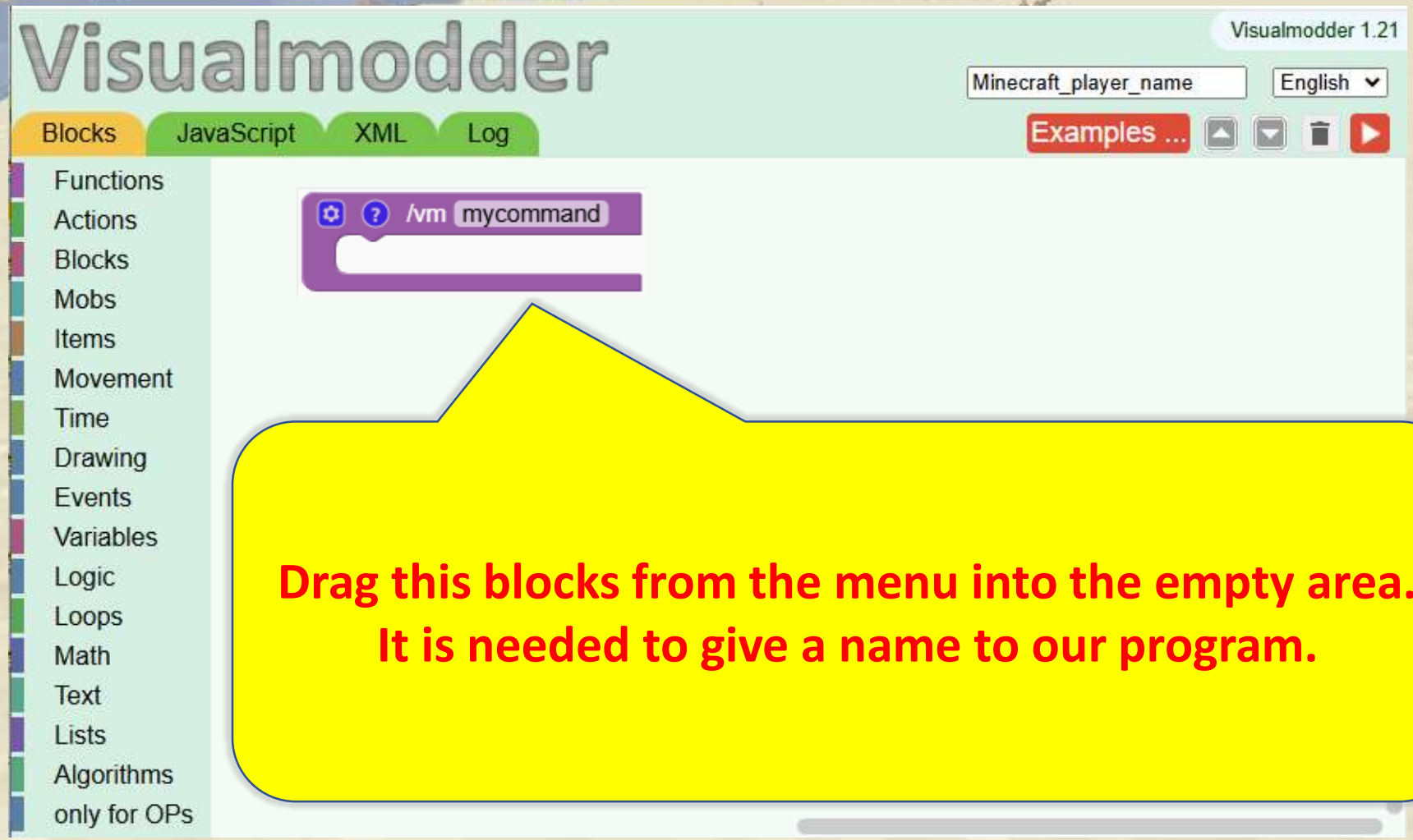
To understand it better, Imagine that an invisible robot is working for us and this empty page is it's brain. We have to add programs so that it knows what we want it to do.

Step 2: Create your first program

First we have to put our player name in the field indicated, otherwise we will not find our programs in Minecraft

Step 2: Create your first program

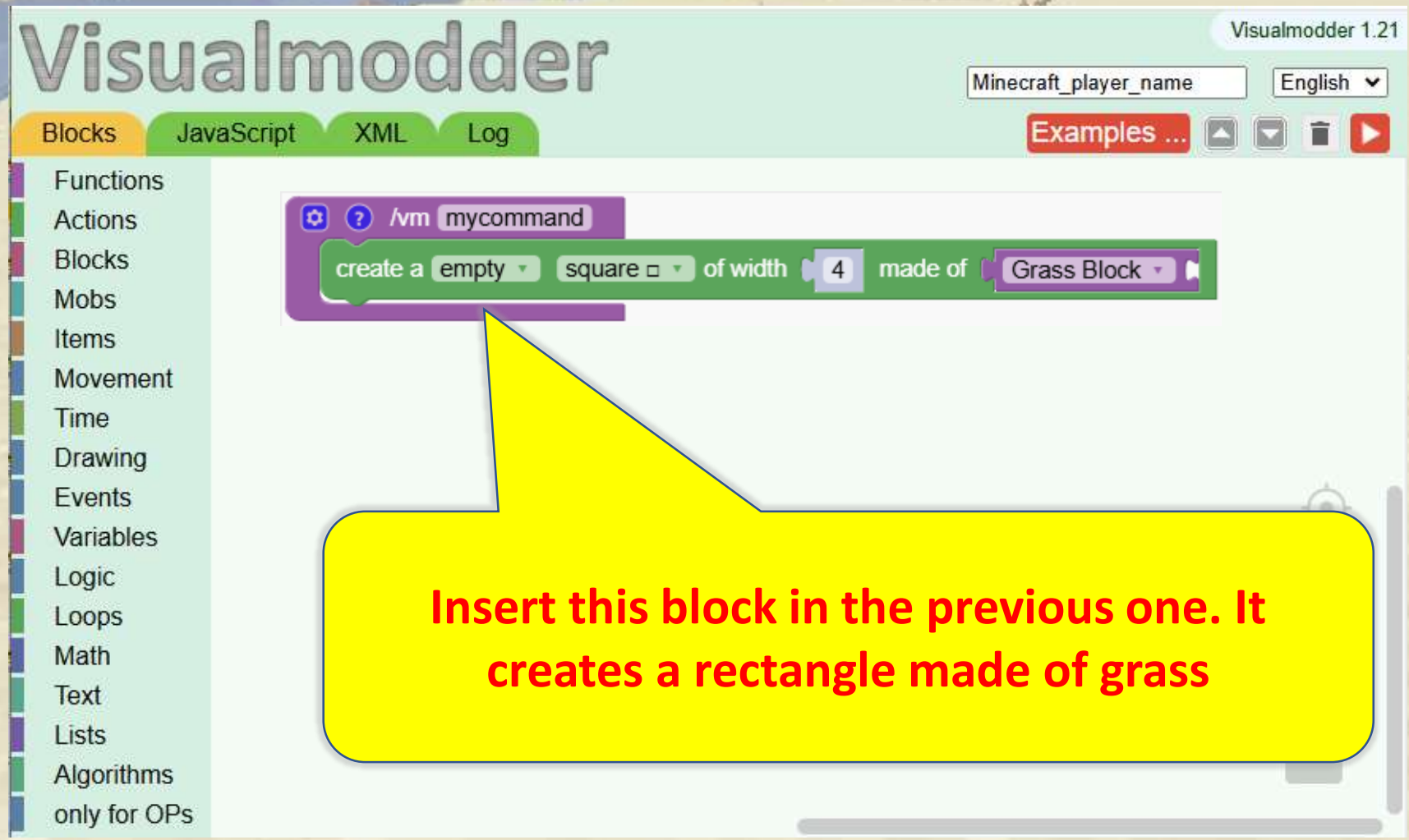
We create a first simple program that builds a square made of blocks.



Drag this blocks from the menu into the empty area.
It is needed to give a name to our program.

Step 2: Create your first program

Block coding allows to connect code like puzzle pieces



Step 2: Create your first program

We pick gold and now the program is ready.

Step 3: Run your first program in Minecraft

We go back to Minecraft and with the command key ‘/’ we type ‘vm mycommand’ which tells our robot to run the program called ‘mycommand’

Step 3: Run your first program in Minecraft

You did it! You ran your first program in Minecraft.

Step 4: Let’s do it again with a tower

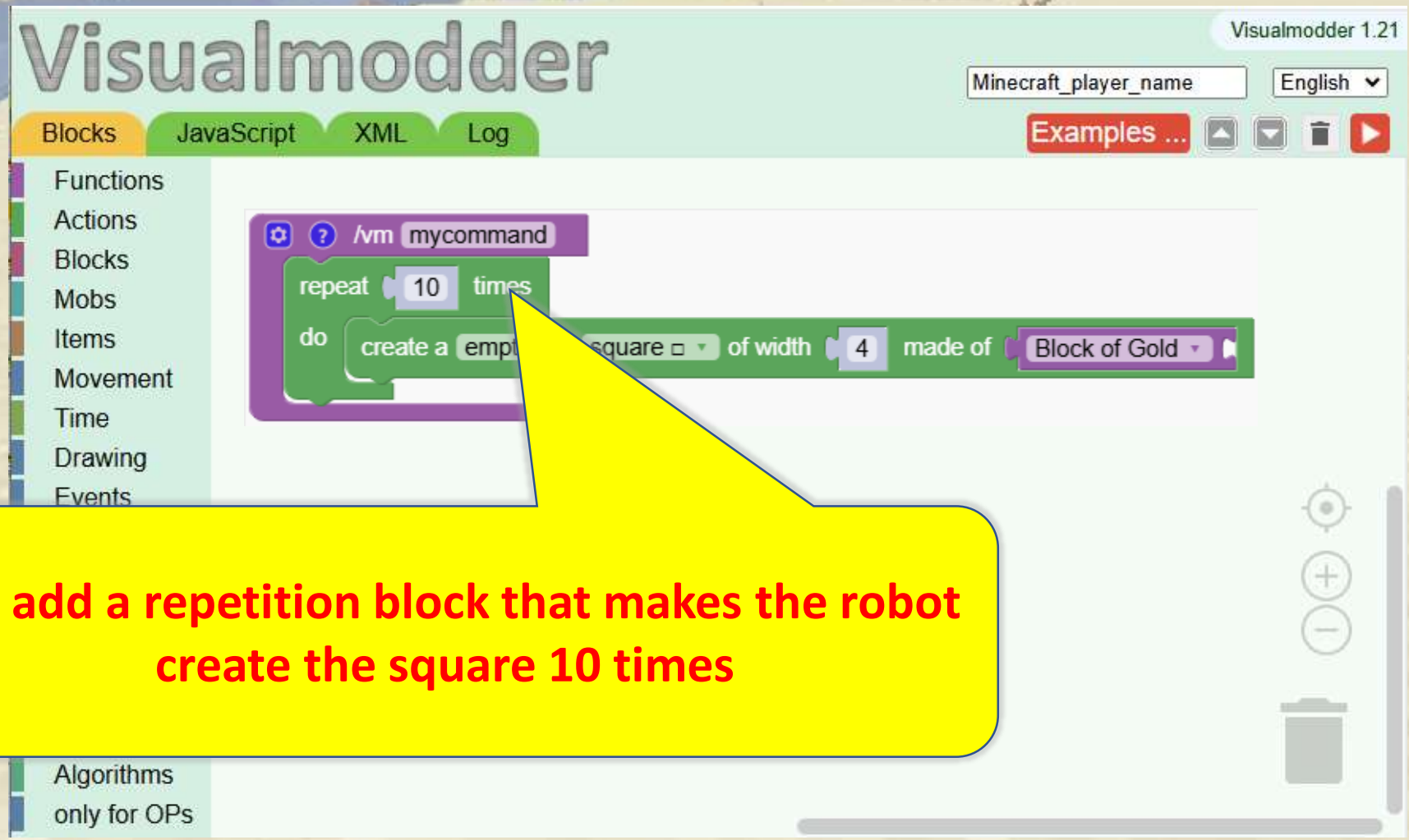
Let’s repeat the process, but this time we’ll make a tower

Step 4: Let’s do it again with a tower

We modify the previous program.

Step 4: Let’s do it again with a tower

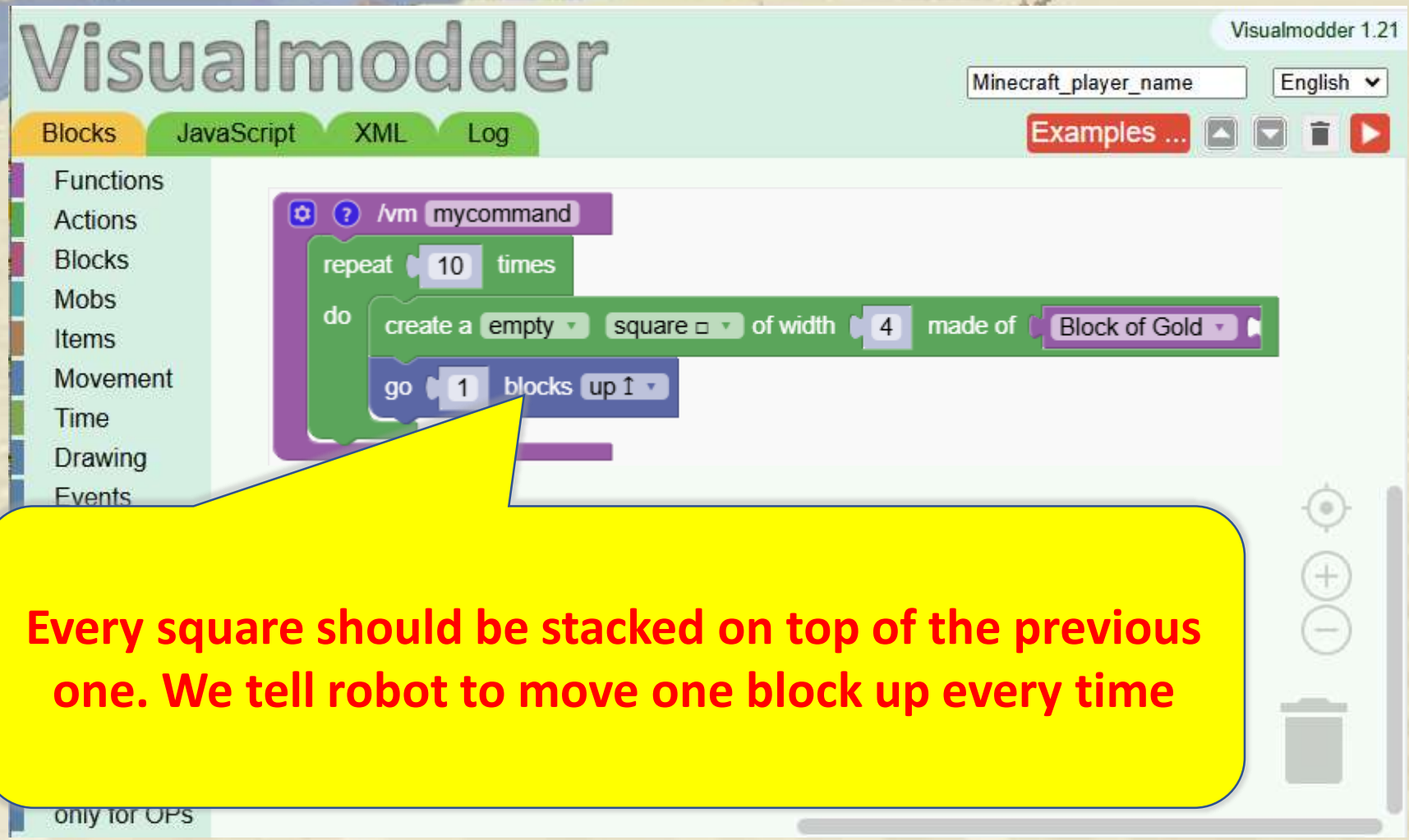
We repeat the square 10 times



We add a repetition block that makes the robot create the square 10 times

Step 4: Let’s do it again with a tower

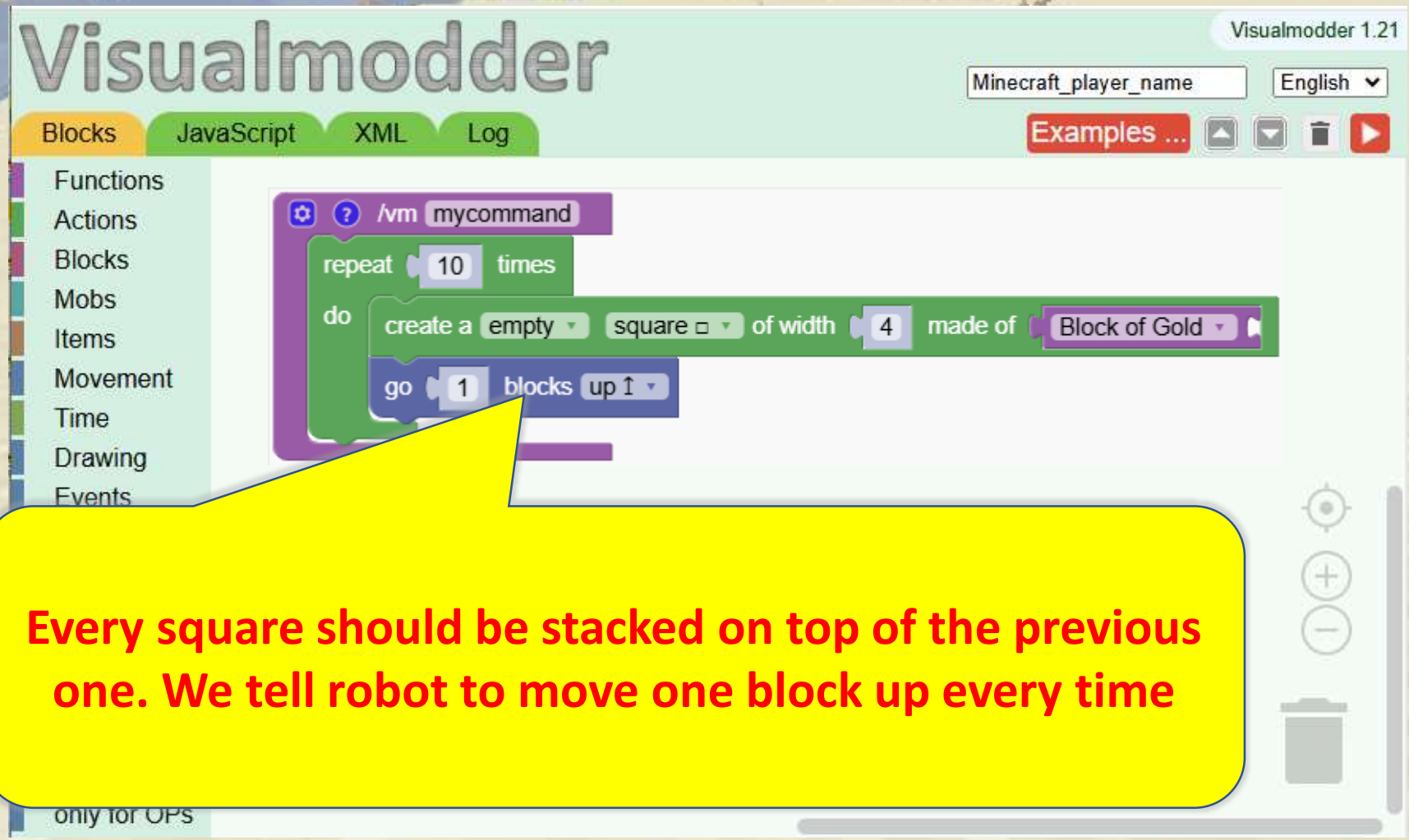
Robots need to be repositioned after creating a square



Every square should be stacked on top of the previous one. We tell robot to move one block up every time

Step 4: Let’s do it again with a tower

The program is ready.



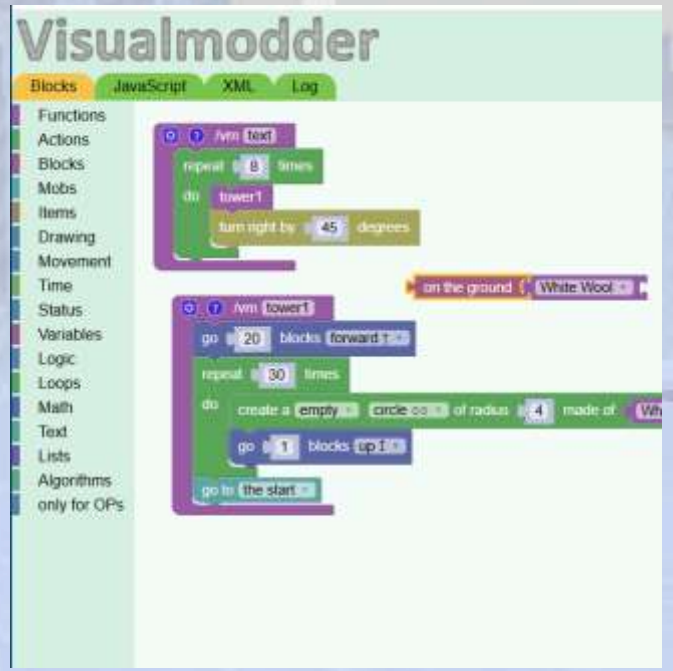
Every square should be stacked on top of the previous one. We tell robot to move one block up every time

Step 4: Let’s do it again with a tower

Type ‘vm mycommand’ and the tower will appear. (We are inside it. Just fly out ☺)

The Coding Editor

A quick overview of the coding editor



The Coding Editor

🔍 Section Overview

We explore the features and user interface of the coding tool to manage and edit programs efficiently.

🎯 Objectives

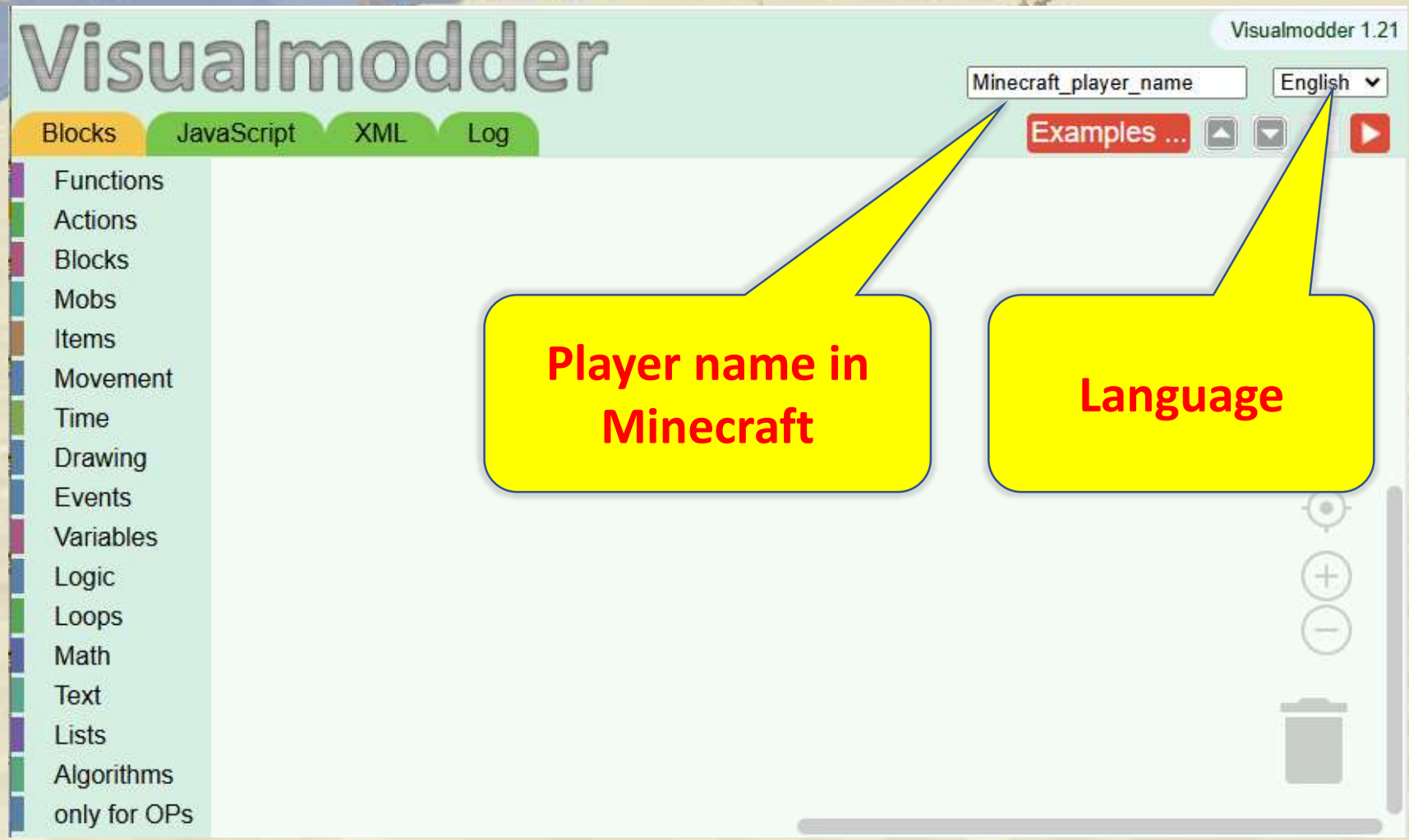
The main goal is to make the coding effort as easy as possible to keep the student’s focused on the coding itself

👌 Expected Outcomes

Understand the essential functions of the coding editor, such as saving, reloading, and organizing programs for better workflow.

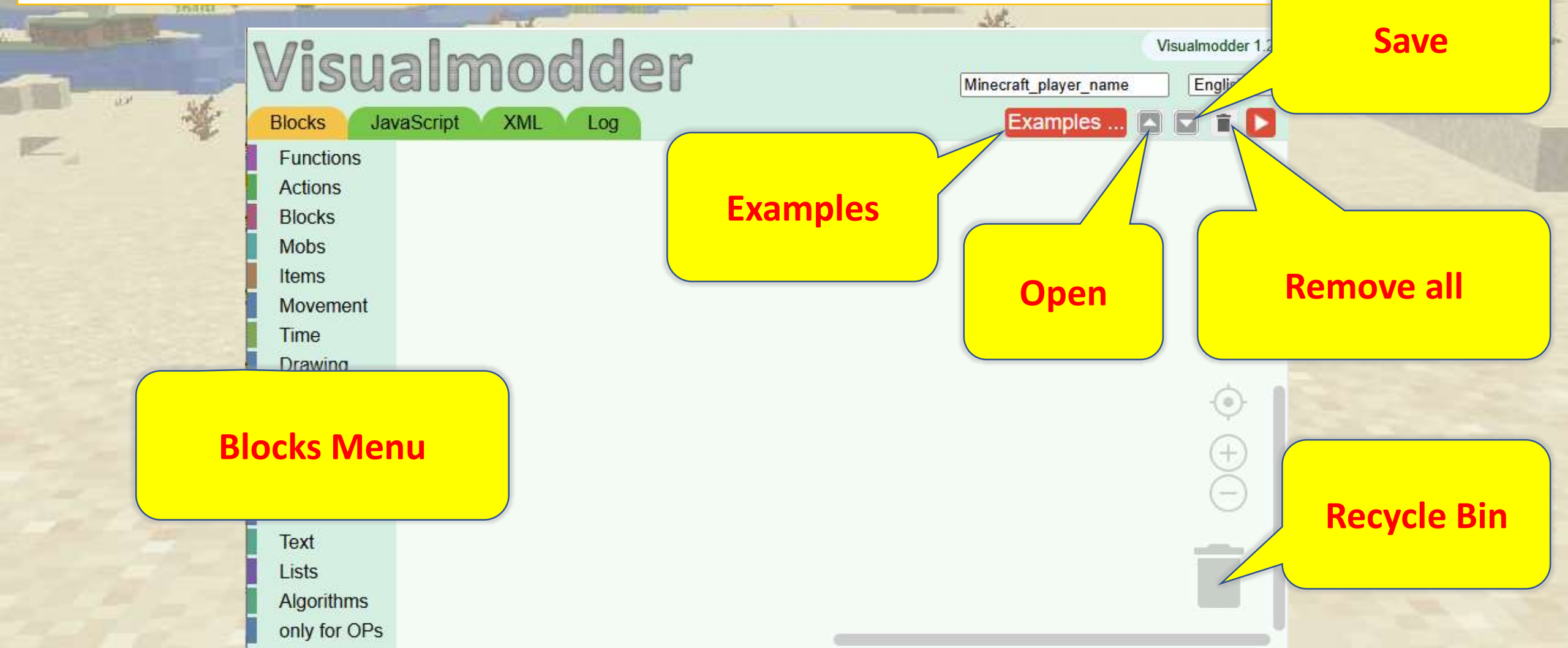
Explanation of the Editor User Interface

Set your preferred language and enter the player name you are using when playing in Minecraft.



Features of the Coding Editor

Here is a list of the fundamental controls of the coding editor



Save and Reload a Program

Practice saving, reloading, and continuing your work without losing progress.

Step 1:
Create some blocks and then click on the save button.
In the popup window you can choose the name of the file to create on your computer

Save and Reload a Program

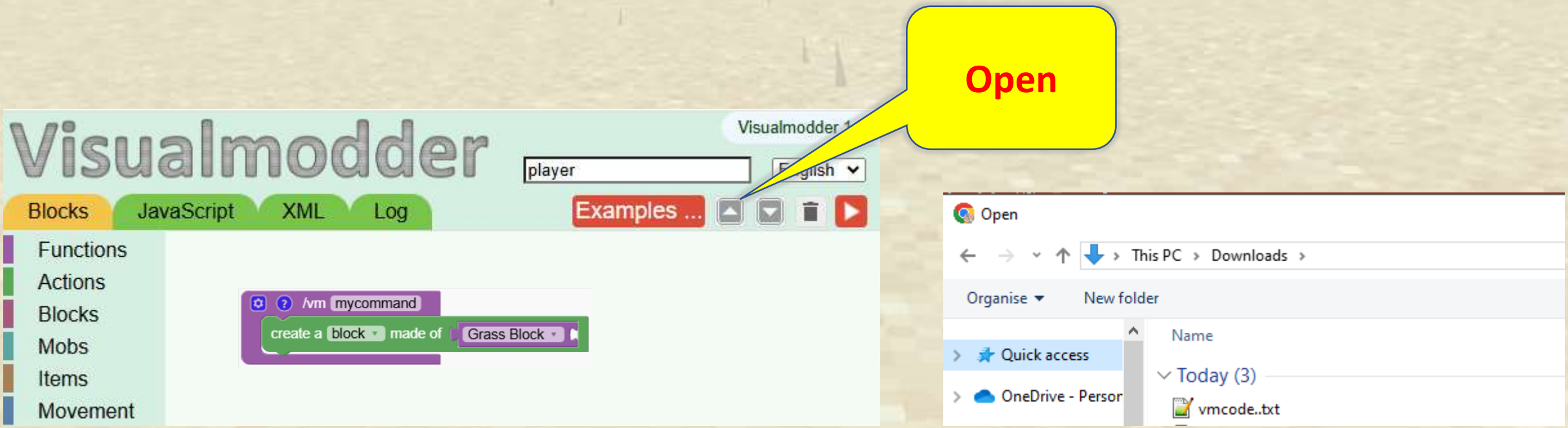
Practice saving, reloading, and continuing your work without losing progress.

Step 2:
Clean the workspace

Save and Reload a Program

Practice saving, reloading, and continuing your work without losing progress.

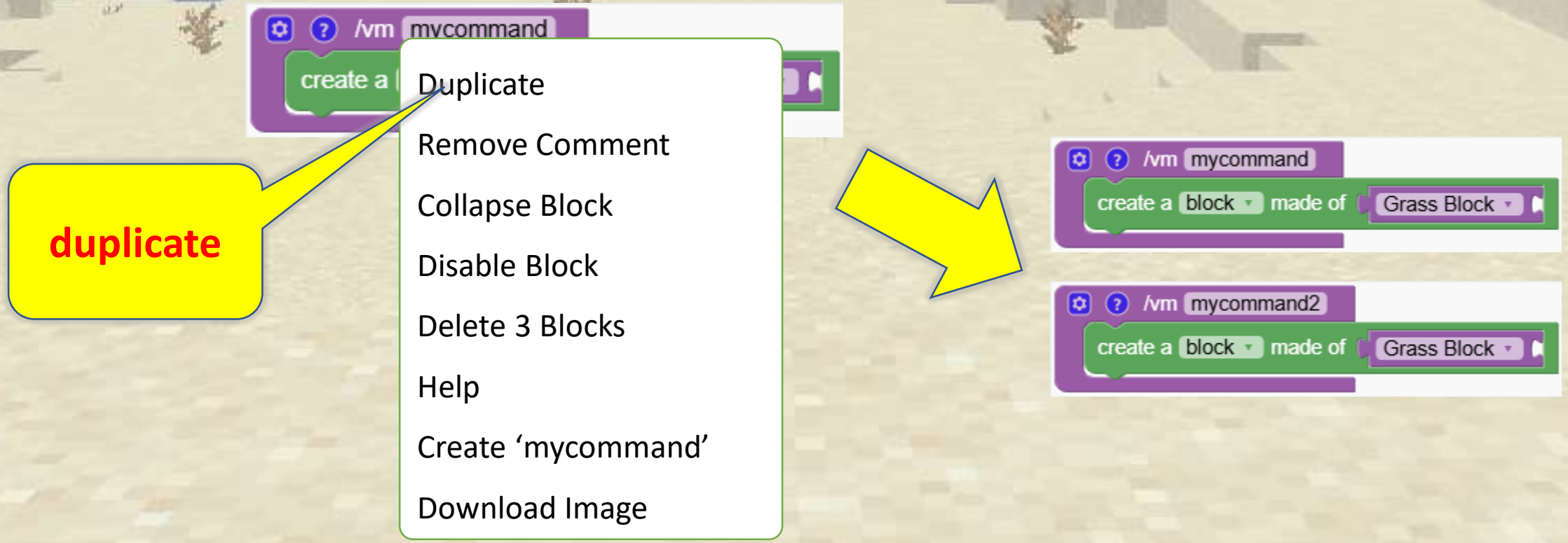
Step 3:
Reload your file. The workspace should now contain the same blocks that you saved in Step 1



Organizing Code

Right-click menu has many useful operations:

Duplicate a block

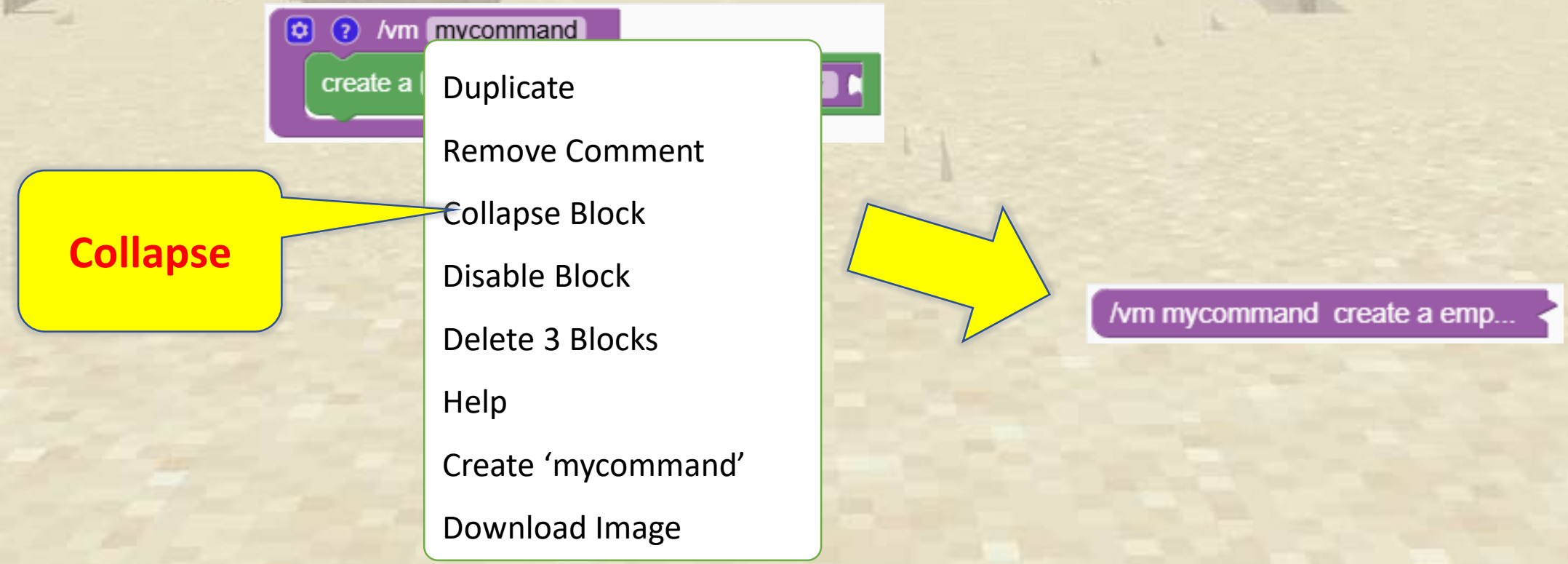


Organizing Code

Right-click menu has many useful operations:

With the operation ‘collapse’ it is possible to shrink a block to save space

Once collapsed, in the menu we find the operation ‘expand’



Running programs in Minecraft

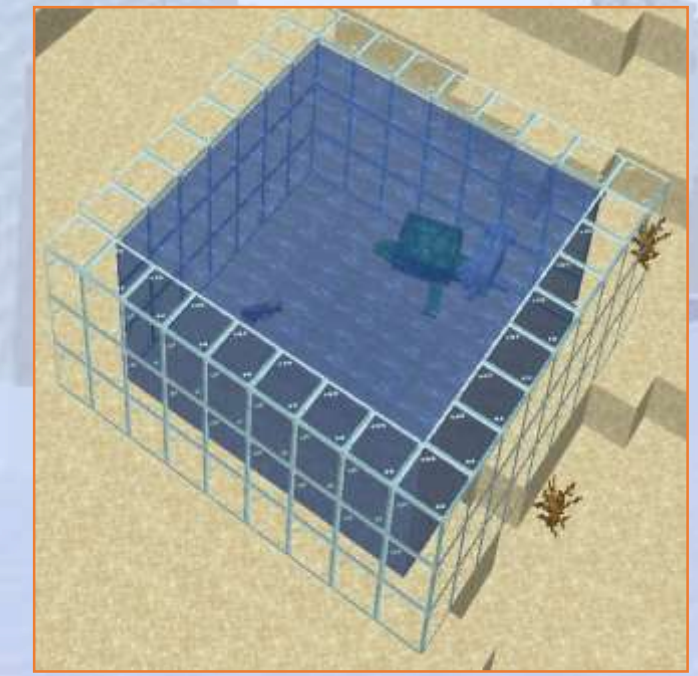
In order to run a program in minecraft you use the command ‘vm’

To access the command dialog you have to press the ‘/’ character. This is configurable in the options of Minecraft.

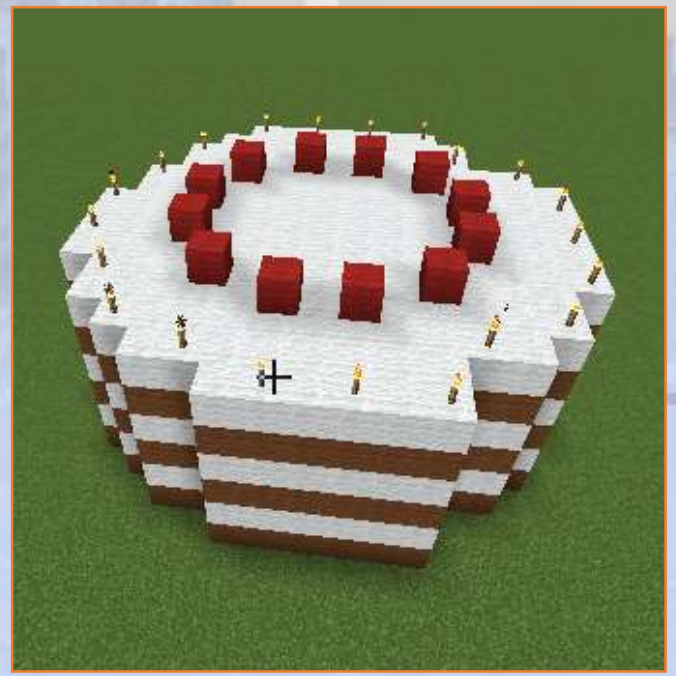
⚠ The ‘t’ character opens a different dialog for chatting

\vm mycommand	► (executes the program called ‘mycommand’)
\vmu	► (Undoes the last creation)
\vmu mycommand	► (Undoes the last creation, and the runs the program ‘mycommand’ again)
\vmtp 100 100	► (Teleport to coordinates 100, 100)

Iteration with Simple Loops



Learn to use the basic repeat command



Iteration with Simple Loops

🔍 Section Overview

We follow guided exercises that explain how to create some amazing structures with the use of simple loops.

🎯 Objectives

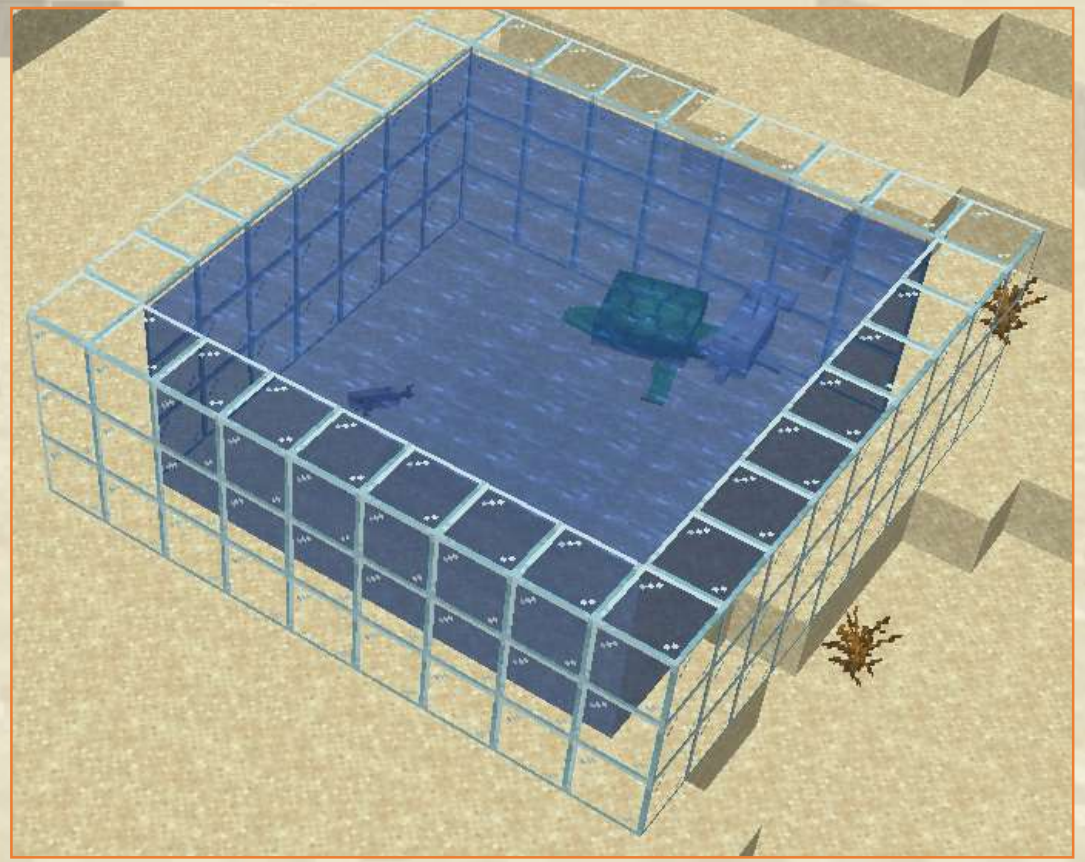
Amaze kids with the power of coding. They learn that coding makes them more efficient in creating big structures

👌 Expected Outcomes

Understand how loops can simplify repetitive tasks and easily create designs like towers, cakes, and any repetitive structures.

Let's Create an Aquarium

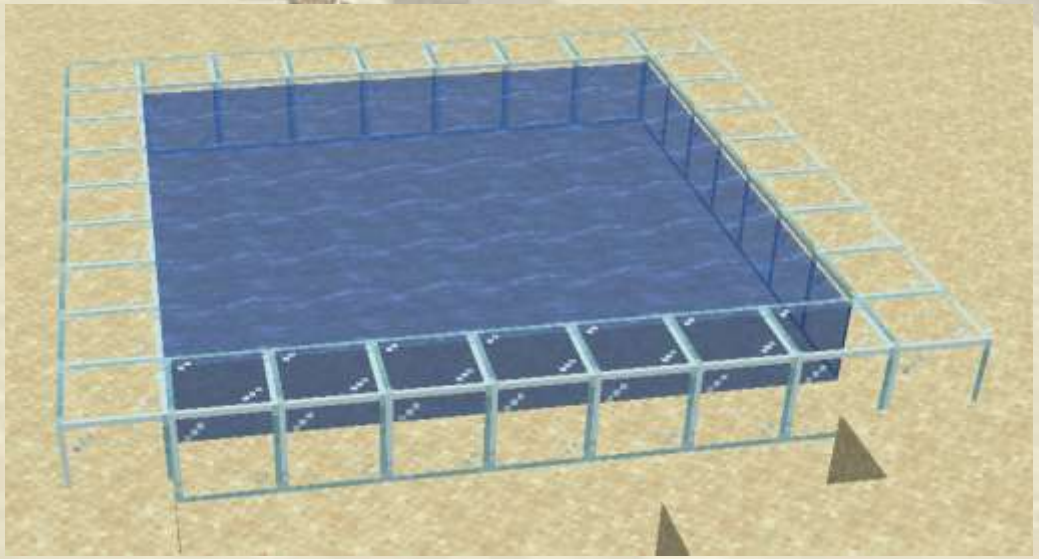
Combine mobs and blocks to create a beautiful aquarium.



Let's Create an Aquarium

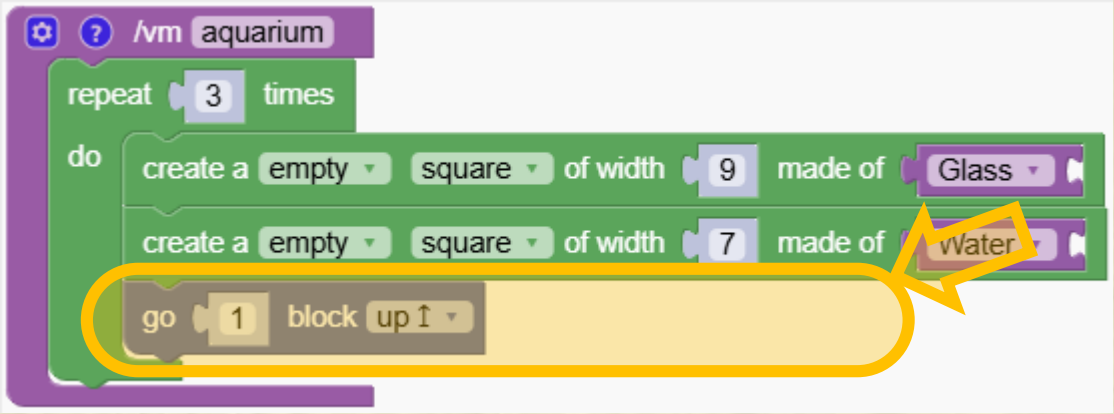
First, we create a square with a side of width 9 blocks, made of glass

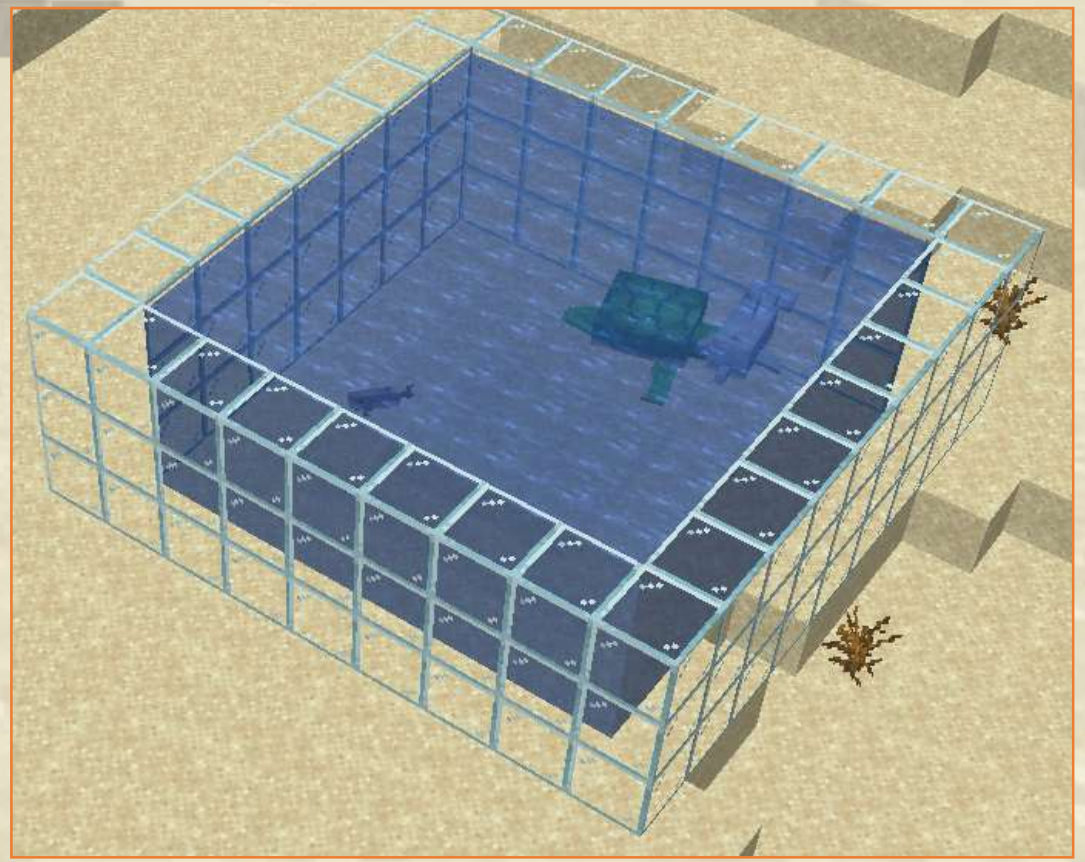
Second, we fill the square it with a smaller square made of water



Let's Create an Aquarium

We repeat the process 3 times moving up one block every time

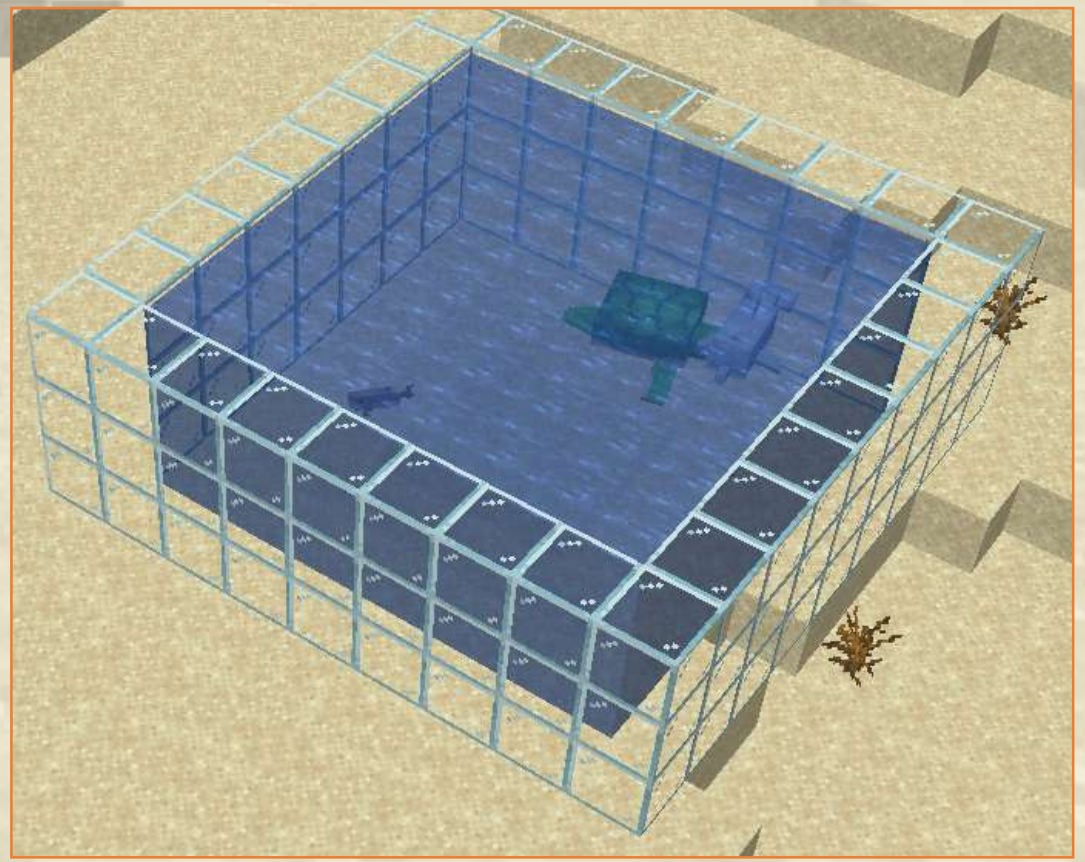




Let's Create an Aquarium

Now we add 3 different mobs.

```
/vm aquarium
repeat 3 times
do
    create a empty square of width 9 made of Glass
    create a empty square of width 7 made of Water
    go 1 block up ↥
    create a block made of Dolphin
    create a block made of Turtle
    create a block made of Cod
```



Be prepared for survival

Using loops to improve our equipment

Be prepared for survival

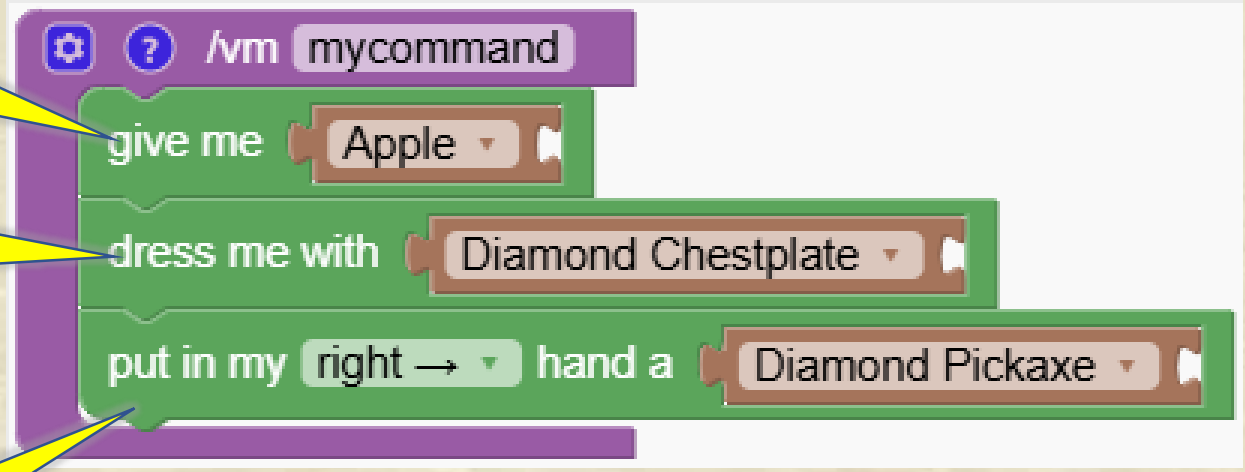
Using loops to improve our equipment

In the blocks menu the are 3 interesting blocks for upgrading our equipment:

Load in inventory

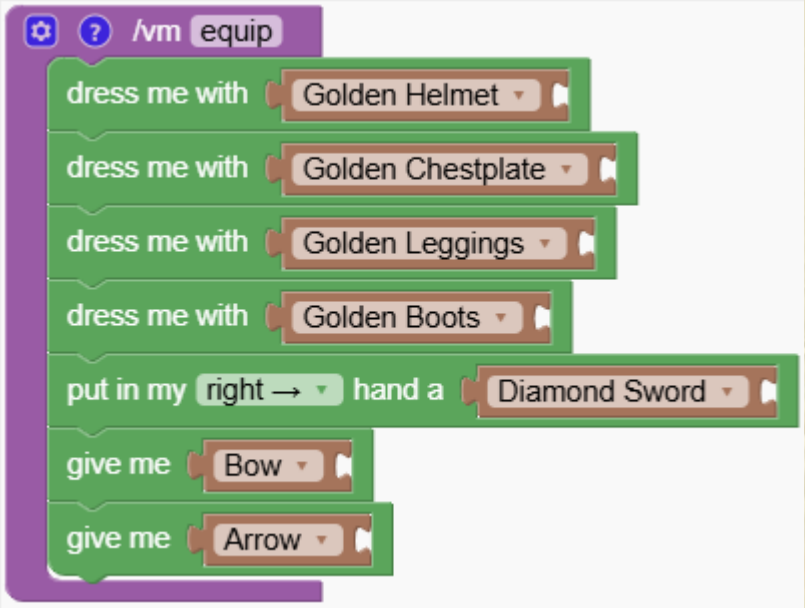
Wear an armor

Yield a tool



Be prepared for survival

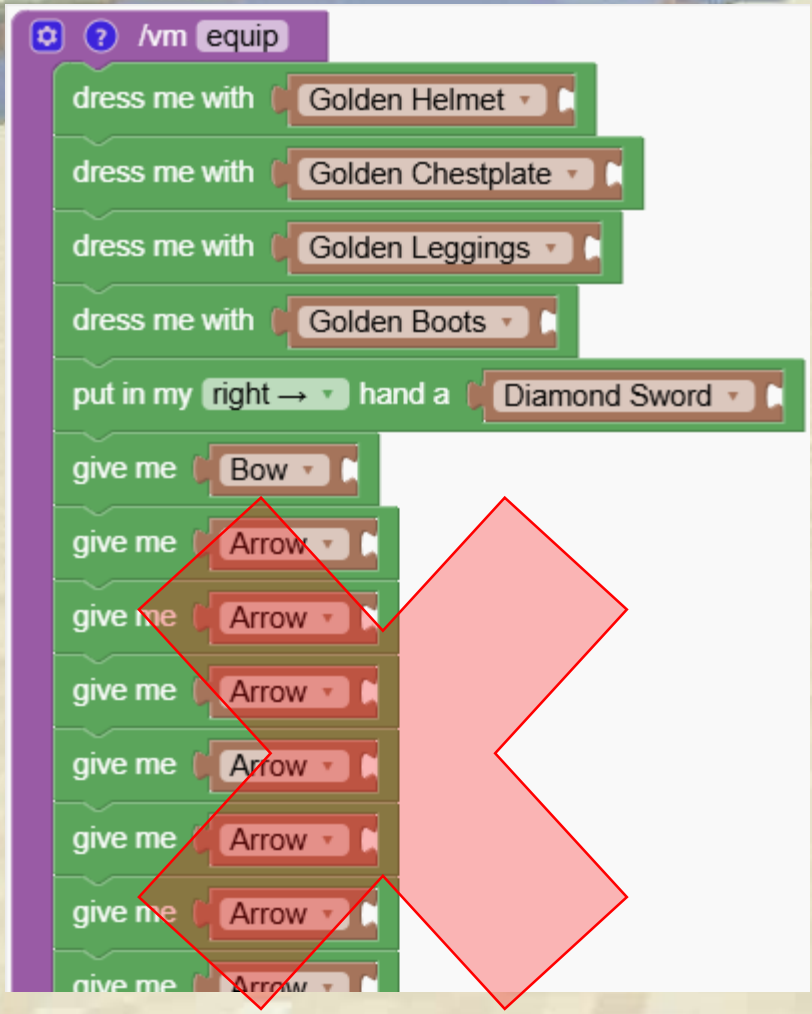
Now we are getting all the gear but we have just one arrow.



Be prepared for survival

Repeating the block 64 times is a bad idea.

What would you do instead?

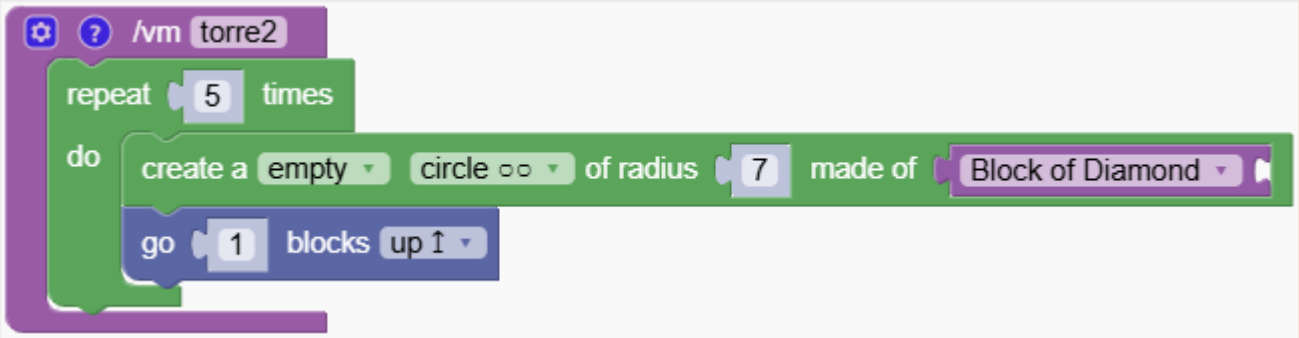


Be prepared for survival

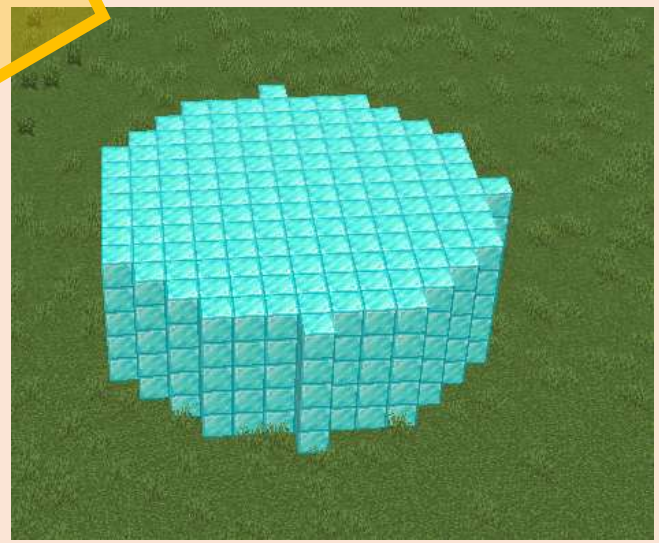
With one simple loop we get 64 arrows

What does this program create?

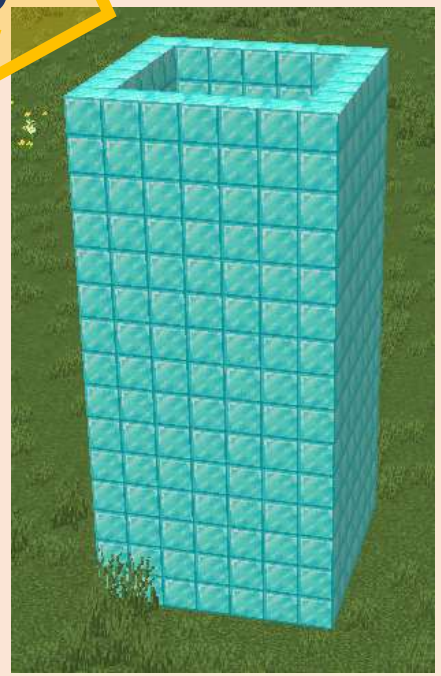
A, B or C?



A

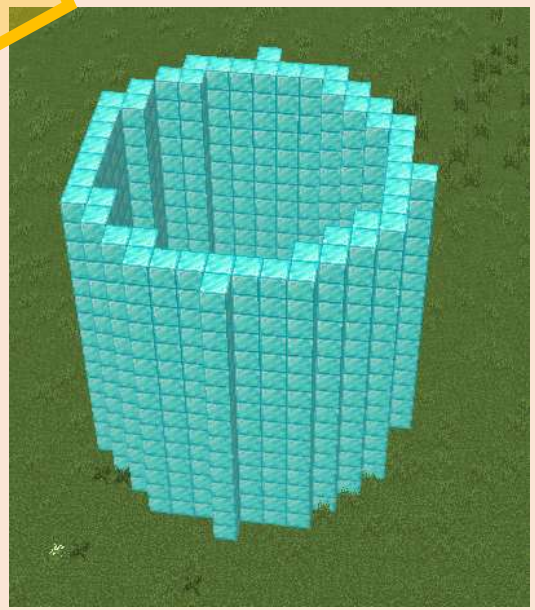


B



C

D

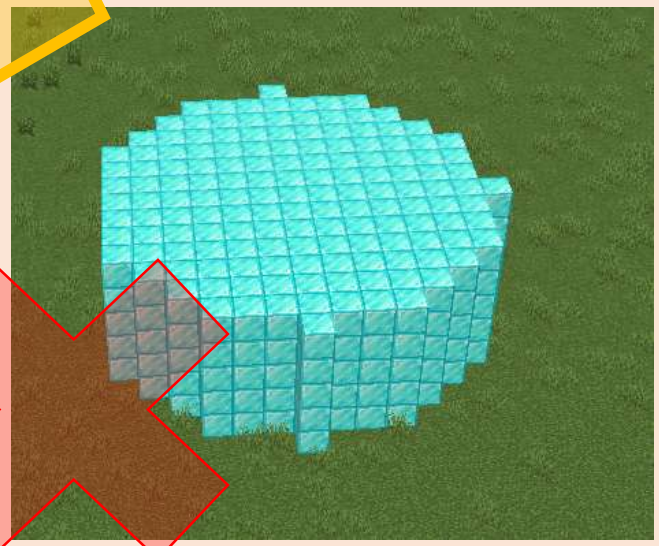


What does this program create?

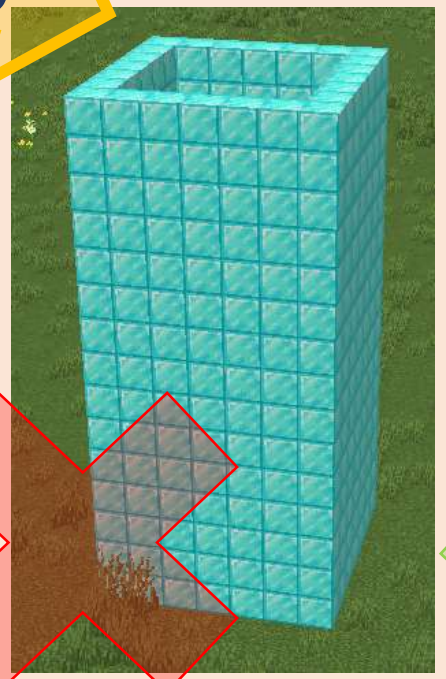
A, B or C?

```
/vm torre2
repeat 5 times
do
    create a empty circle ○○ of radius 7 made of Block of Diamond
    go 1 blocks up ↑
```

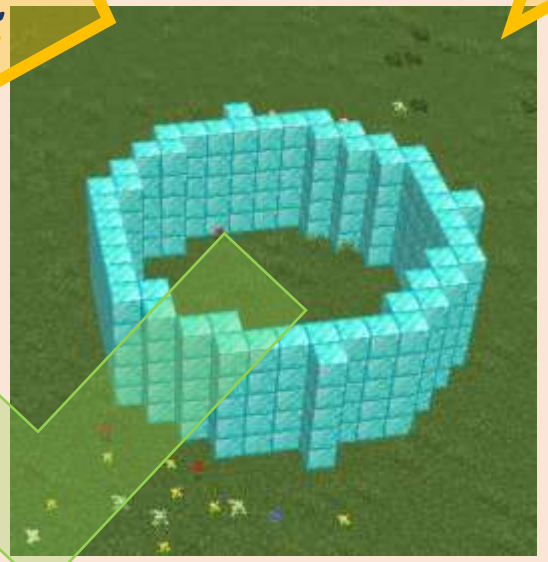
A



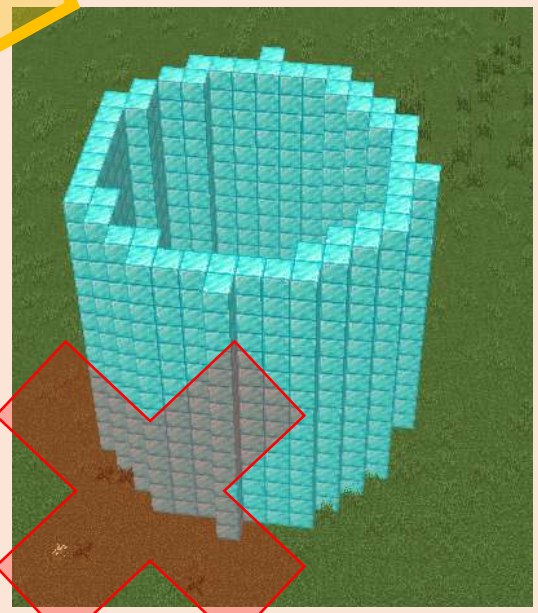
B



C



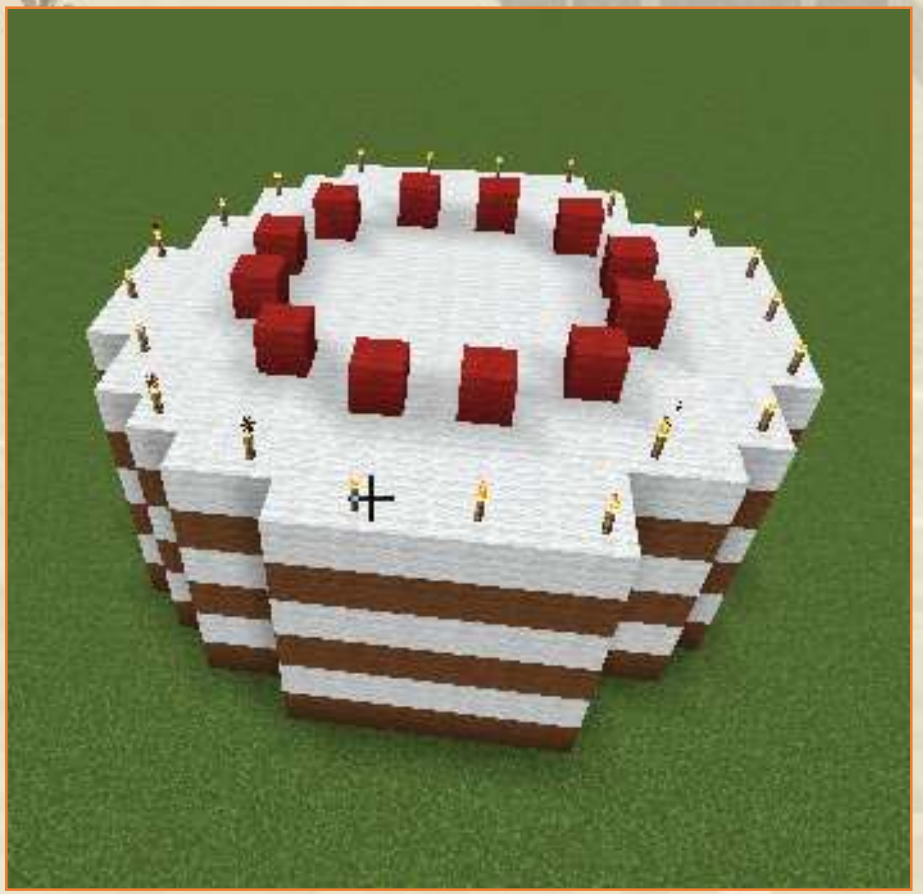
D



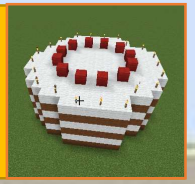
Create a Birthday Cake

We are using loops to design and build a cake in Minecraft.

Our cake features layers inspired by vanilla and chocolate, topped with cherries and adorned with candles.

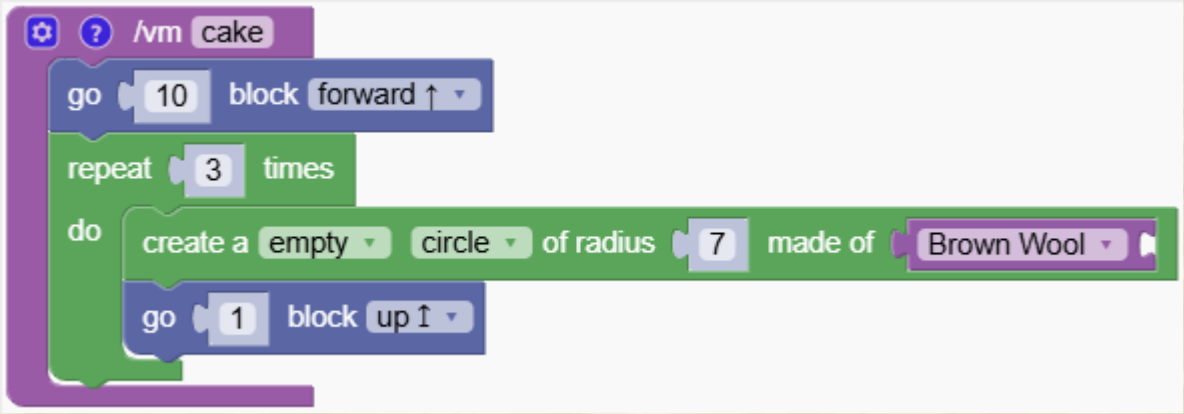


Create a Birthday Cake

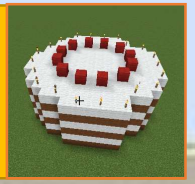


First, we move the start position 10 steps further away to avoid being trapped in the cake.

Second, we create a simple circular tower. With a radius of 7 blocks

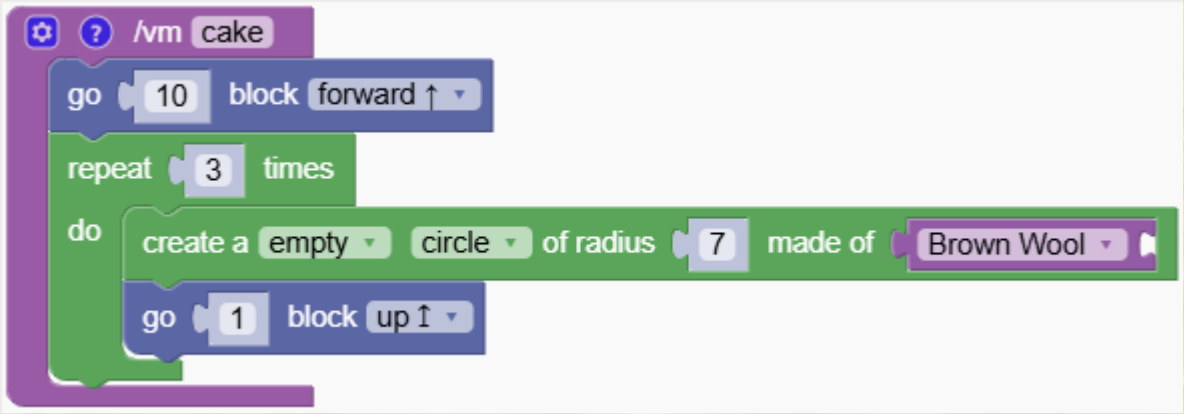


Create a Birthday Cake

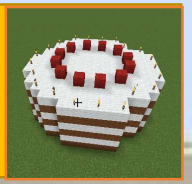


How do we add the white layers?

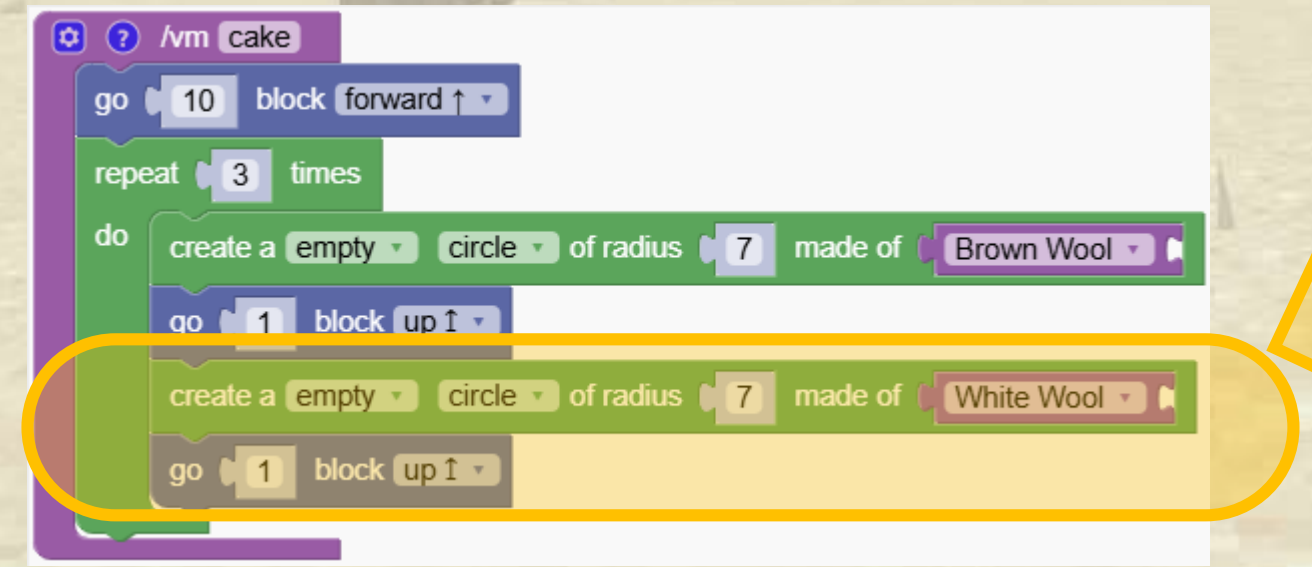
Can you modify the program so that it adds a white layer after having added a brown layer?



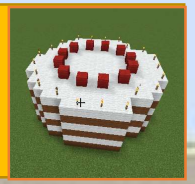
Create a Birthday Cake



Now we insert another layer in the cake, which means that after having inserted a brown layer we go one step up and add a white layer

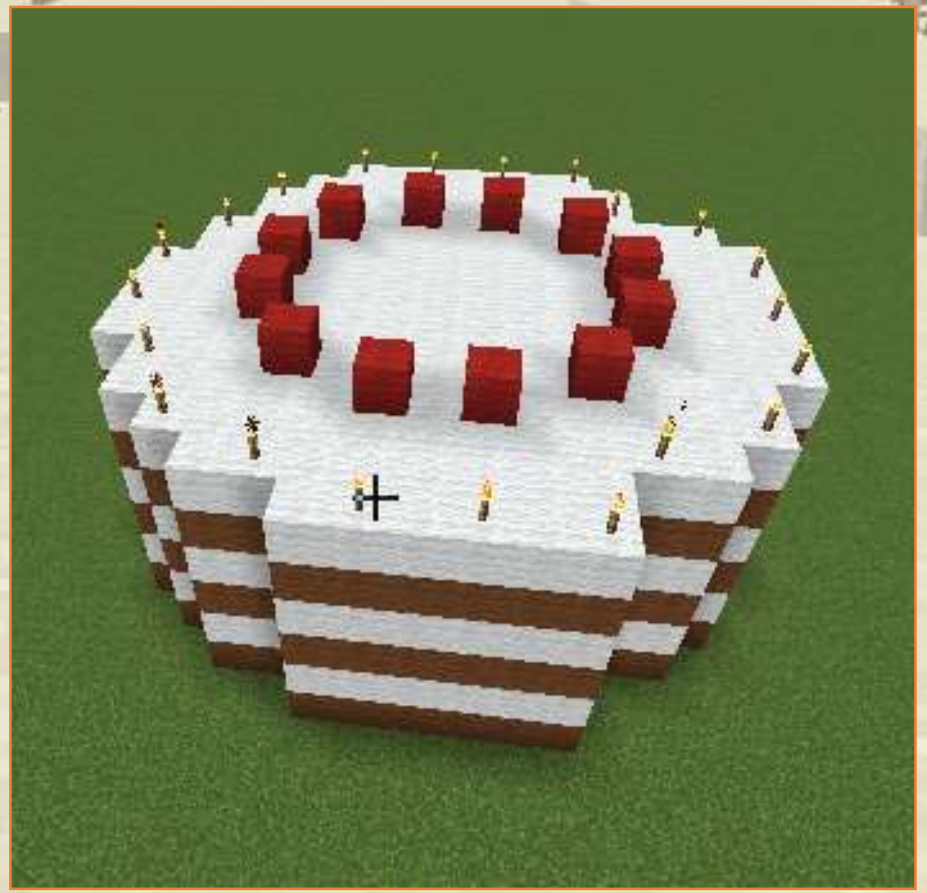


Create a Birthday Cake



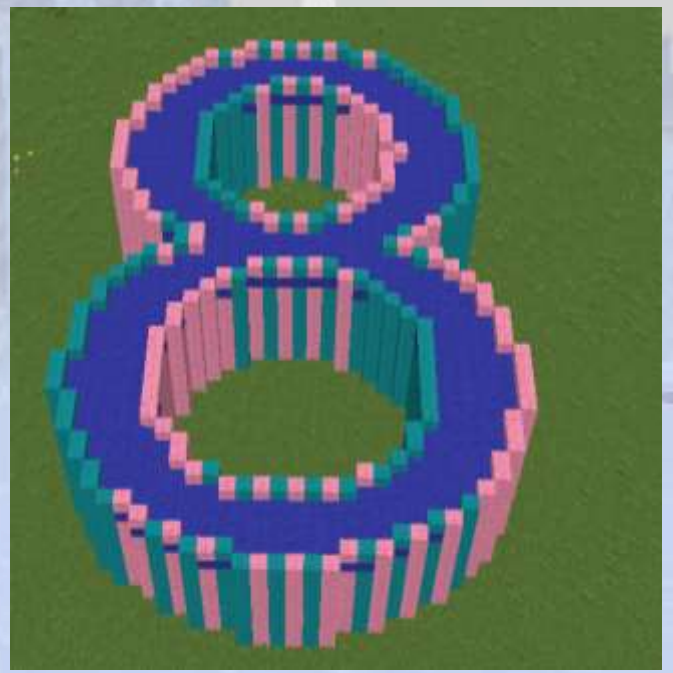
At the end of the program, outside the loop we add to circles on with lights the other with cherries.
We alternate them with air to create spacing.

```
/vm cake
go 10 block forward ↑
repeat 3 times
do
    create a empty circle of radius 7 made of Brown Wool
    go 1 block up ↥
    create a empty circle of radius 7 made of White Wool
    go 1 block up ↥
create a empty circle of radius 7 made of Torch Air
create a empty circle of radius 4 made of Red Wool Air
```



Combining Blocks

Create beautiful structures by combining blocks



Combining Blocks

🔍 Section Overview

We will explore expand the simple towers to more engaging structures

🎯 Objectives

Practice the use of coding for creating beautiful structures.

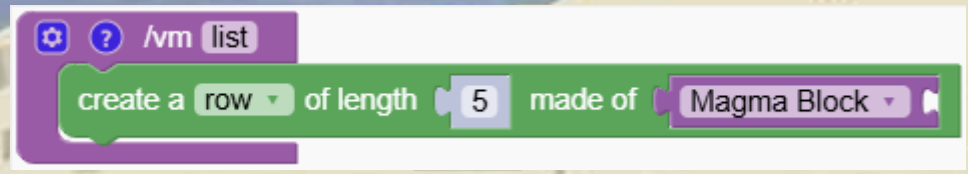
👌 Expected Outcomes

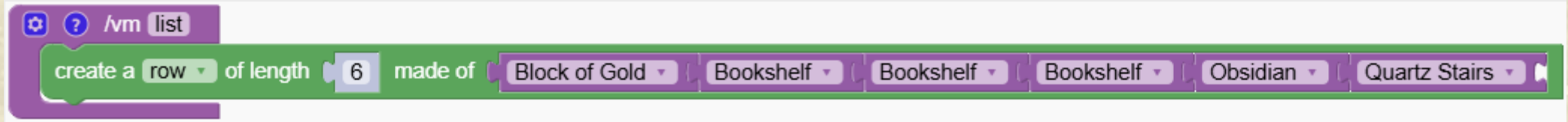
The students will feel more secure in running programs and modifying code

Blocks lists

We can mix objects by organizing them in a list

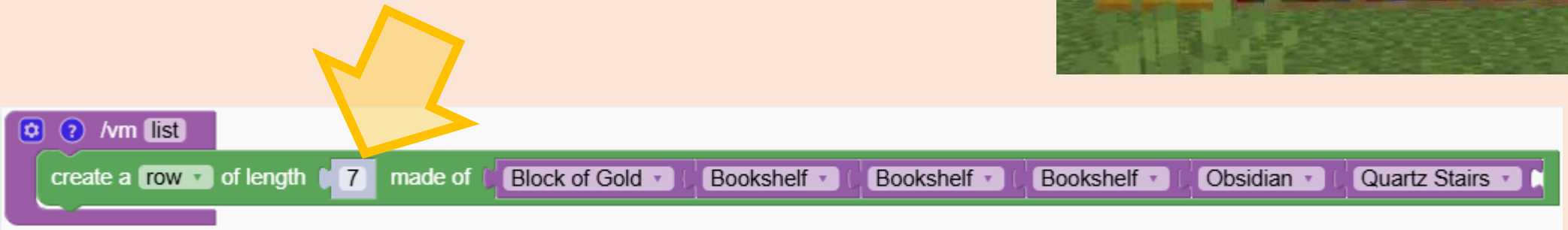
In the first program the robot will always use the same block but in the second program they are mixed





Blocks lists

What happens if we tell robot to make the list longer?



Quiz

Blocks lists

The robot restarts the list from the beginning

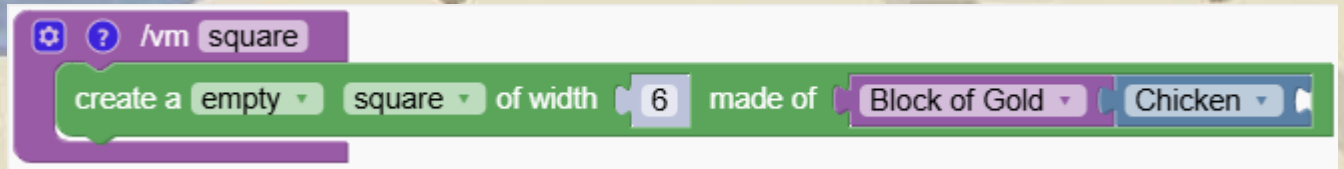
Blocks lists

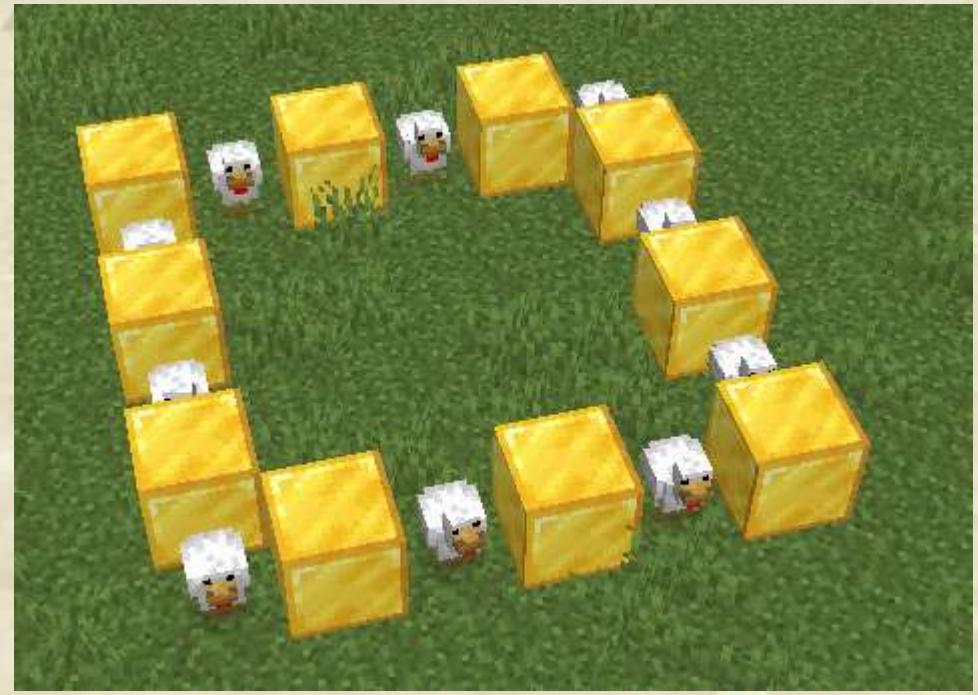
We can avoid repeating may times the same Minecraft block.

This two programs have the same result but the second one is shorter

Blocks lists

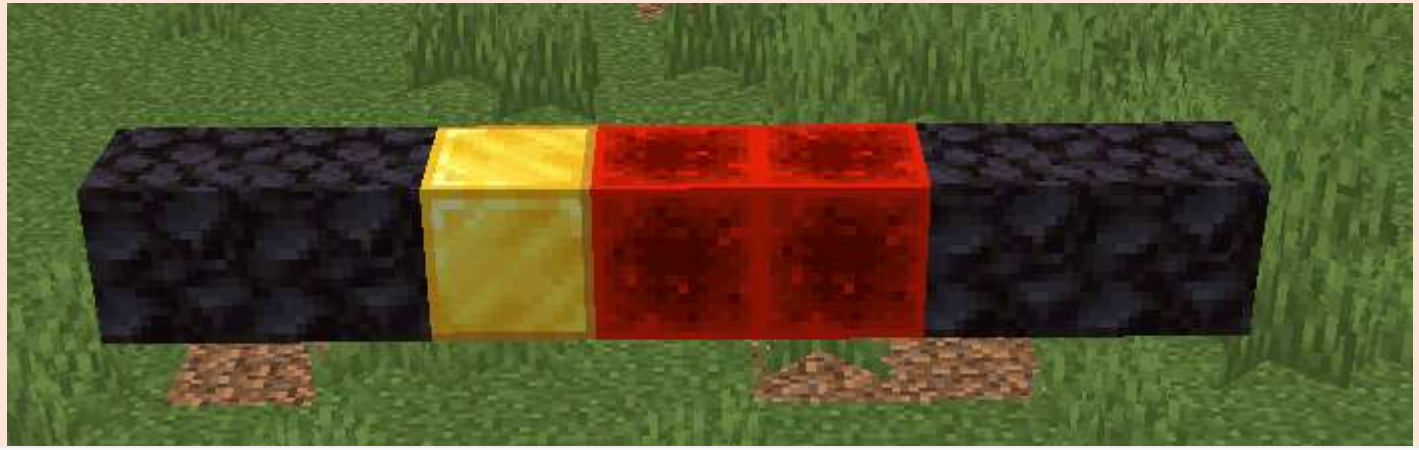
Minecraft blocks can be combined with mobs





What blocks are created by these programs?

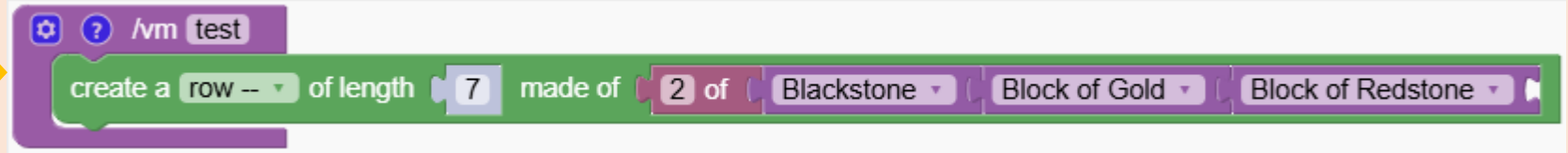
A, B or C?



A

B

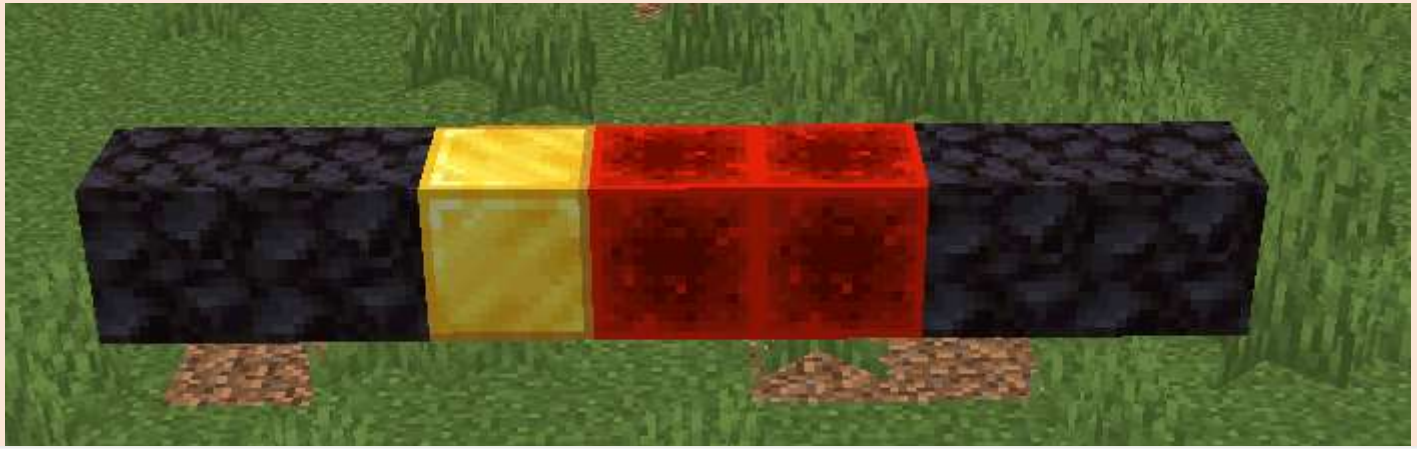
C



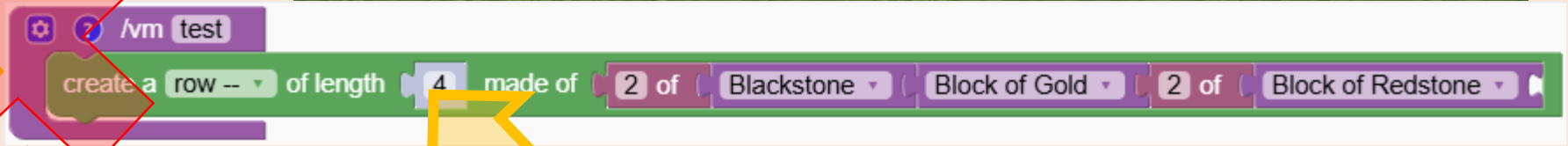
Quiz

What blocks are created by these programs?

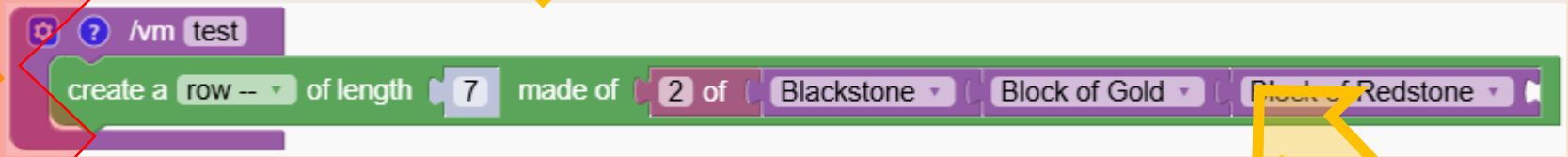
A, B or C?



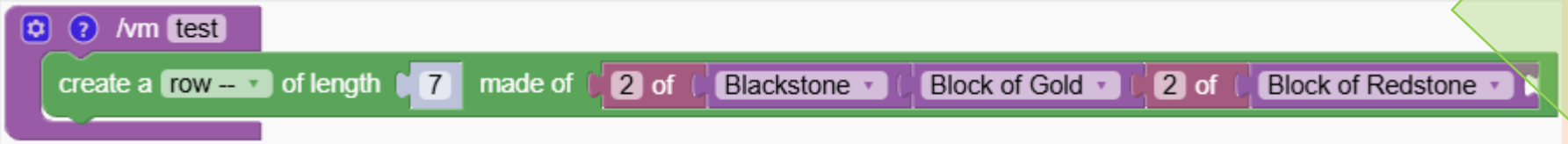
A



B



C

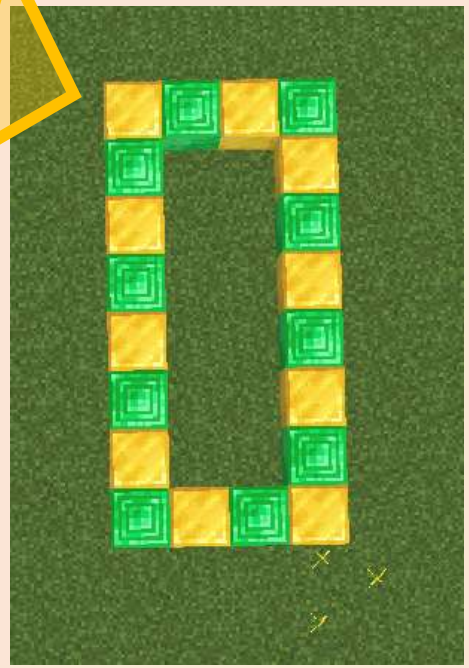


Quiz

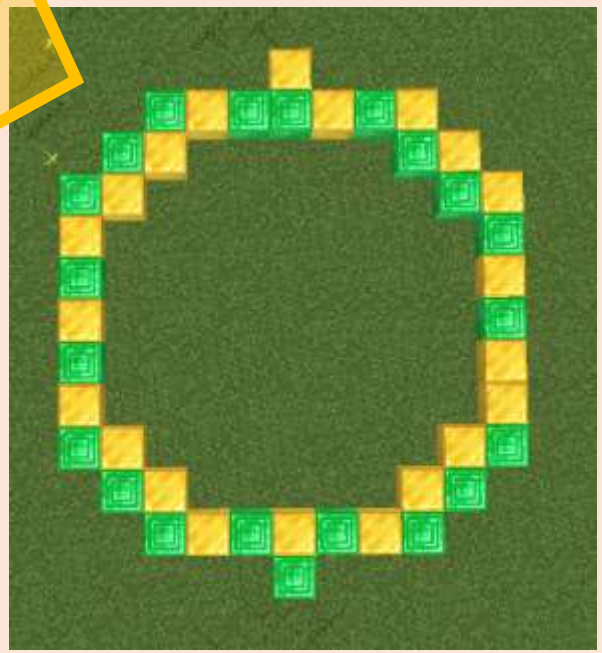
What does this program create?

A, B or C?

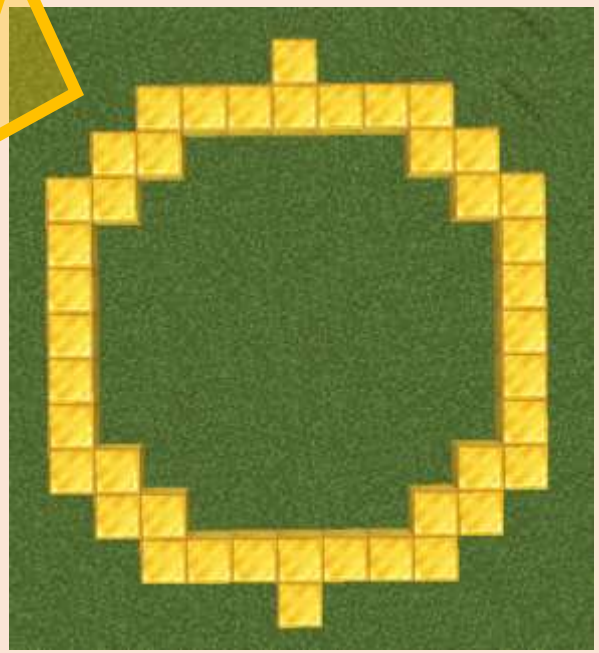
A



B



C

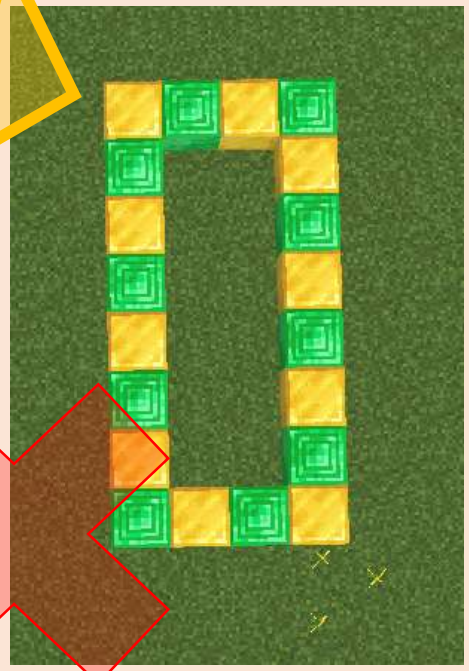


Quiz

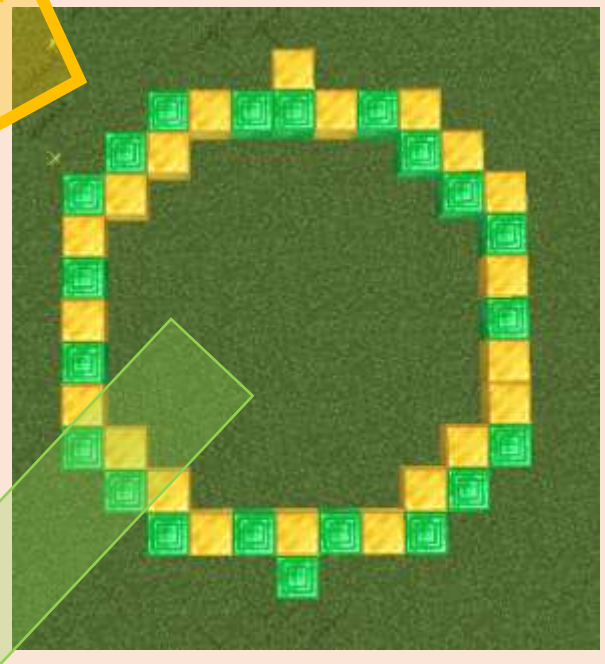
What does this program create?

A, B or C?

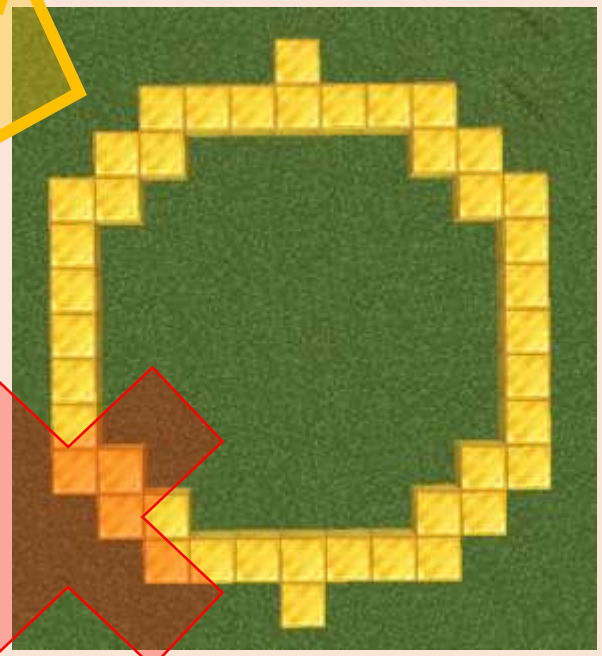
A



B



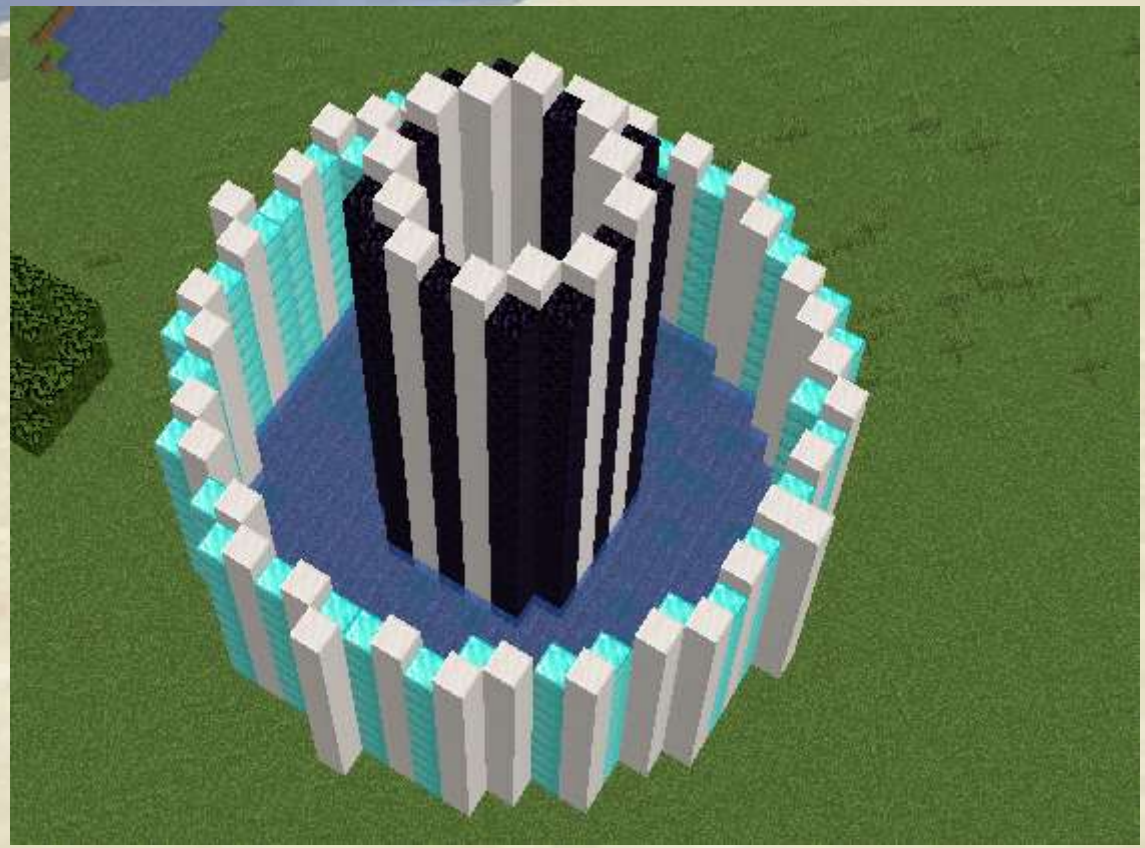
C



Quiz

Make your own castle

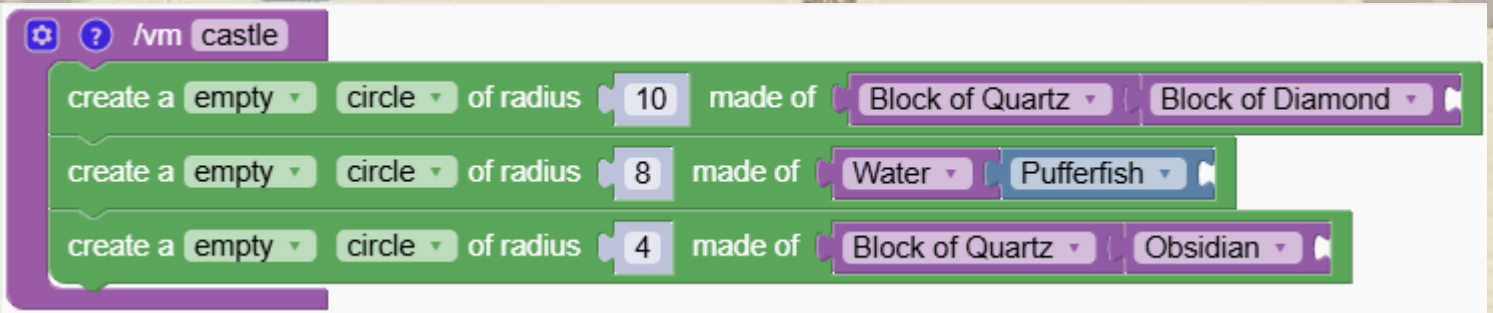
We are building a own castle by combining blocks and Mobs

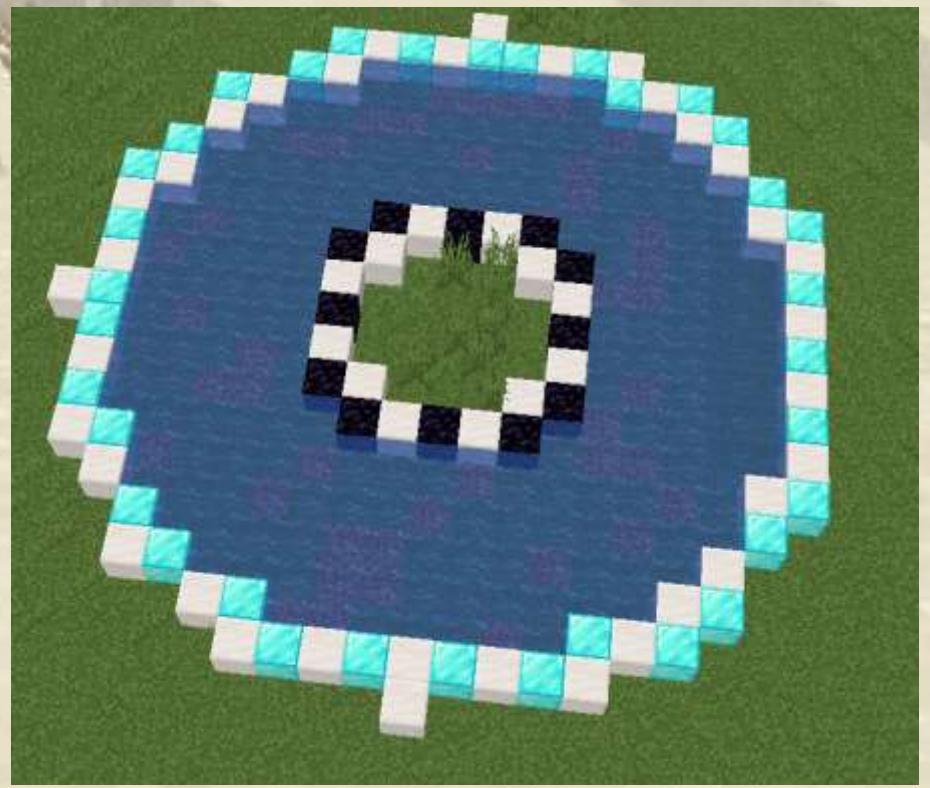


Make your own castle

First we create the base of the castle.

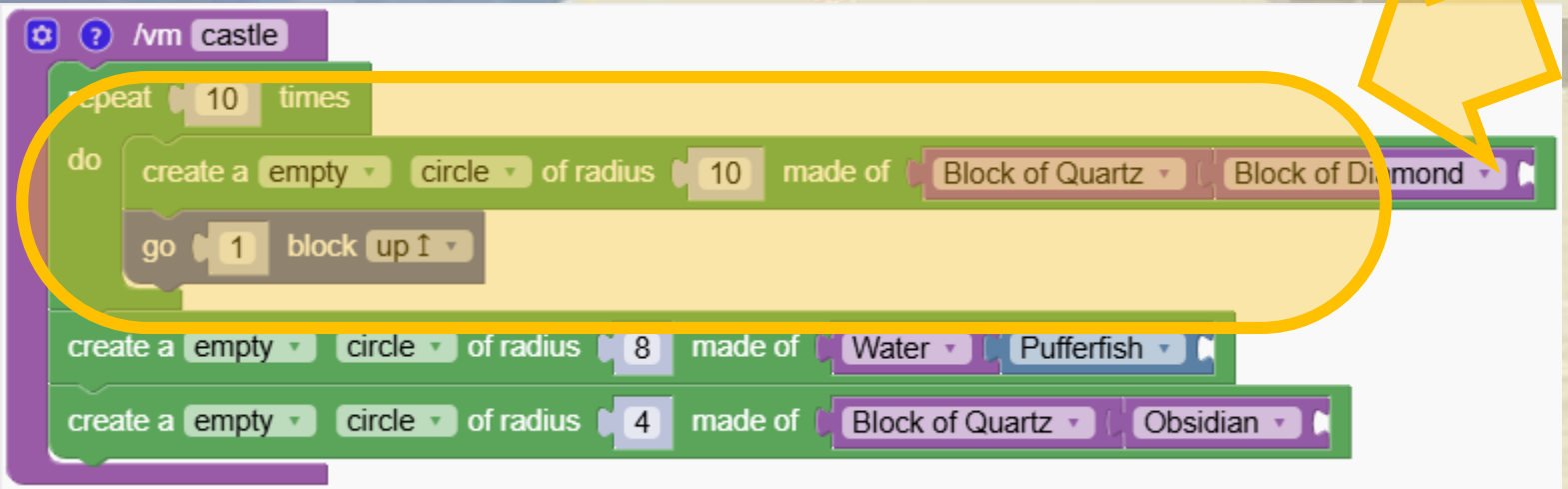
We added some pufferfish. Don’t go to close to them!

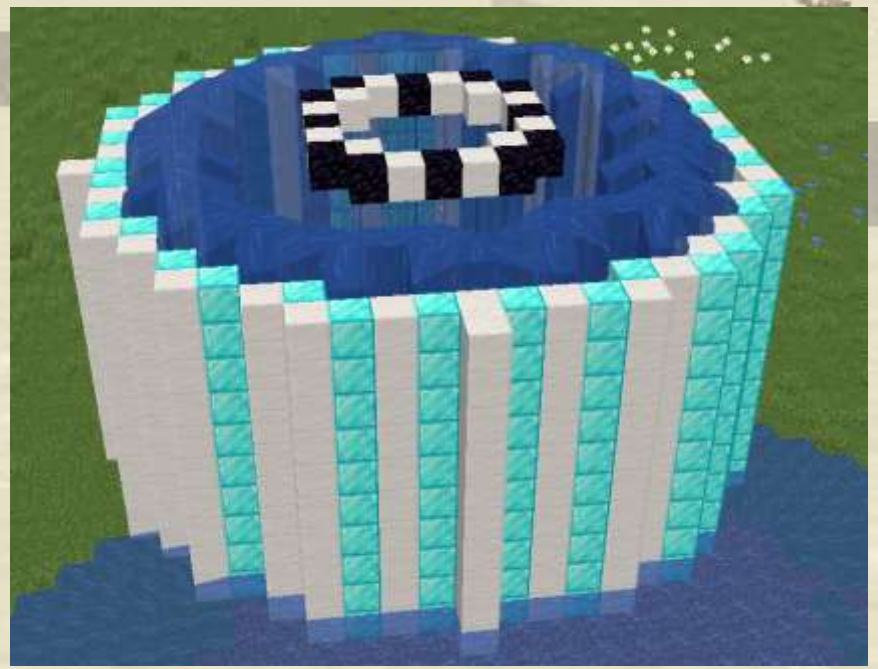




Make your own castle

We add a loop to make the outside wall grow. But something is wrong



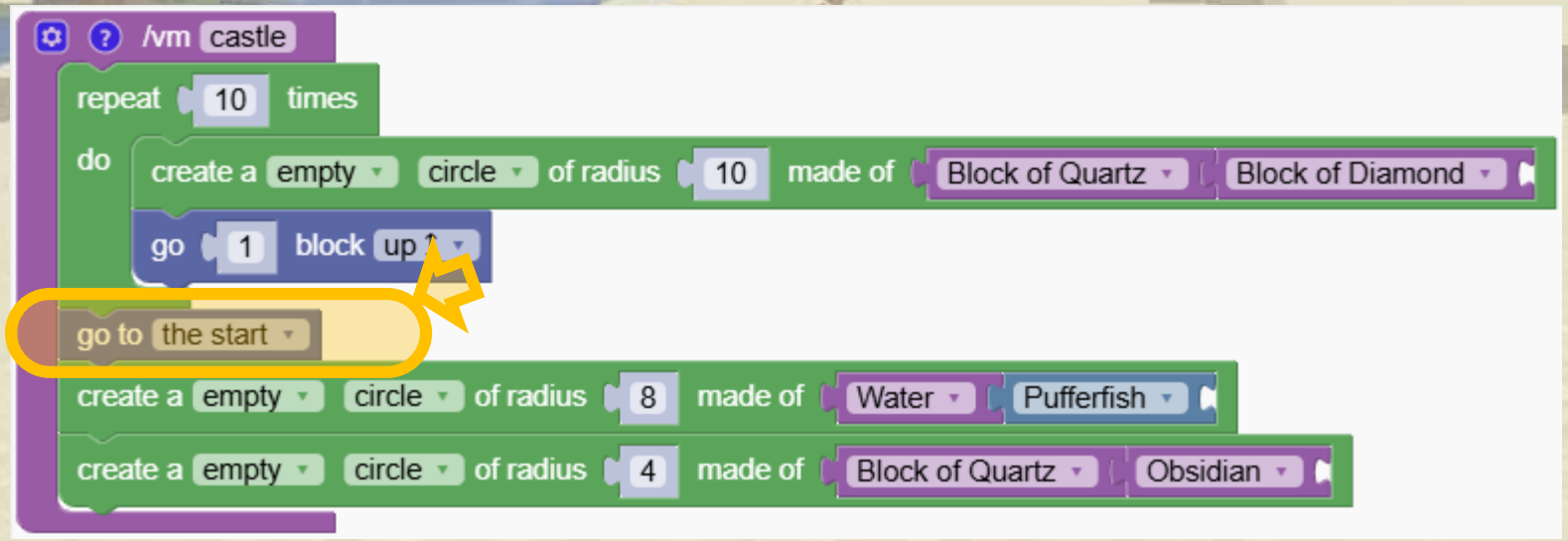


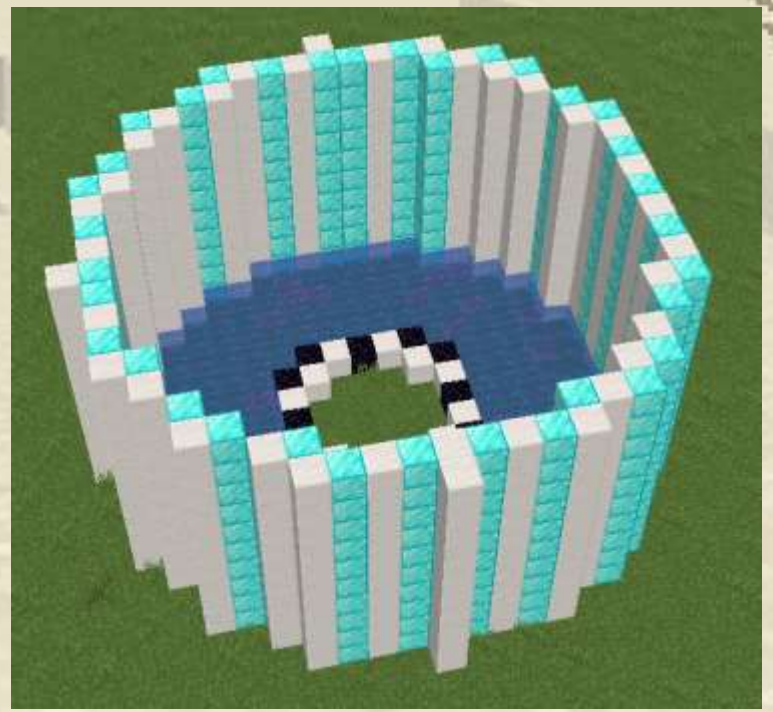
The robots moves all the way to the top of the outside wall and then continues from there to make the inner wall.

We have to tell robot to go back to the start position before doing the water and the inner wall

Make your own castle

We will explore interesting blocks and mobs, learning how to create and interact with them using our coding tools.



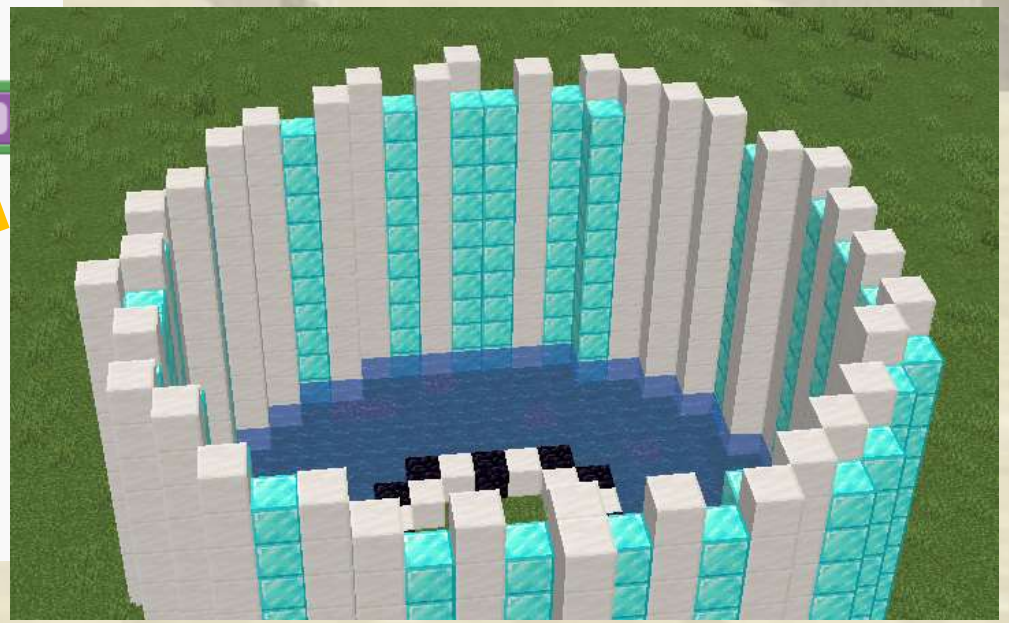


Make your own castle

We would like to have some crown like edge on the walls

So we add a level made of quartz and air

```
/vm castle
repeat 10 times
do
    create a empty circle of radius 10 made of Block of Quartz | Block of Diamond
    go 1 block up ↑
    create a empty circle of radius 10 made of Block of Quartz | Air
    go to the start
    create a empty circle of radius 8 made of Water | Pufferfish
    create a empty circle of radius 4 made of Block of Quartz | Obsidian
```



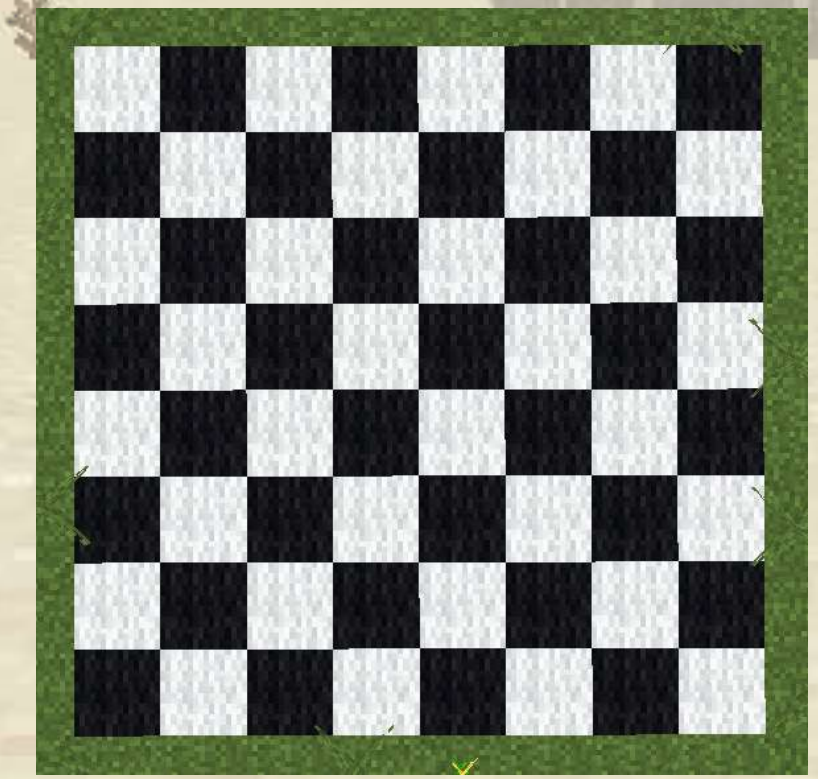
Make your own castle

To finish we repeat the inner circle to become a tower in the same way as the outer tower

```
/vm castle
repeat 10 times
do
    create a empty circle of radius 10 made of Block of Quartz Block of Diamond
    go 1 block up
create a empty circle of radius 10 made of Block of Quartz Air
go to the start
create a empty circle of radius 8 made of Water Pufferfish
repeat 20 times
do
    create a empty circle of radius 4 made of Block of Quartz Obsidian
    go 1 block up
create a empty circle of radius 4 made of Block of Quartz Air
```

Chess Board

How do we create a chessboard?



Chess Board

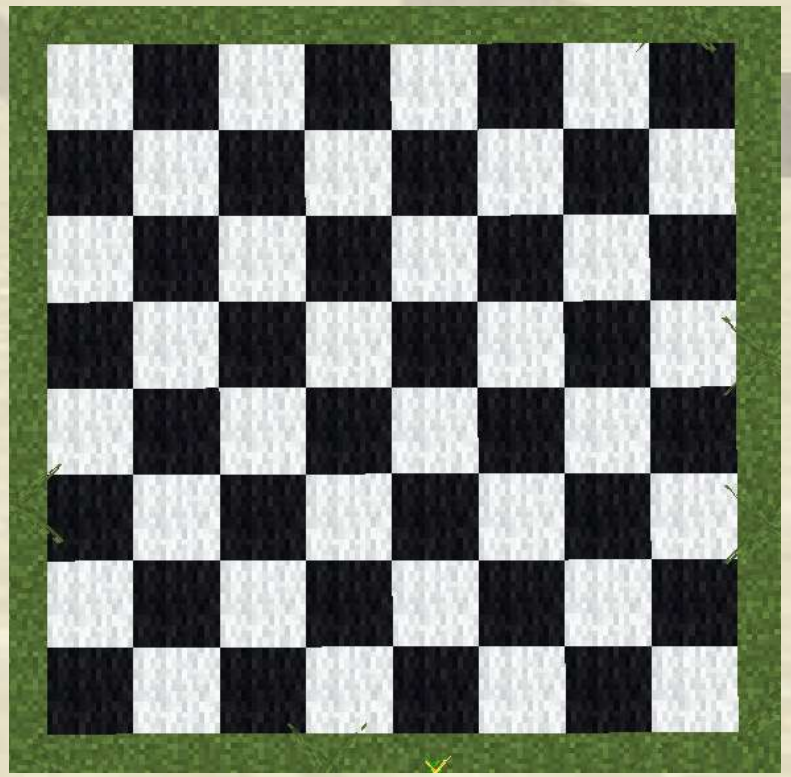
We are building a chess board.

First we create the outside blocks by alternating black and white

Chess Board

We are building a chess board.

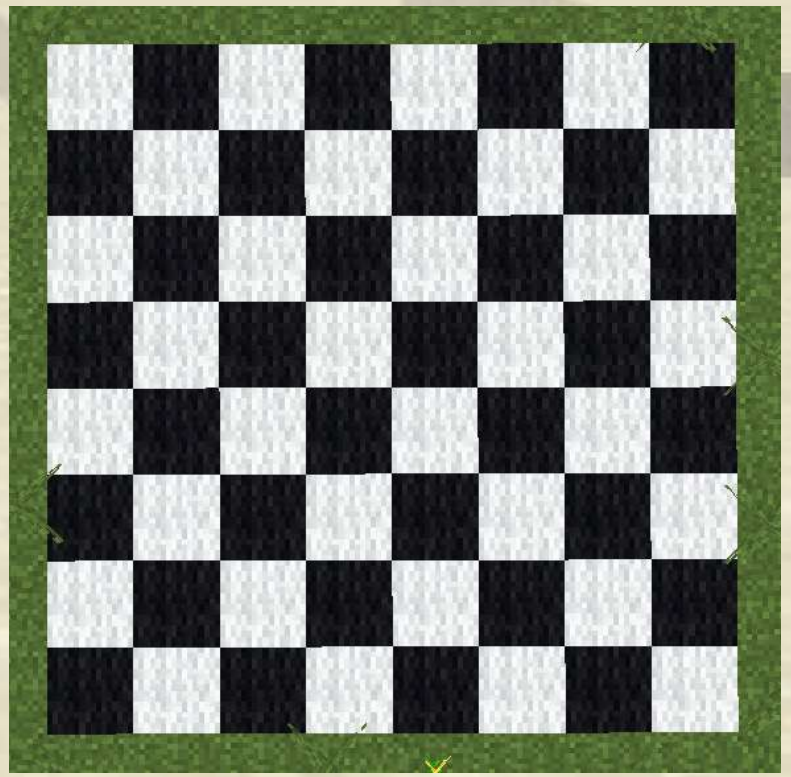
Now we have to add the squares inside. Can you do it?



Chess Board

The chess board is formed with 4 squares.

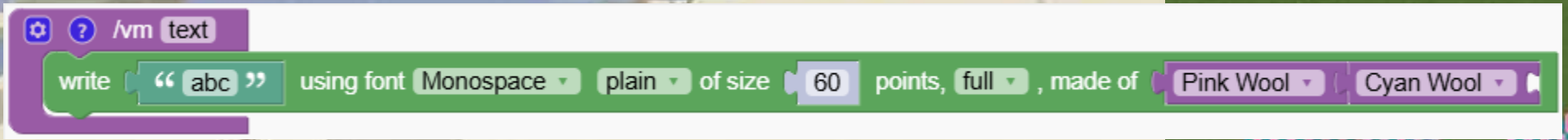
```
/vm chess
create a empty square □ of width 8 made of Black Carpet White Carpet
create a empty square □ of width 6 made of Black Carpet White Carpet
create a empty square □ of width 4 made of Black Carpet White Carpet
create a empty square □ of width 2 made of Black Carpet White Carpet
```

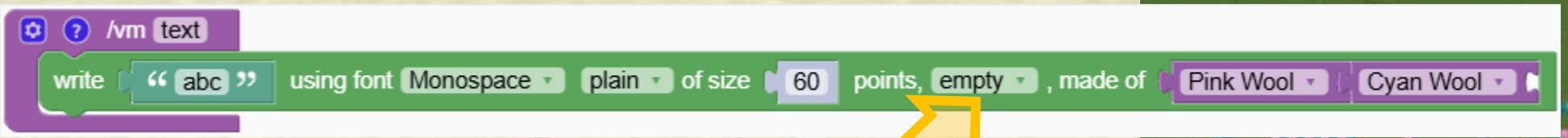


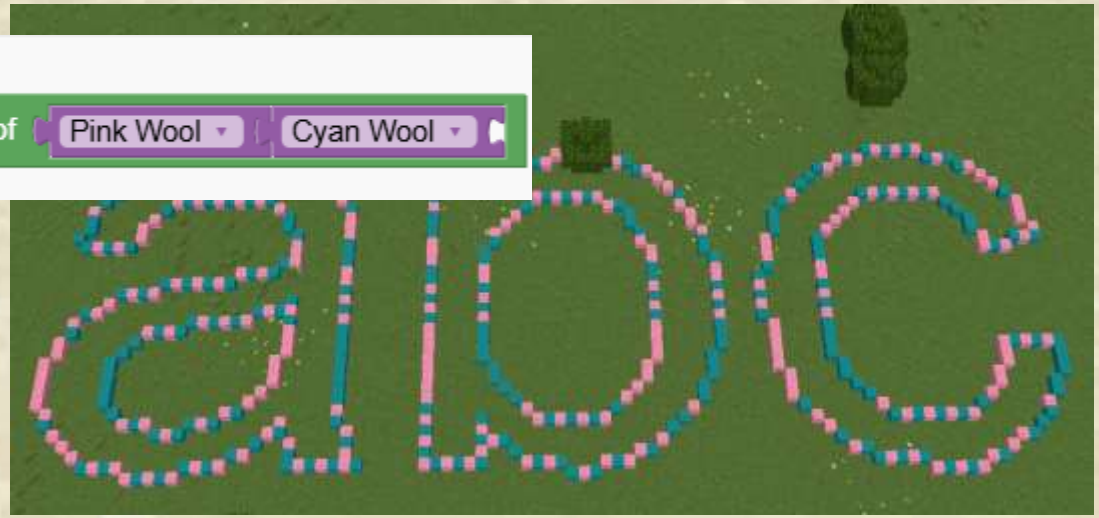
Use letters to create fun structures

We are able to write text with blocks:

You can customize it's appearance.





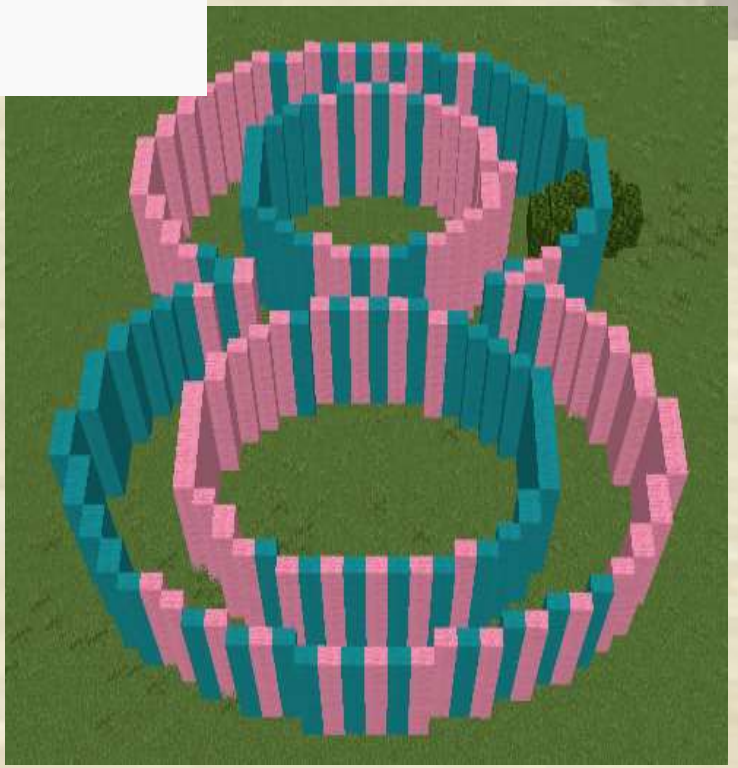


Use letters to create fun structures

We are making a castle in the shape of a number 8.

(Pick the number or letter you prefer for your castle)

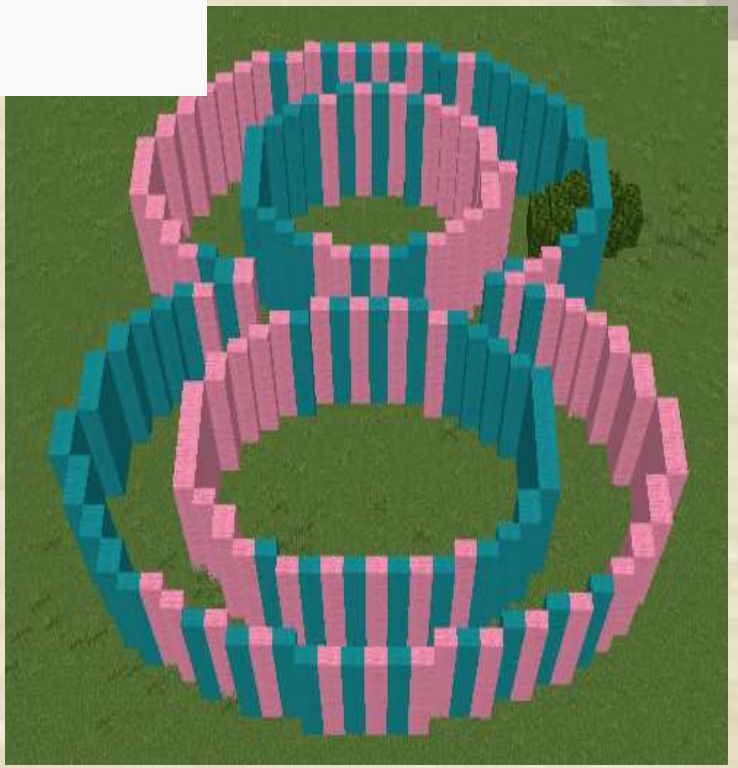
```
/vm text
repeat 10 times
do
    write “8” using font Monospace plain of size 60 points, empty , made of Pink Wool Cyan Wool
    go 1 blocks up
```



Use letters to create fun structures

How can you add the roof in another color?

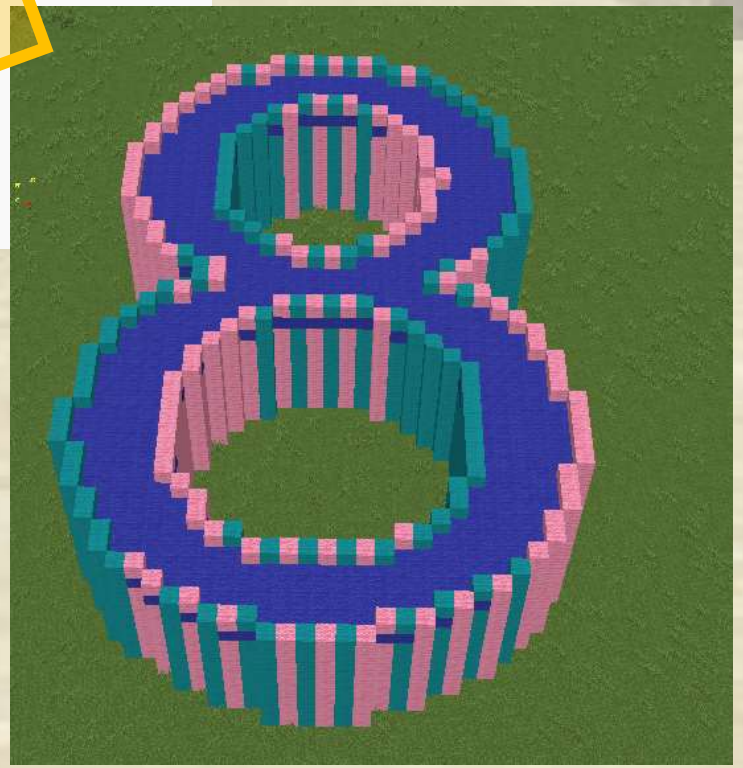
```
/vm text
repeat 10 times
do
    write “8” using font Monospace plain of size 60 points, empty , made of Pink Wool Cyan Wool
    go 1 blocks up
```



Use letters to create fun structures

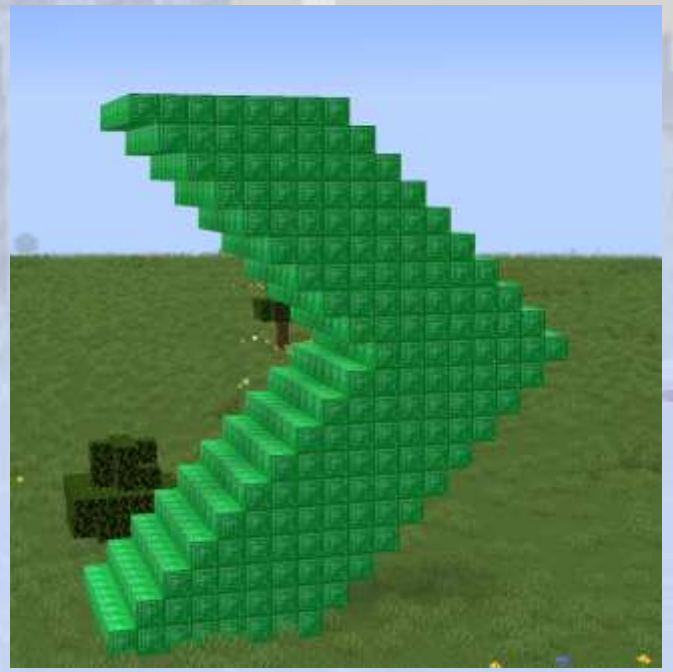
Outside the repeat, we just add another full layer.

```
/vm text
repeat 10 times
do
    write "8" using font Monospace plain of size 60 points, empty, made of Pink Wool Cyan Wool
    go 1 blocks up
go 2 blocks down
write "8" using font Monospace plain of size 60 points, full, made of Blue Wool
```



Moving in the world

Learn how to control the robot position



Moving in the world

🔍 Section Overview

We are doing in some simple exercises that explain the movements of the robot. We create some amazing towers with the addition of simple movements.

🎯 Objectives

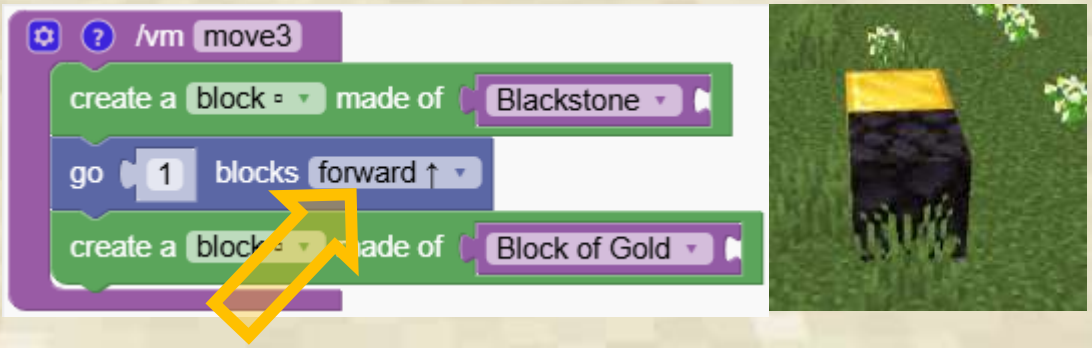
Master positioning blocks in 3D space using movement blocks and structured learning exercises.

👌 Expected Outcomes

Students will learn the fundamentals of turtle graphics while developing their 3D spatial awareness.

The movement blocks

The robot can be moved in the world



Let's create a smiley face

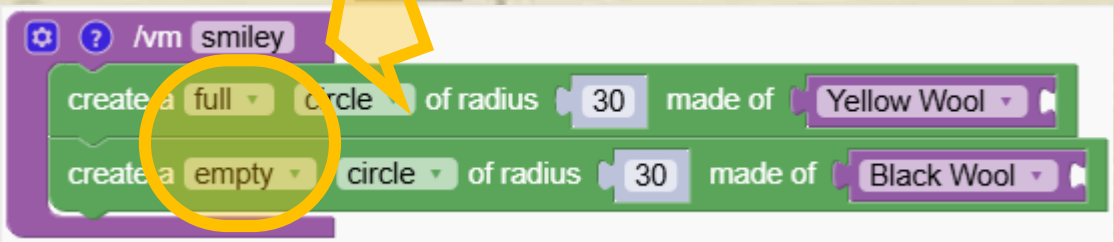
Learn block placement by building a simple and fun smiley face.

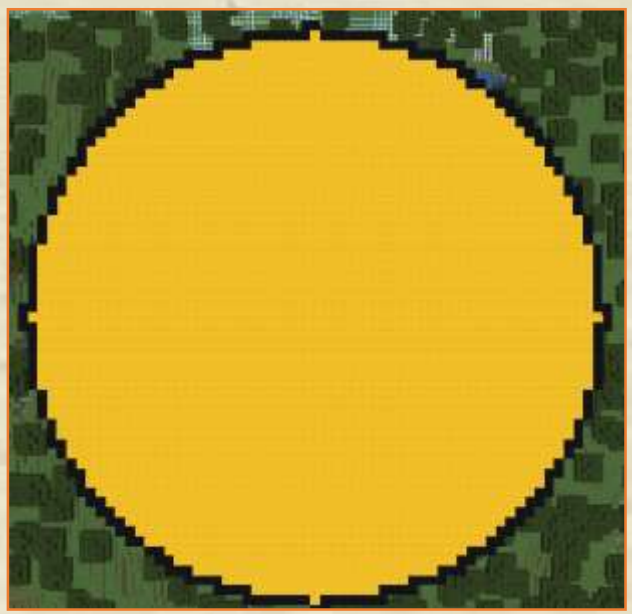
The students will have fun by customizing it

Let's create a smiley face

Lets create two circles of radius 30 blocks.

The first one is full and the second one is empty because it is just a black border



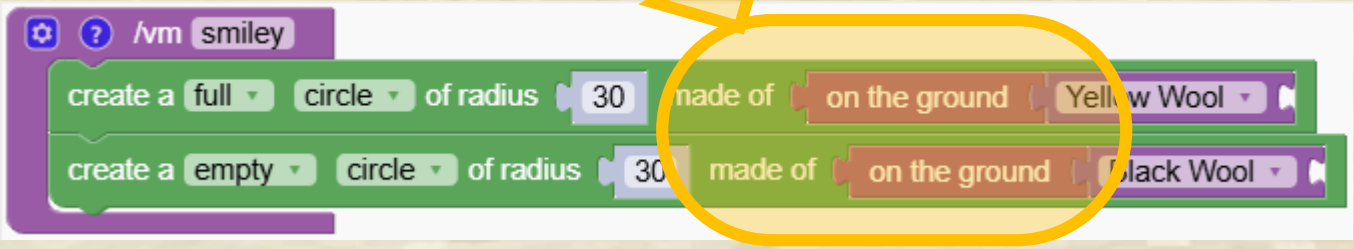


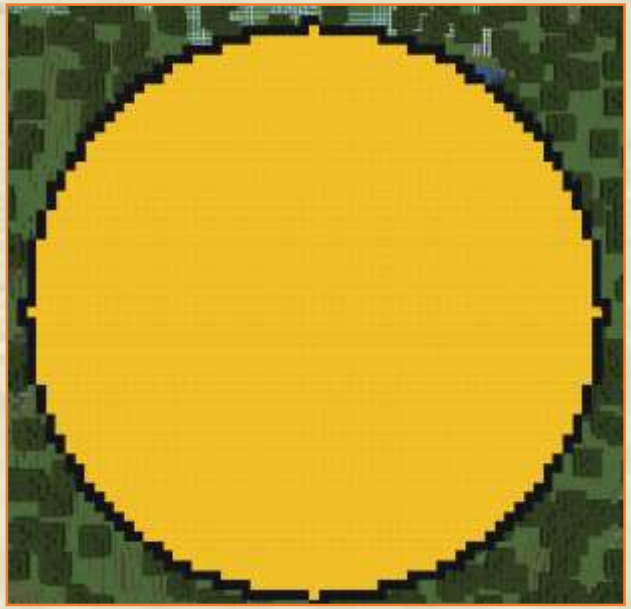
Let's create a smiley face

Every time we create the circles we have to fly high up in order to see the whole smiley.

To be more efficient, we want to fly high above ground and look at the smiley faces from there.

Therefore we use this block to say that the block should be on top of the first solid block found

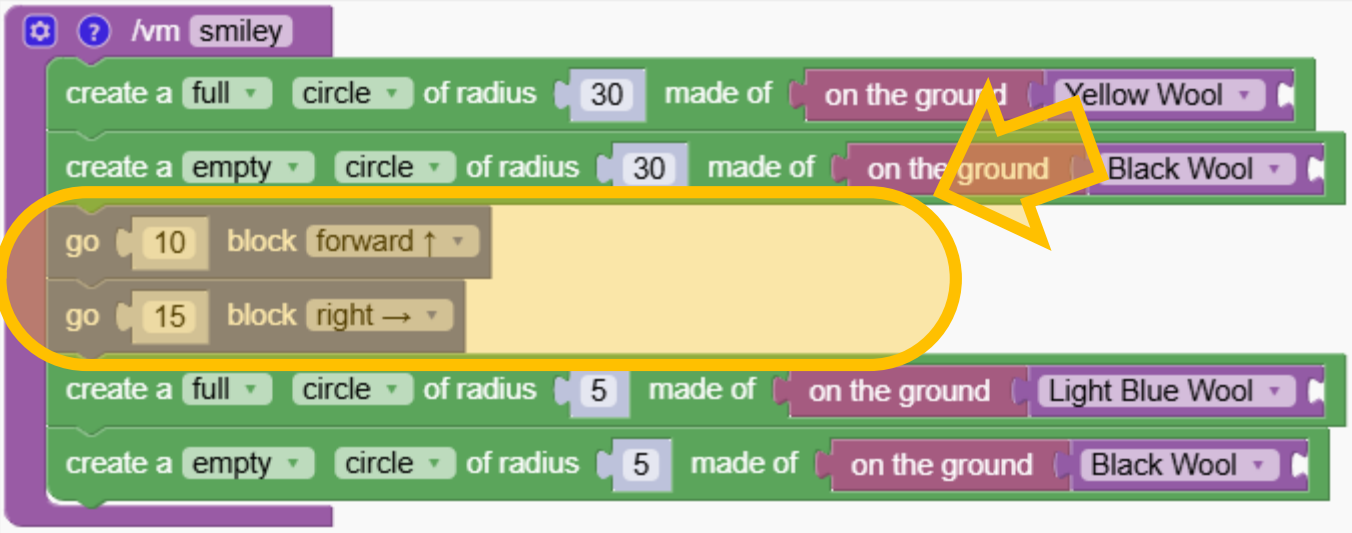


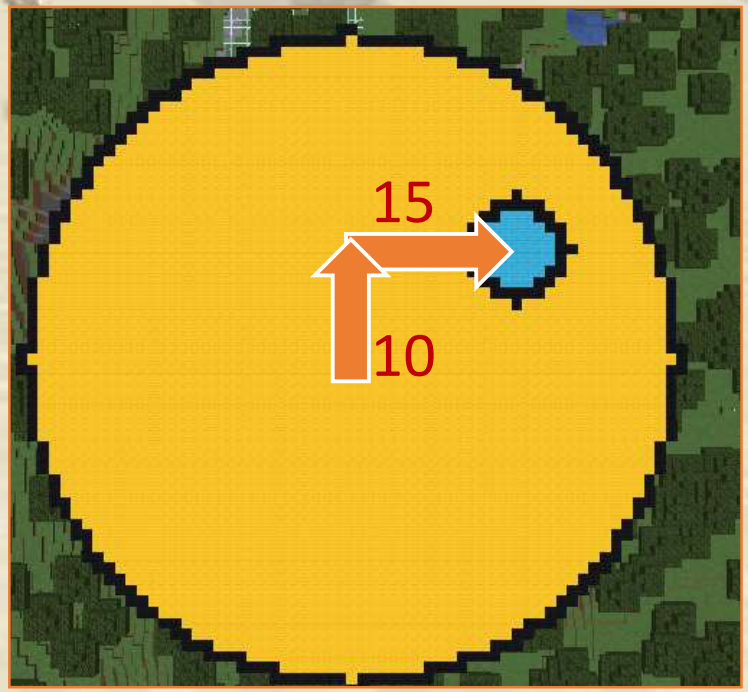


Let's create a smiley face

Our robot is located at the center of the face.

Now we give the order to move 10 steps forward and 15 step right before making the circles for the eye

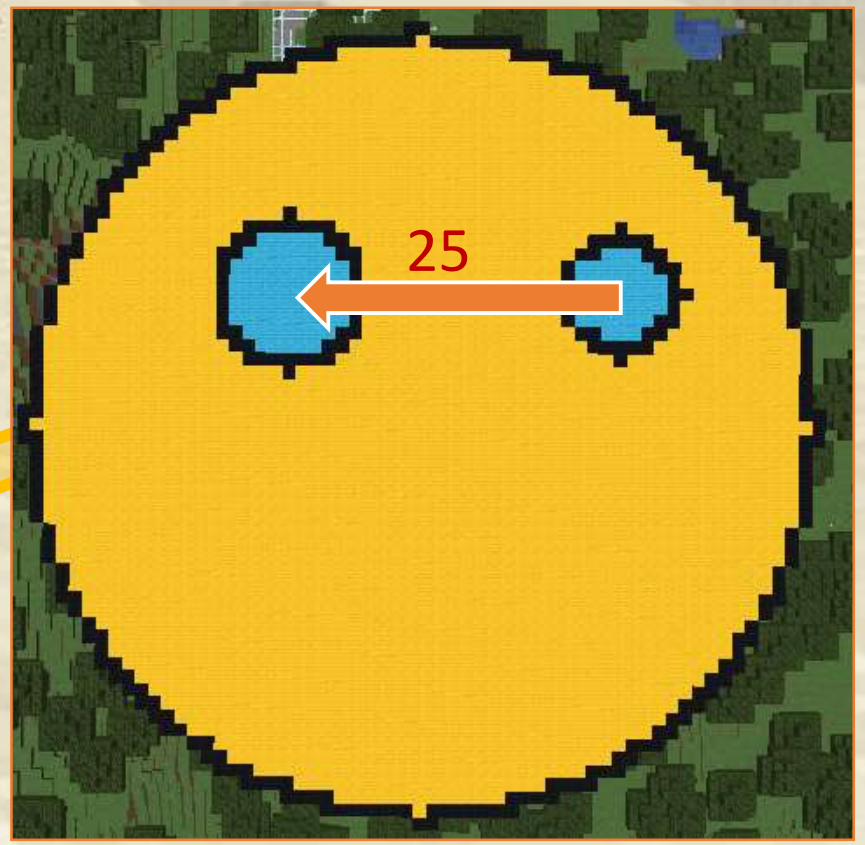




Let's create a smiley face

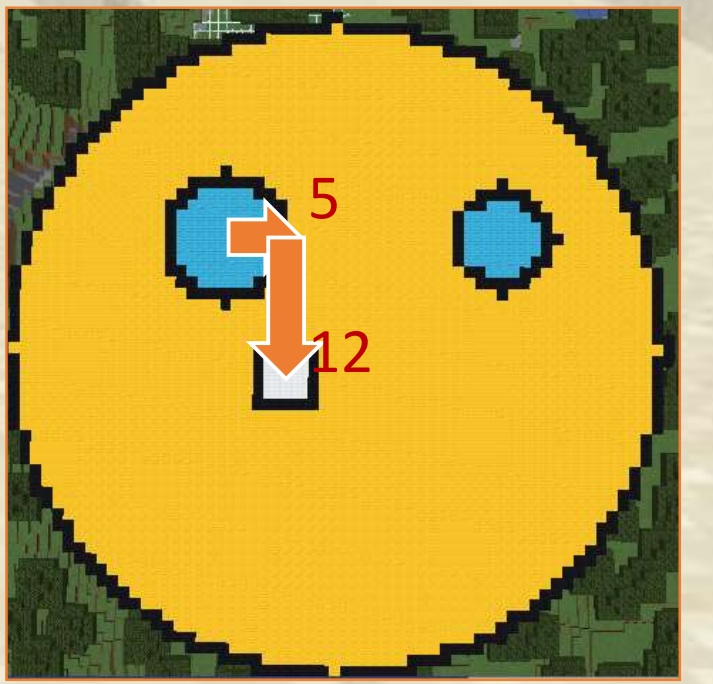
Now we give the order to move 25 steps left andmake 2 circles of with 6 blocks

```
/vm smiley
create a full circle of radius 30 made of on the ground Yellow Wool
create a empty circle of radius 30 made of on the ground Black Wool
go 10 block forward ↑
go 15 block right →
create a full circle of radius 5 made of on the ground Light Blue Wool
create a empty circle of radius 5 made of on the ground Black Wool
go 25 block left ←
create a full circle of radius 6 made of on the ground Light Blue Wool
create a empty circle of radius 6 made of on the ground Black Wool
```



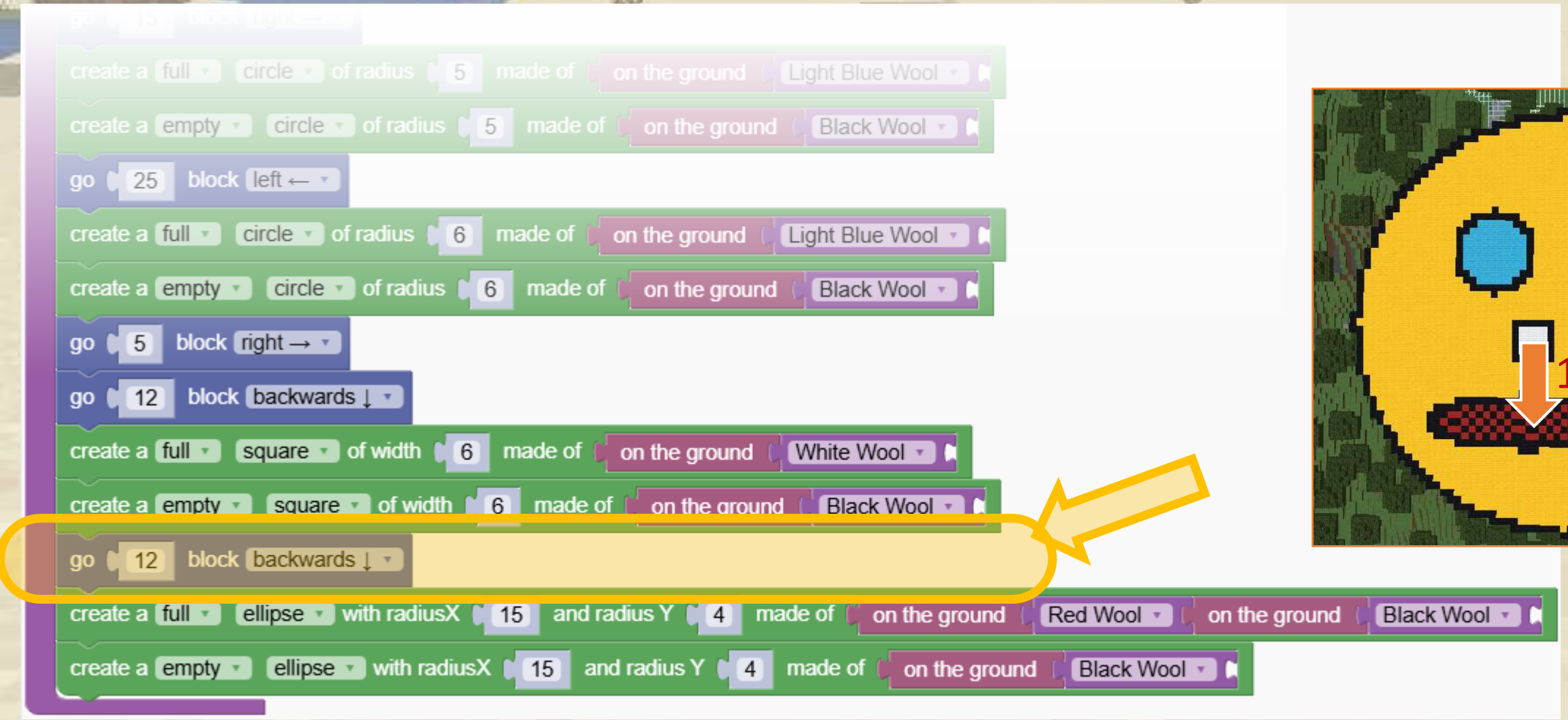
Let's create a smiley face

Now we give the order to move 25 steps left and to make 2 circles of with 6 blocks



Let's create a smiley face

Now we give the order to move 12 blocks backwards



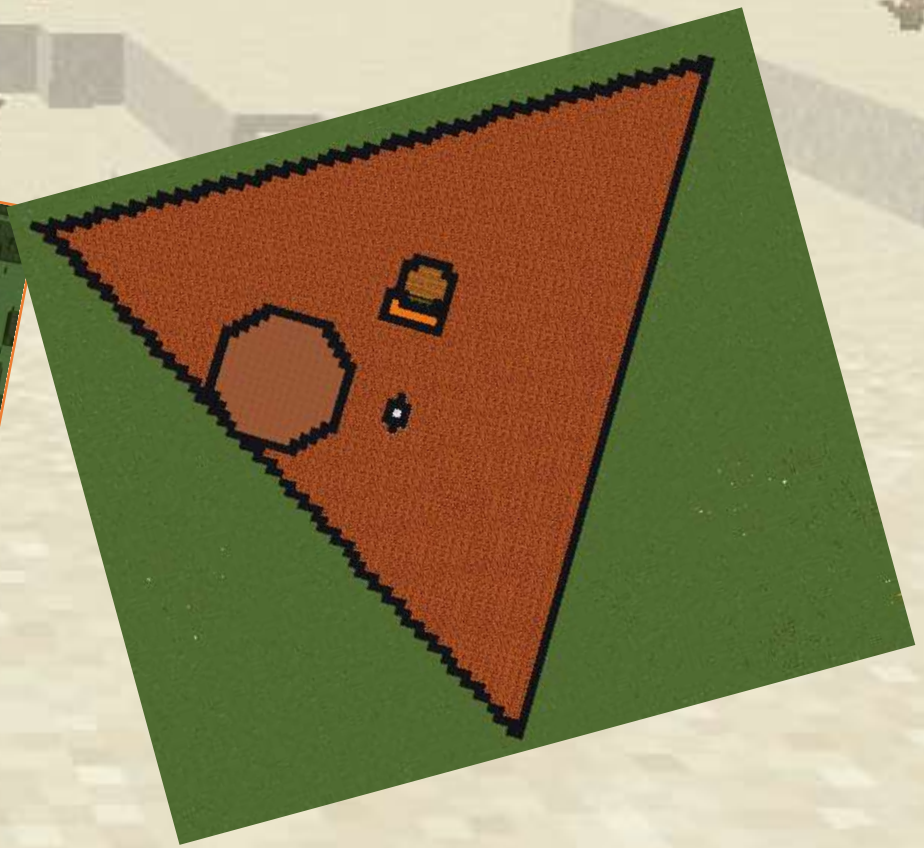
Let's create a smiley face

Now is finished

```
create a full circle of radius 5 made of on the ground Light Blue Wool
create a empty circle of radius 5 made of on the ground Black Wool
go 25 block left ←
create a full circle of radius 6 made of on the ground Light Blue Wool
create a empty circle of radius 6 made of on the ground Black Wool
go 5 block right →
go 12 block backwards ↓
create a full square of width 6 made of on the ground White Wool
create a empty square of width 6 made of on the ground Black Wool
go 12 block backwards ↓
create a full ellipse with radiusX 15 and radius Y 4 made of on the ground Red Wool on the ground Black Wool
create a empty ellipse with radiusX 15 and radius Y 4 made of on the ground Black Wool
```

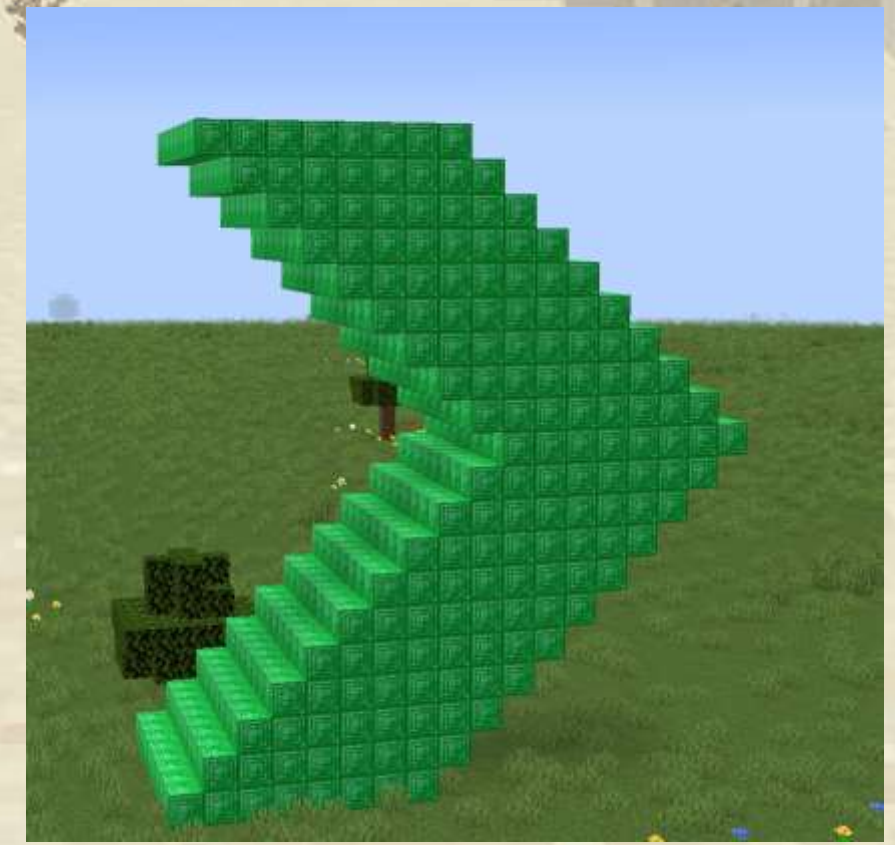
Independent time: Make your own smiley

Have fun customizing the program and making your own smiley faces.



We make a tower in the shape of an arrow

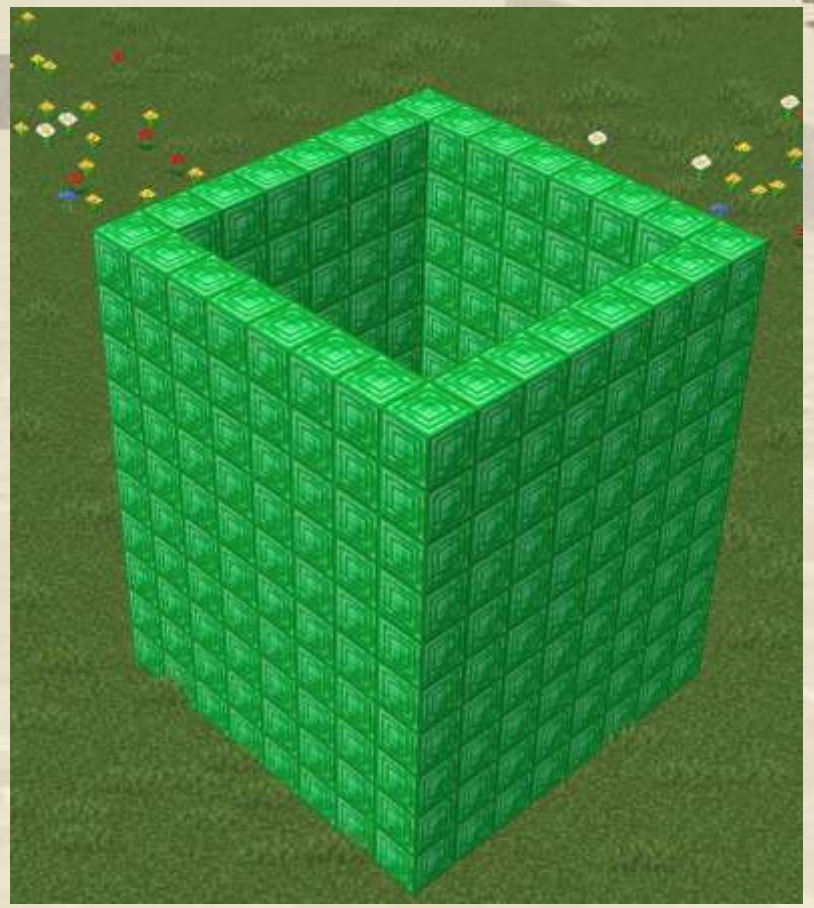
Combine movements to construct a tower shaped like an arrow.



We make a tower in the shape of an arrow

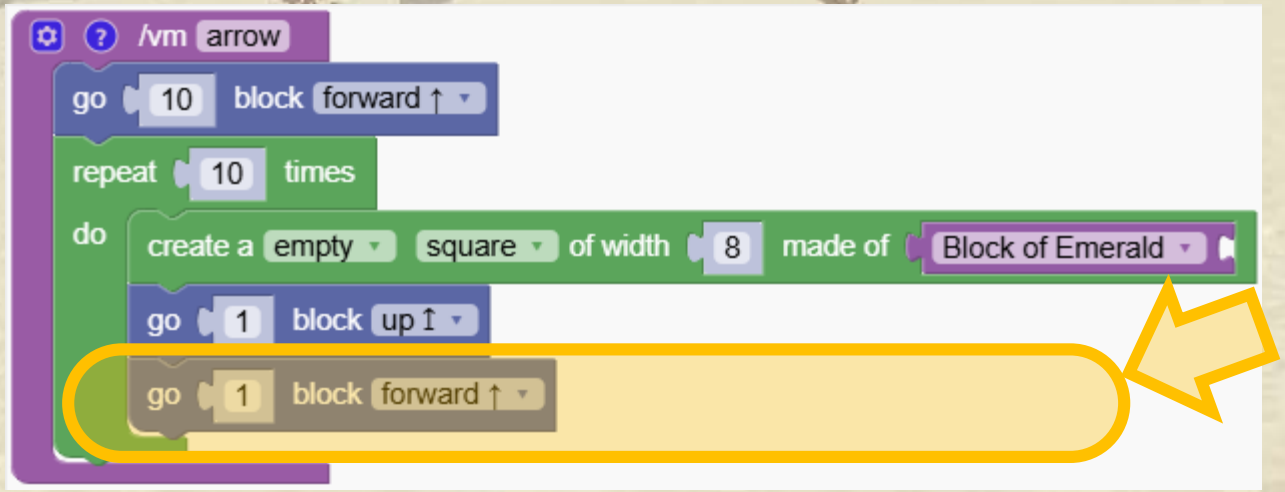
Let’s start by creating a simple emerald tower

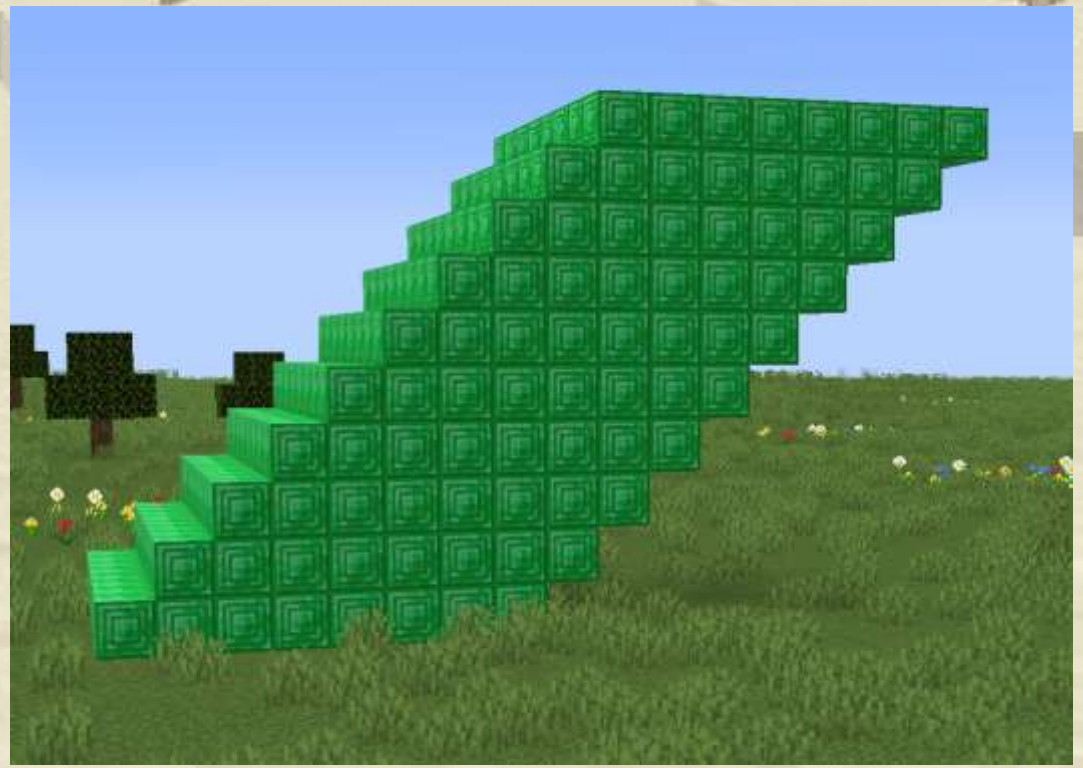
```
/vm arrow
go 10 block forward ↑
repeat 10 times
do create a empty square of width 8 made of Block of Emerald
   go 1 block up ↥
```



We make a tower in the shape of an arrow

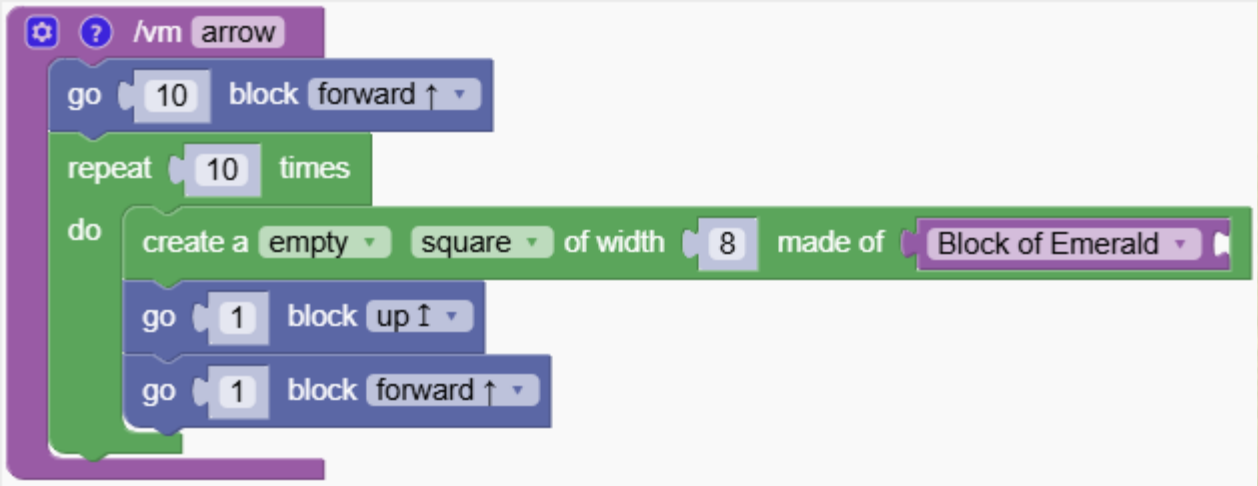
We add a step forward to make the tower grow forward

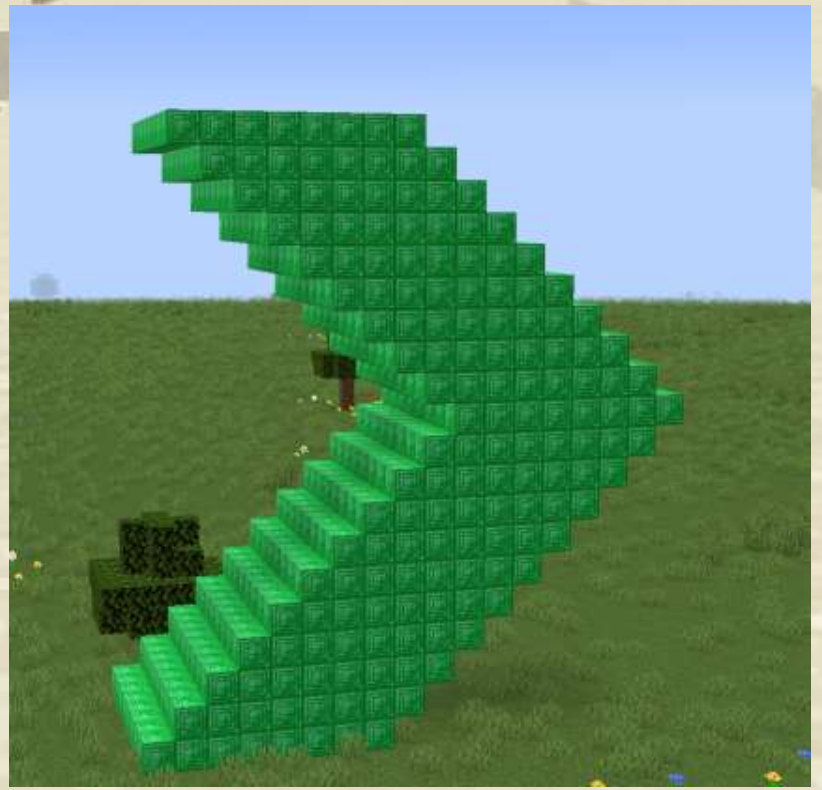




We make a tower in the shape of an arrow

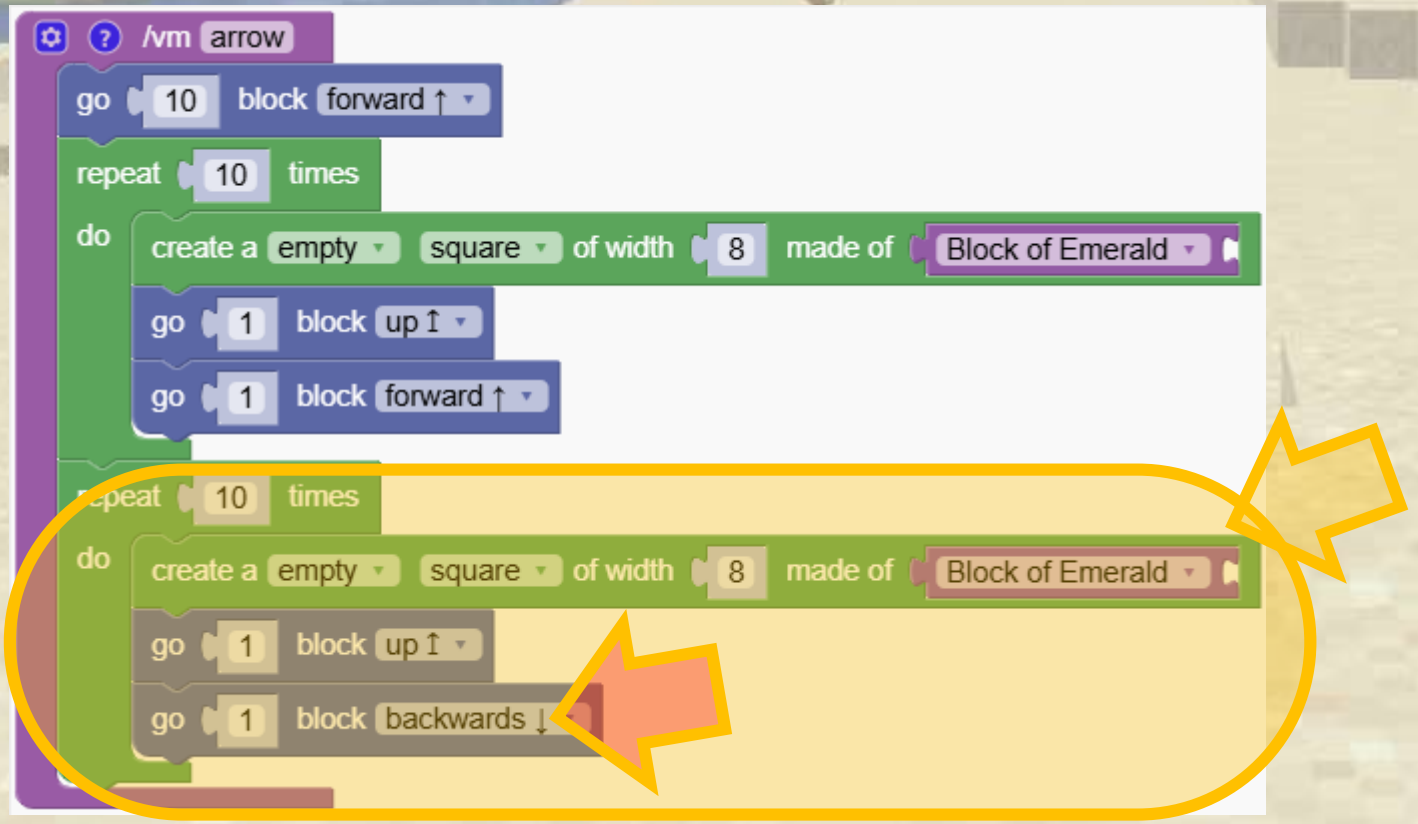
Now we want to add another tower that goes in the other direction.
Can you do it? (Hint: Instead of going forward the tower has to go backwards)

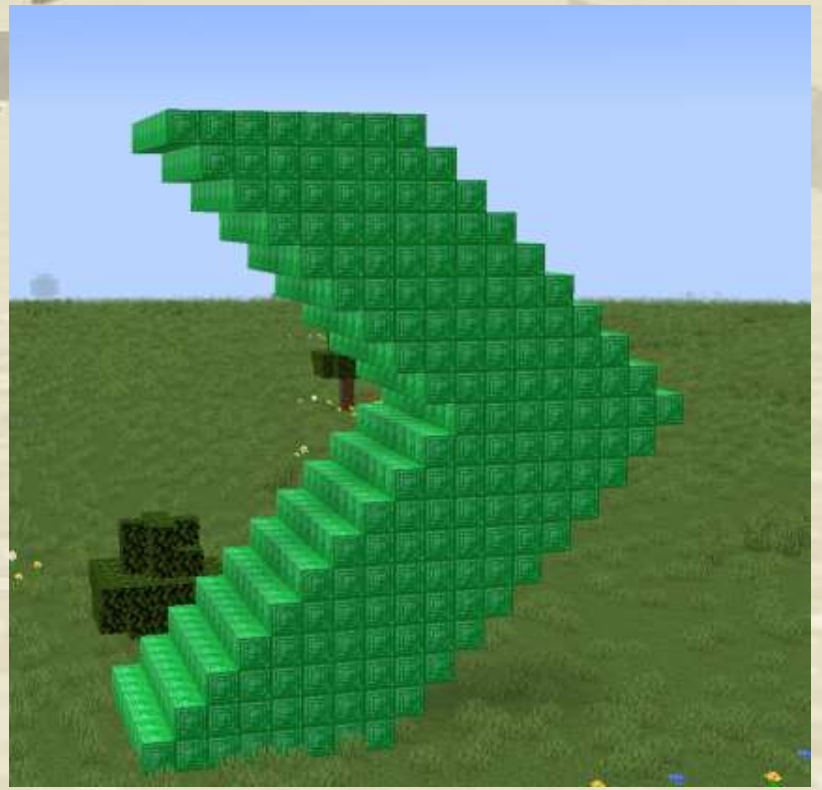




We make a tower in the shape of an arrow

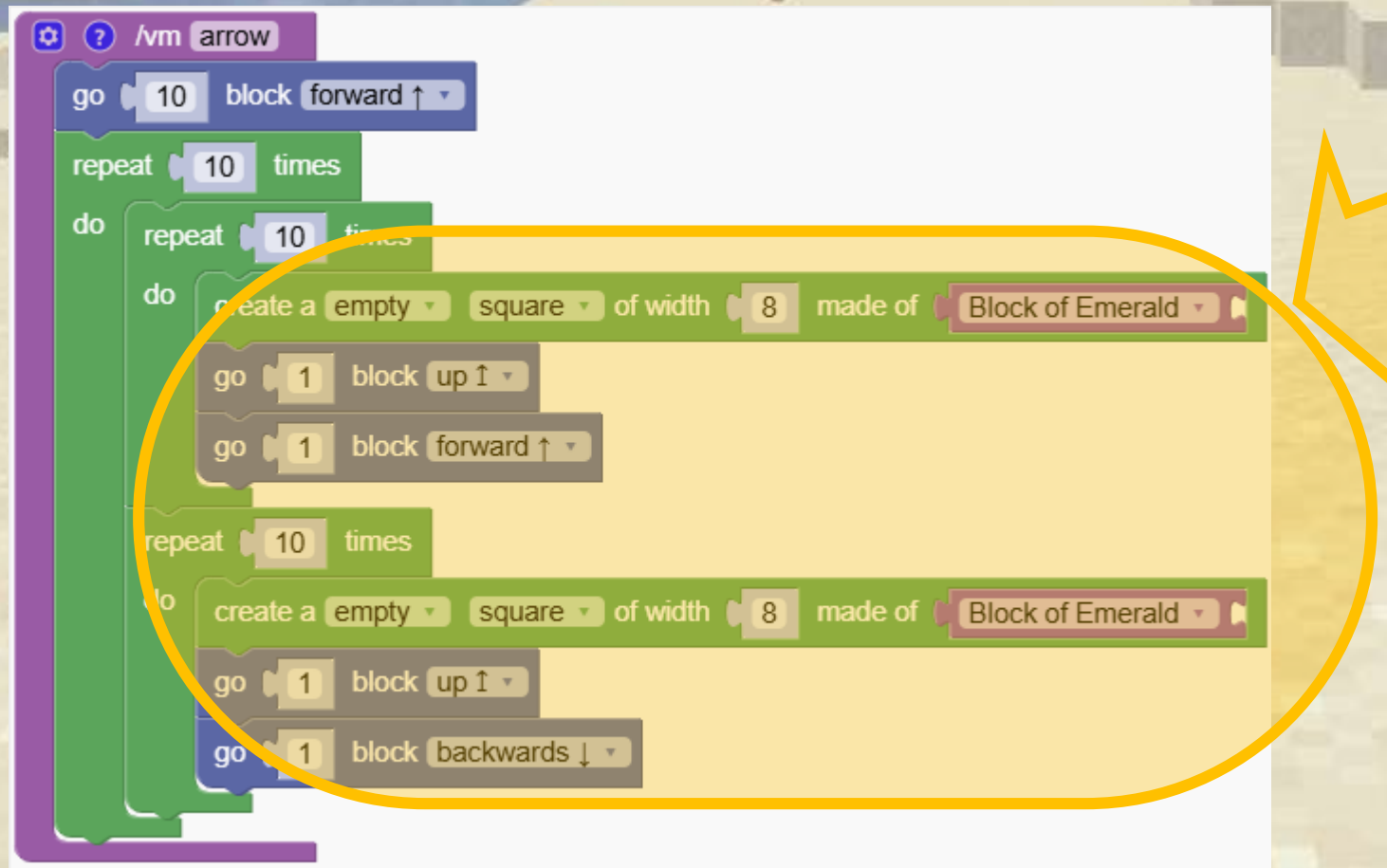
Now we want to add another tower that goes in the other direction.
We duplicate the repeating block and we change the direction of the tower

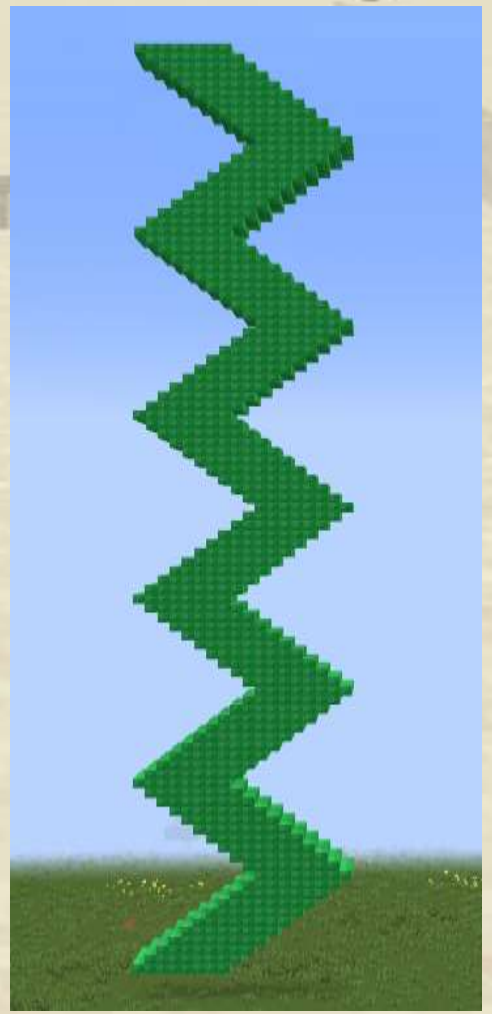




We make a tower in the shape of an arrow

Let's do an amazing tower. Just add a repeating block around the whole program and our tower becomes amazing!





How do we make a chicken bomb?

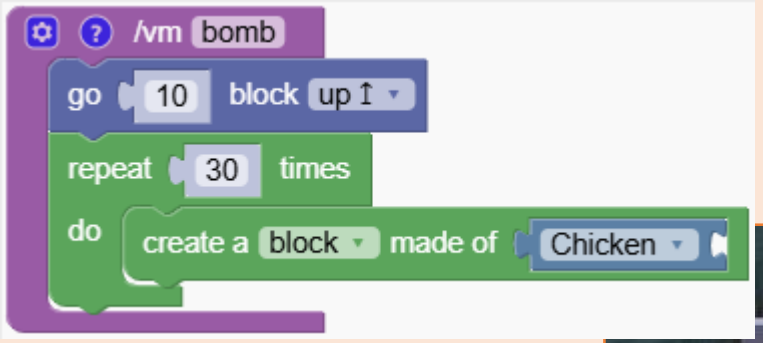
A chicken bomb is made with 30 chickens all spawned at the same position in the air. When the chickens land on the ground they spread similar to an explosion

Quiz

How do we make a chicken bomb?

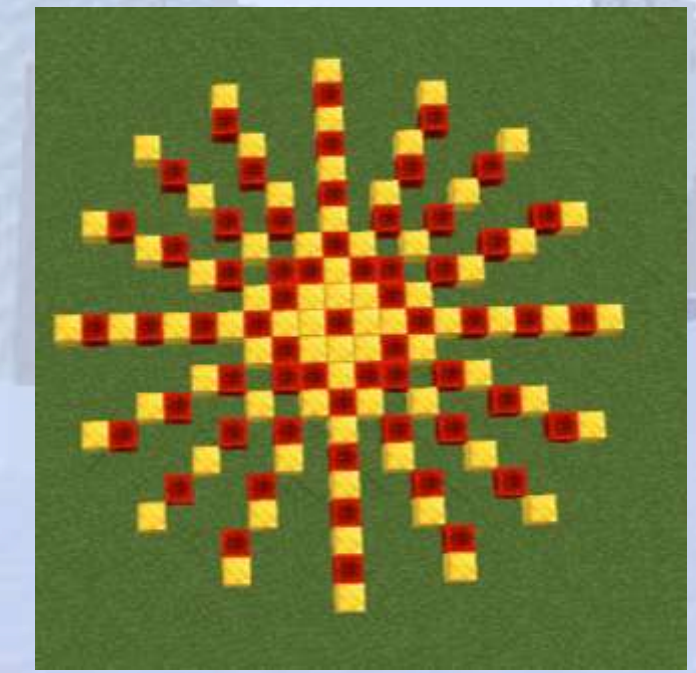
Here is the solution.

What happens if we use another mob instead of chickens?

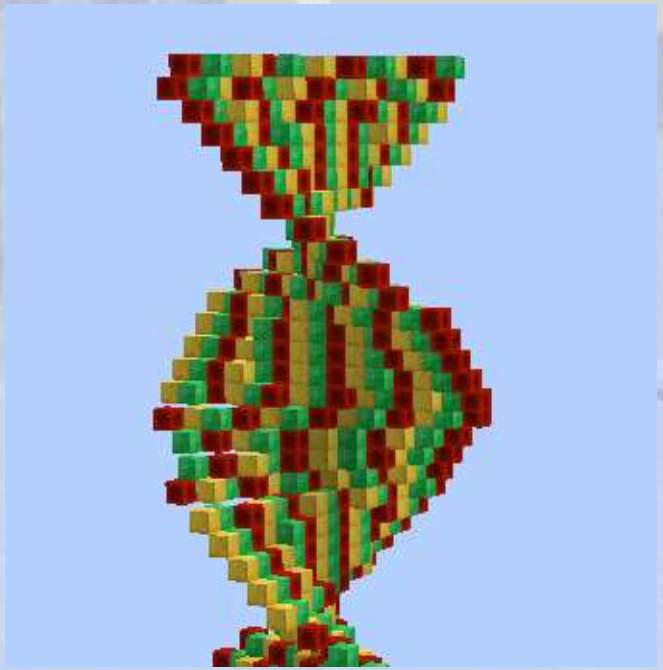


Quiz

Horizontal Rotation



Amazing structures created with simple rotations



Horizontal rotation

🔍 Section Overview

We create few structures that leverage the possibility to turn the robot

🎯 Objectives

Learn how to rotate objects horizontally and create interesting shapes like spirals and patterns.

👌 Expected Outcomes

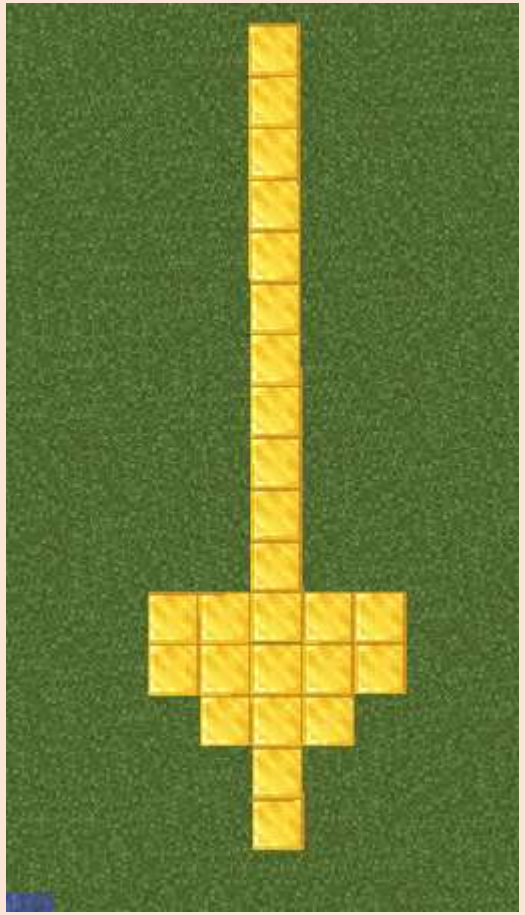
Students will understand the concept of angles and how to use them in coding

Angles

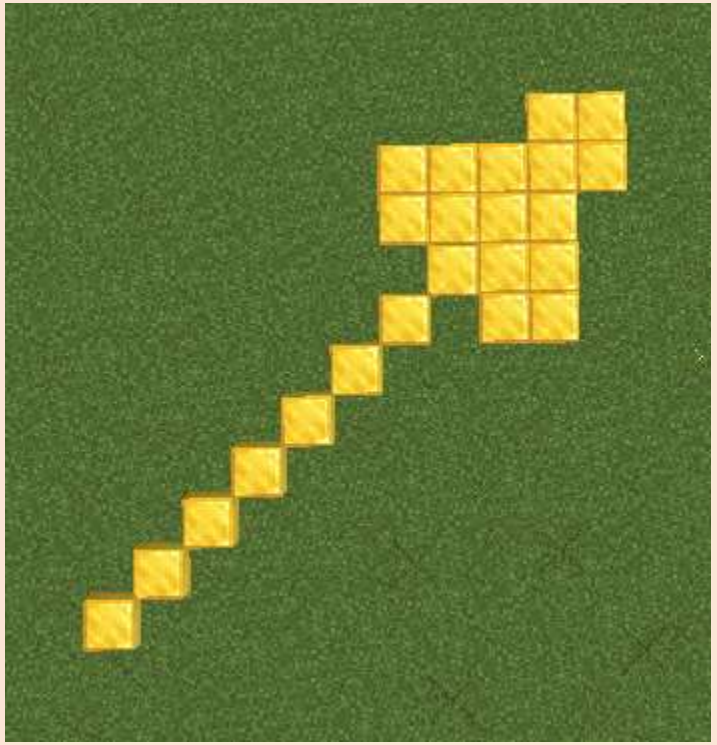
Review the concept of angles

Which angle is this?

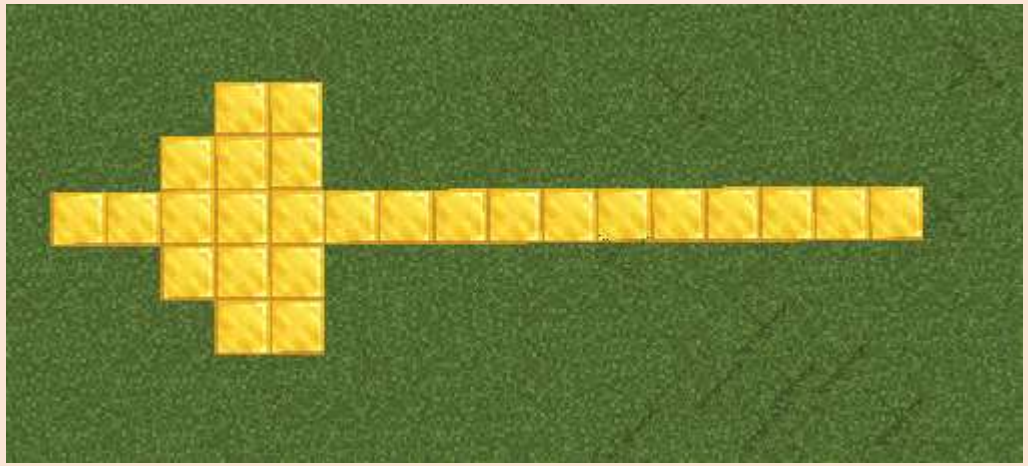
Test your knowledge of angles with this activity.



?



?

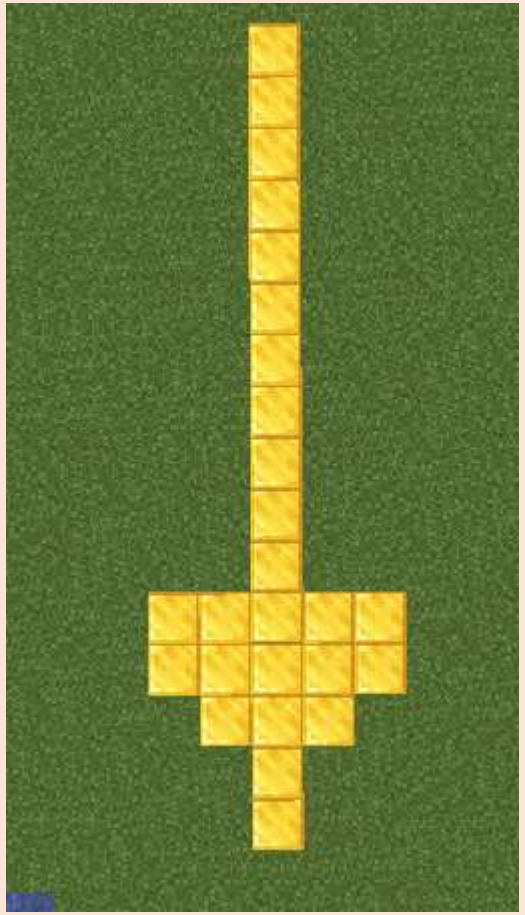


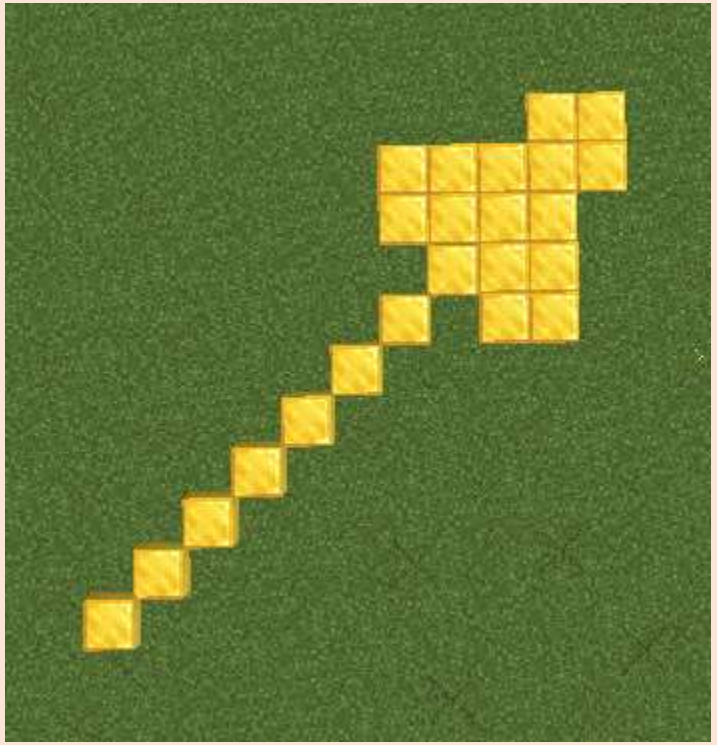
?

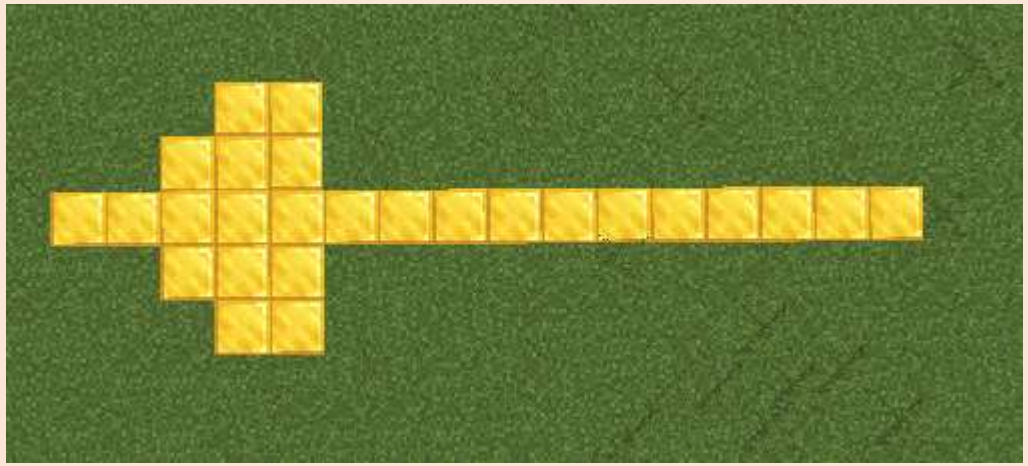
Quiz

Which angle is this?

Solution:



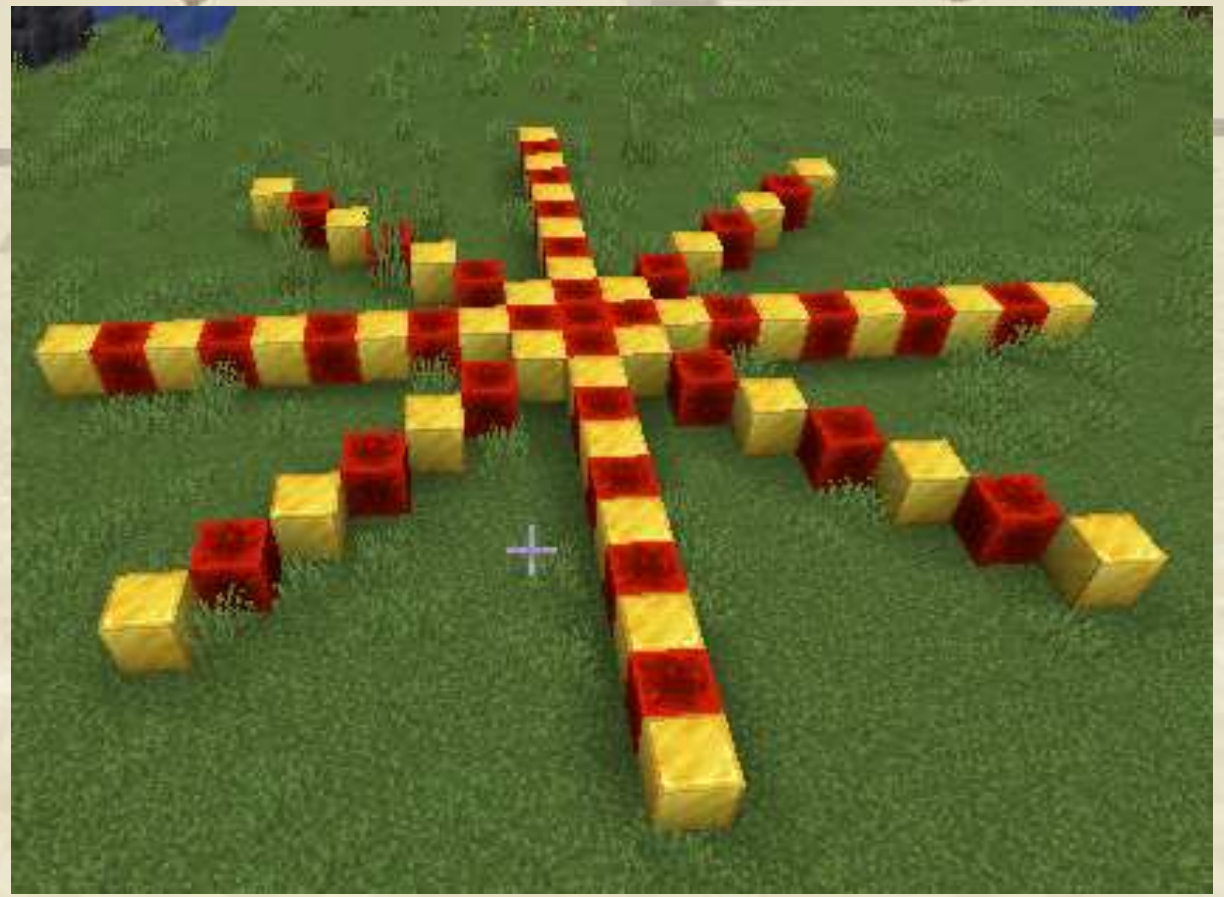




180 **45** **270** Quiz

Create a sun by rotating a row of blocks

Use simple rotation to create a fun sun drawing.

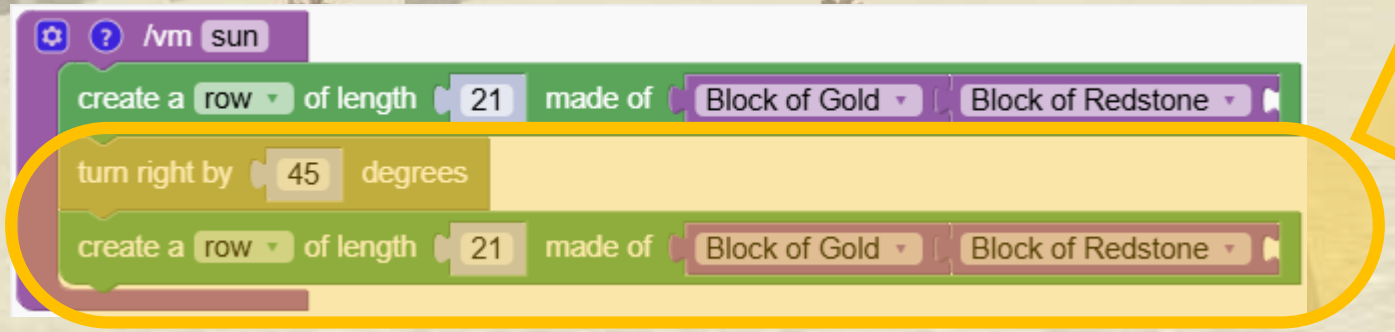


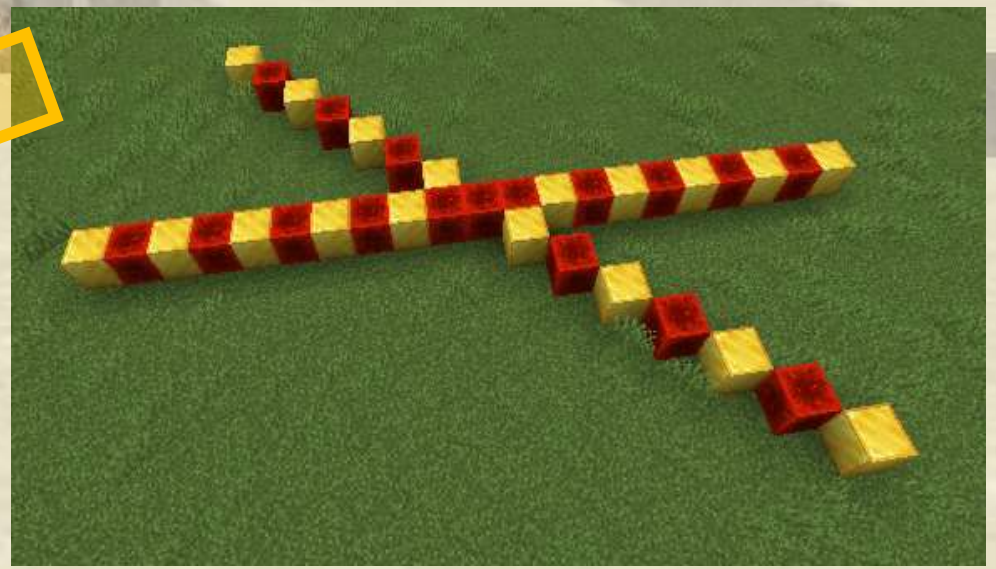
Create a sun by rotating a row of blocks

We start wit one line of blocks.

Create a sun by rotating a row of blocks

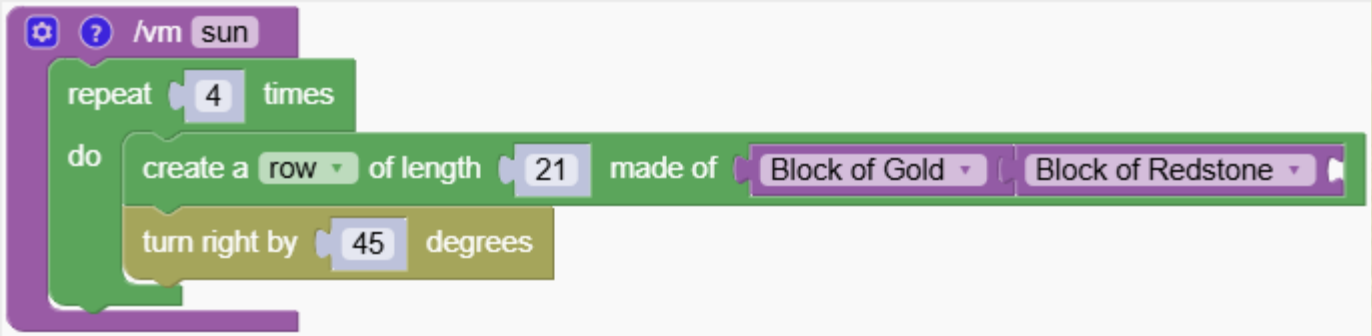
We add a second line after having done a 45 degrees rotation

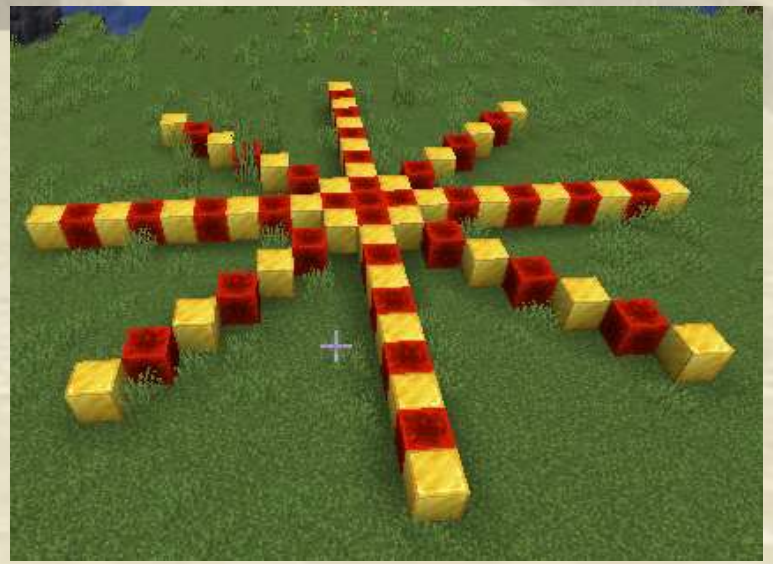




Create a sun by rotating a row of blocks

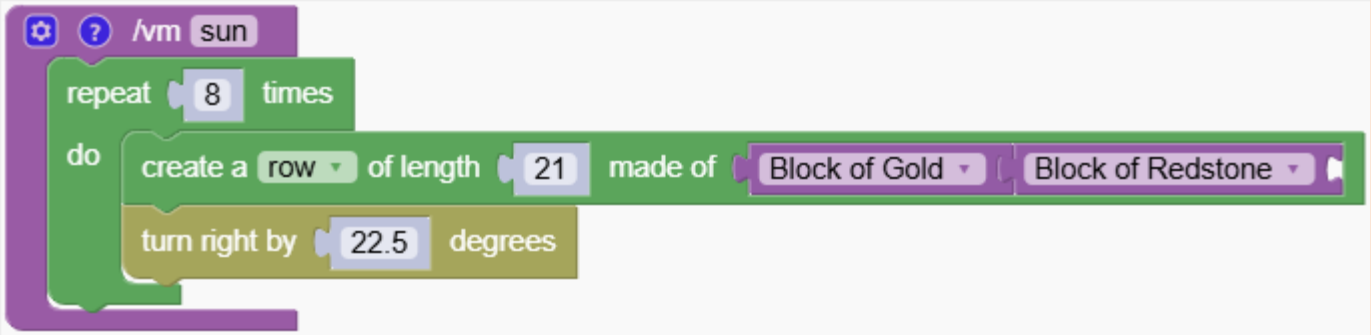
We use a loop to do 4 lines

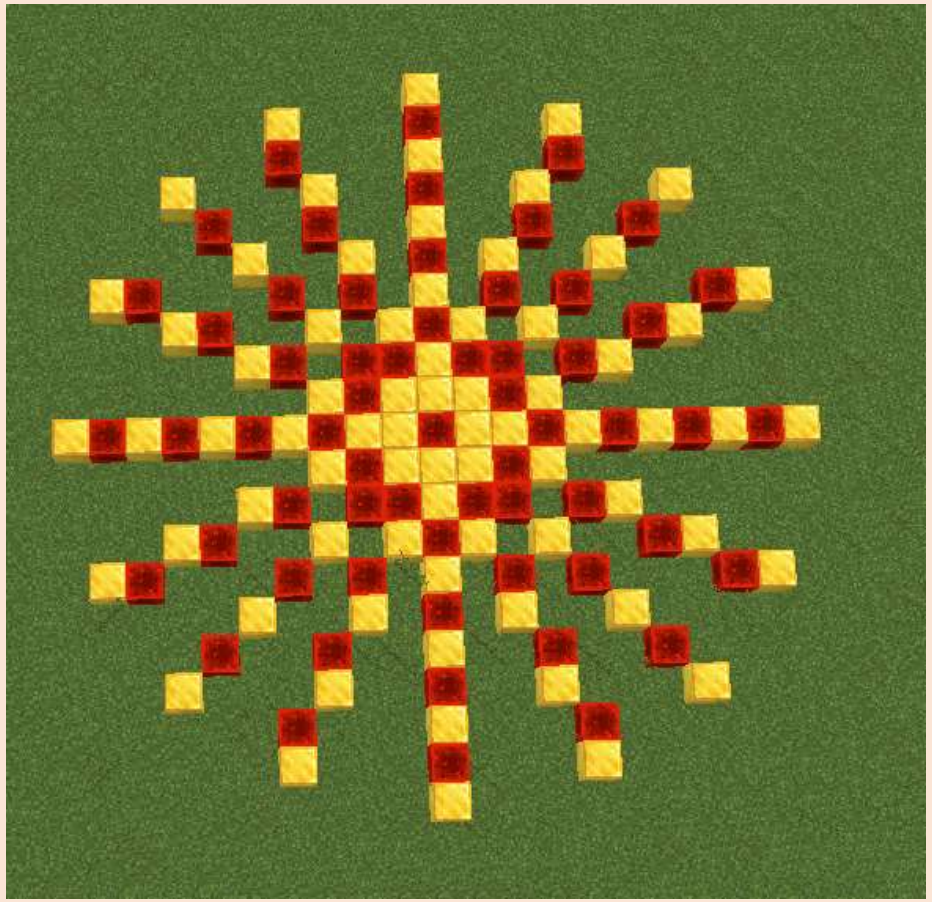




How do I double the number of spikes from 4 to 8?

You need to halve the angle and double the repetitions

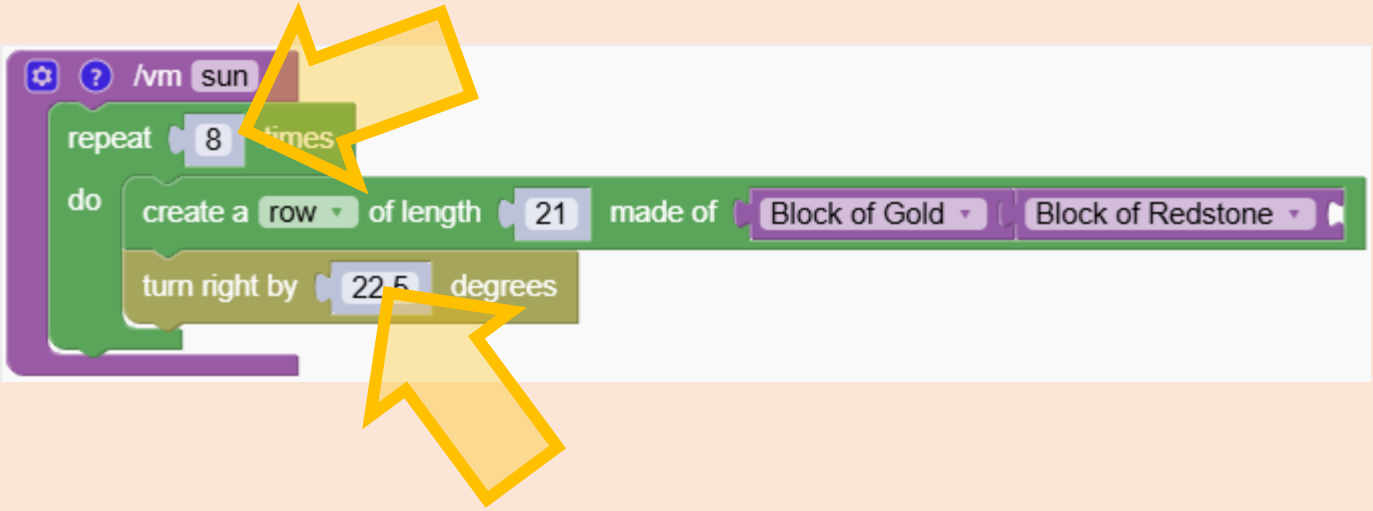


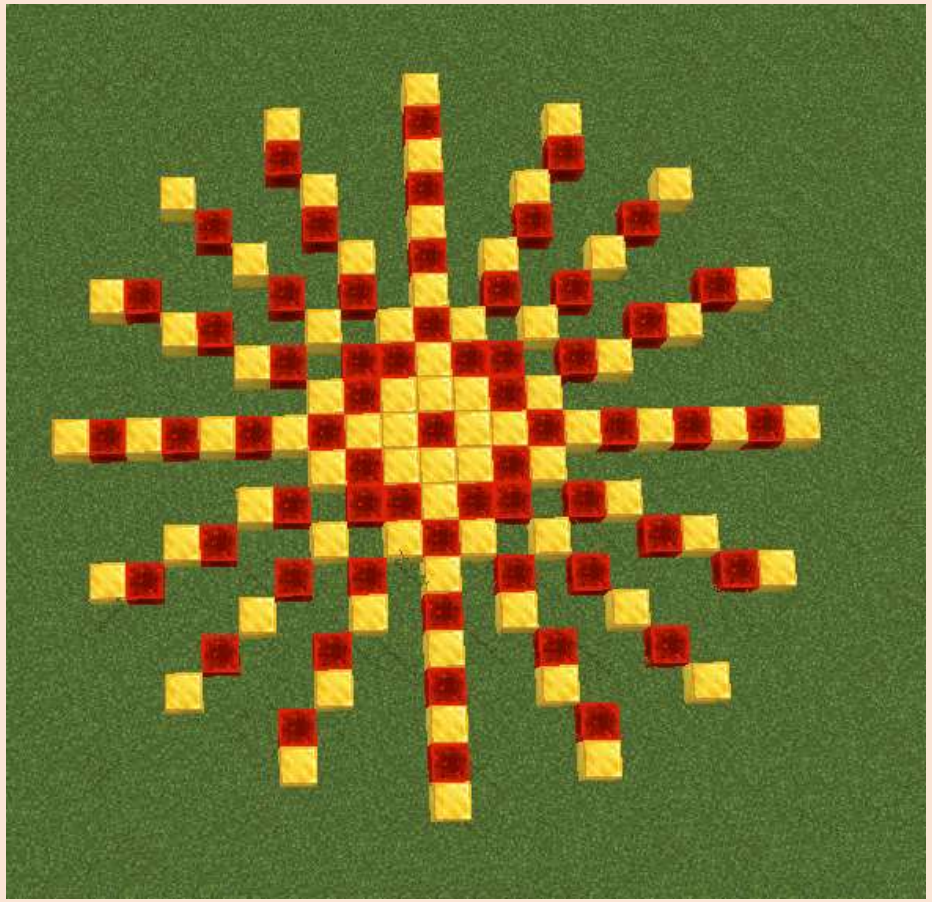


Quiz

How do I double the number of spikes?

Solution





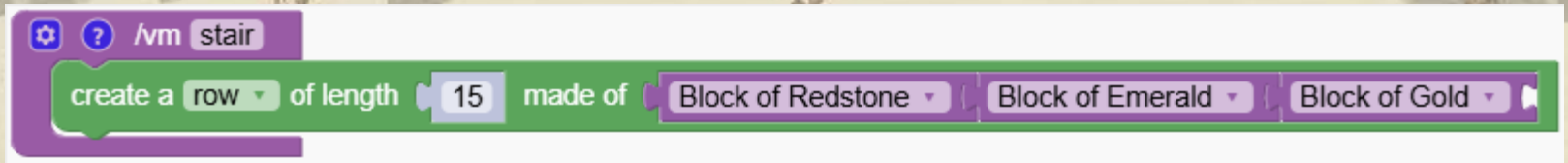
Quiz

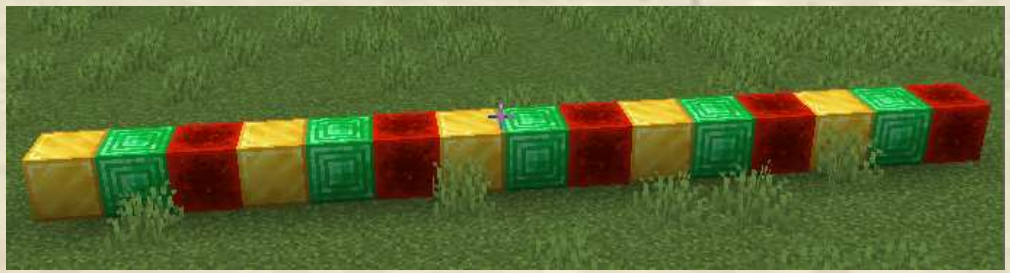
Create a rotating stair

Create a rotating structure by changing the angle and height.

Create a rotating stair

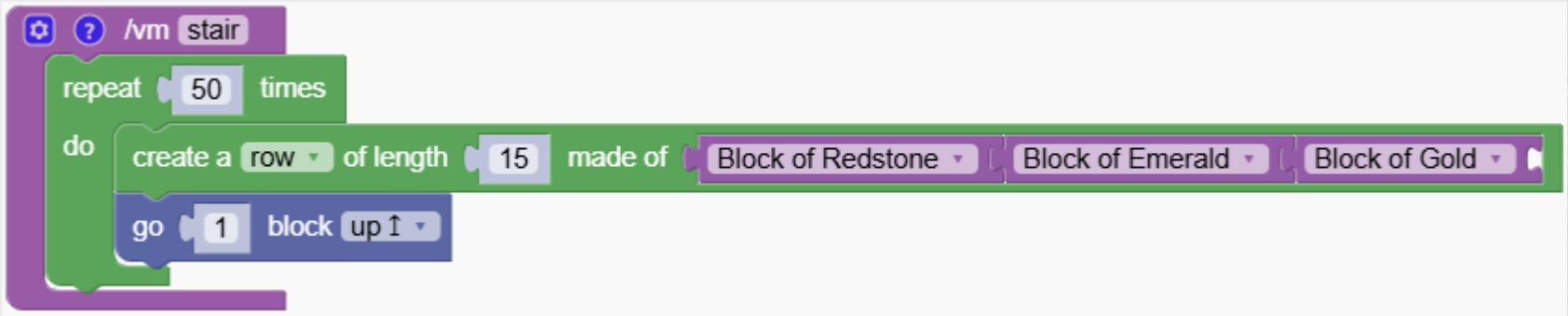
First we create simple row





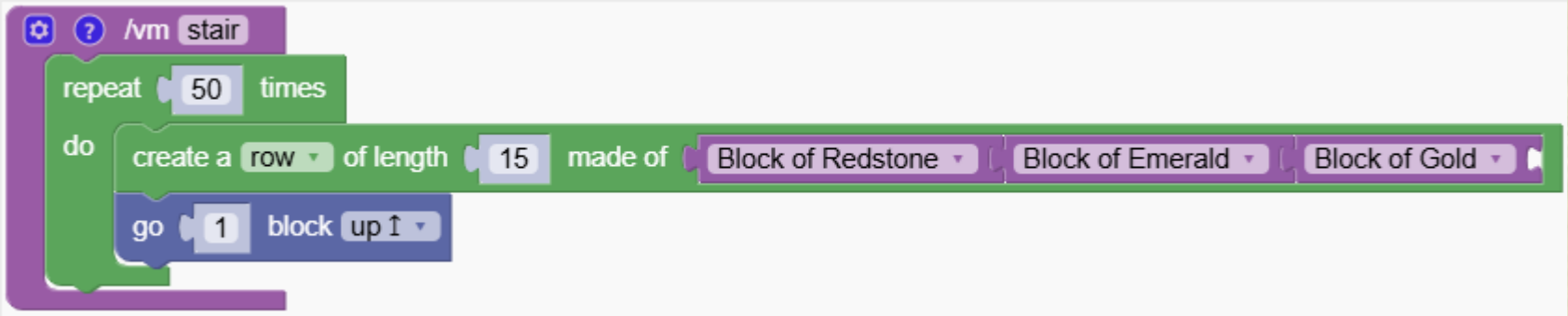
Create a rotating stair

Now we extend the row upwards by using a simple repetition



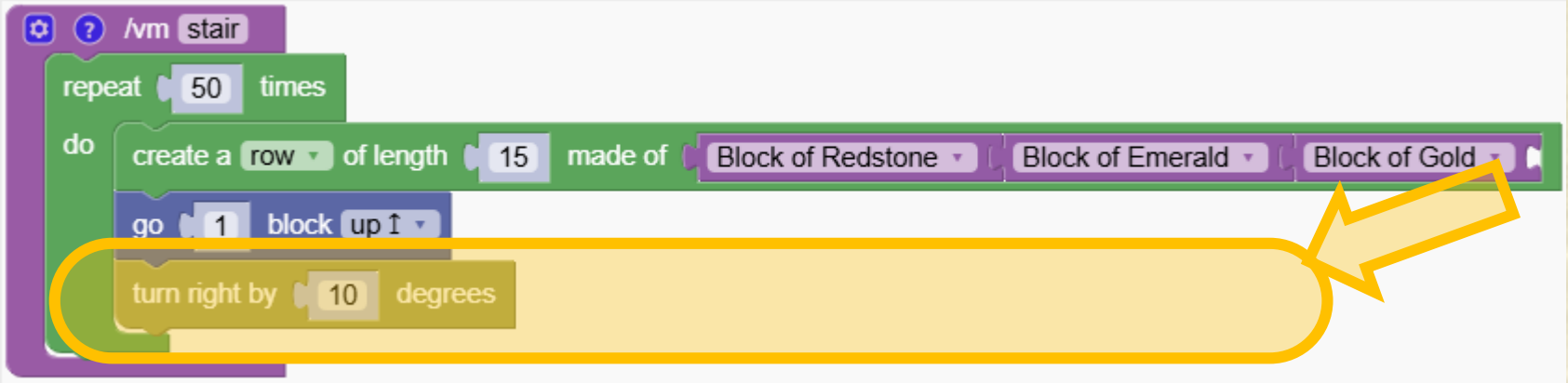
Create a rotating stair

Can you transform the wall into a spiral?



Create a rotating stair

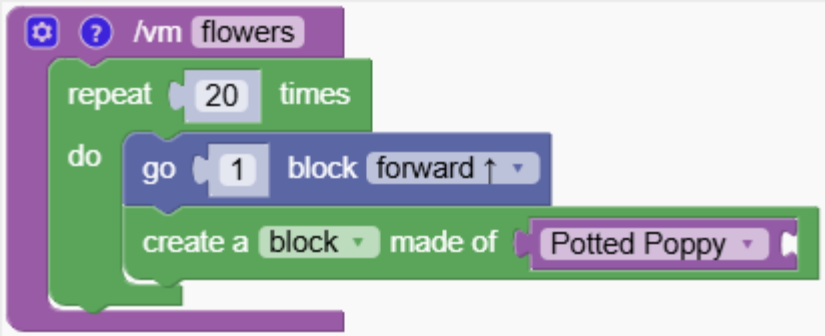
We just add a little rotation of 10 degrees and we have a rotating stair

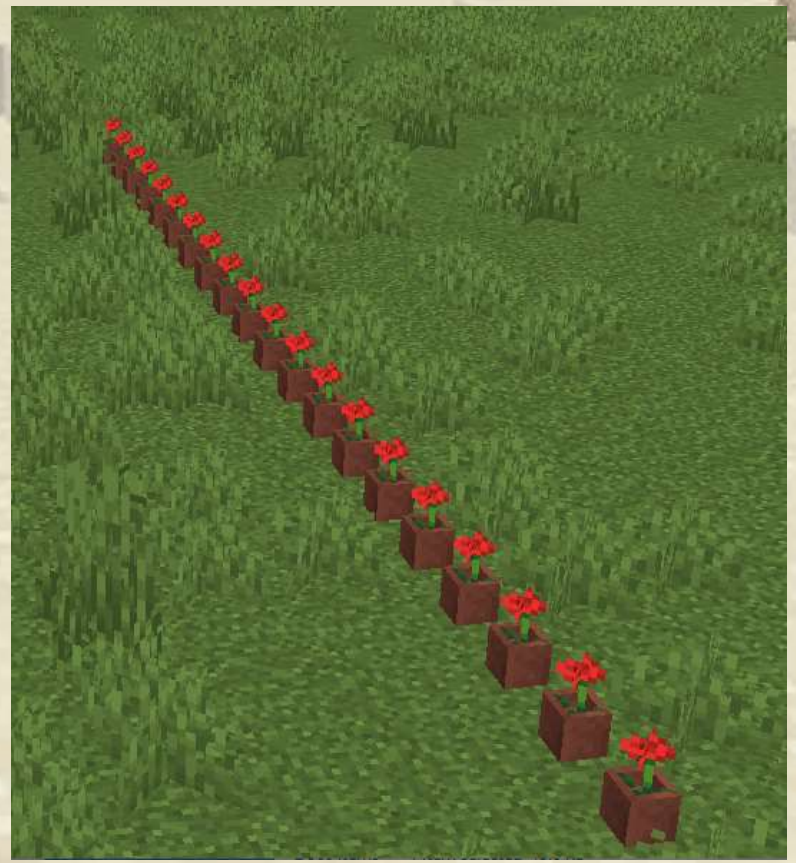


The flower thrower

Learn how to set the direction of the robot to where I'm looking.

We are creating a command that generates a row of flowers





The flower thrower

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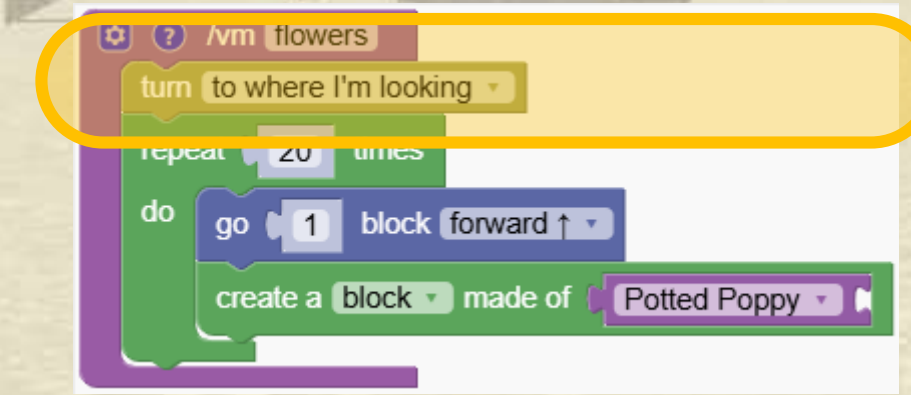
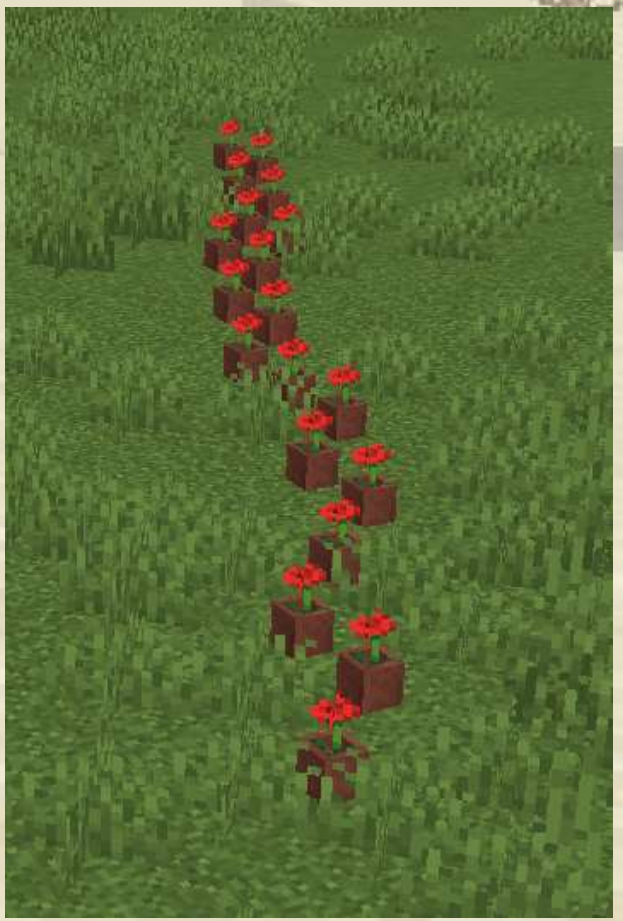
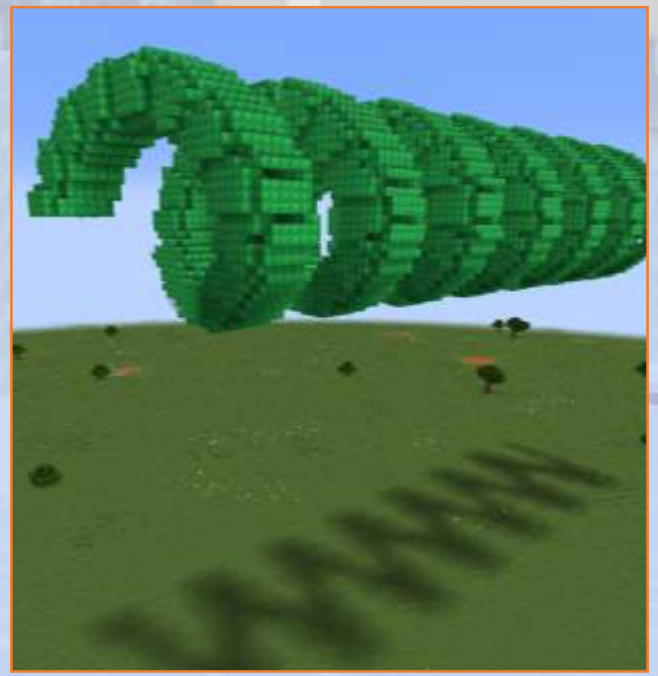




Vertical Rotation

Amazing structures created with simple rotations



Vertical rotation

🔍 Section Overview

We are creating bent towers and rainbows

🎯 Objectives

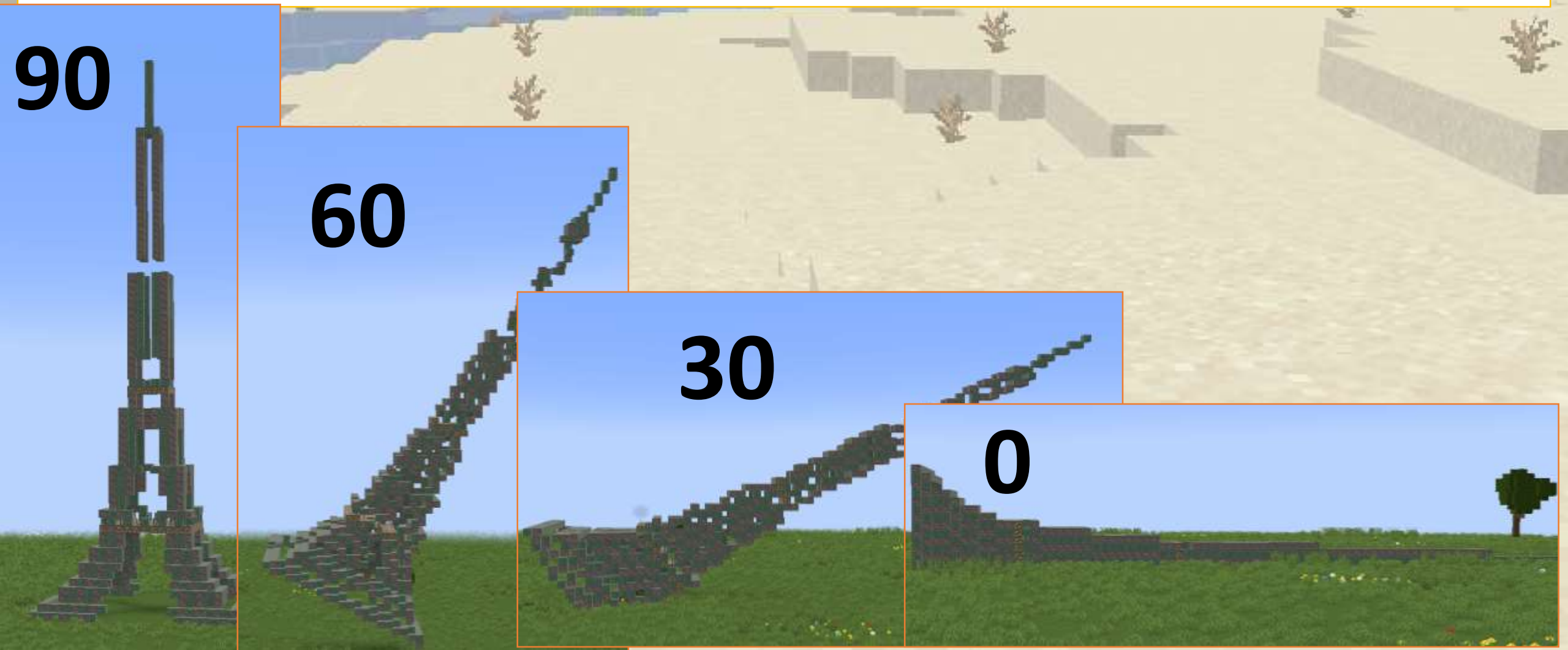
Extend rotations into the vertical dimension to create complex 3D structures

👌 Expected Outcomes

Students will understand rotation angles in the vertical direction

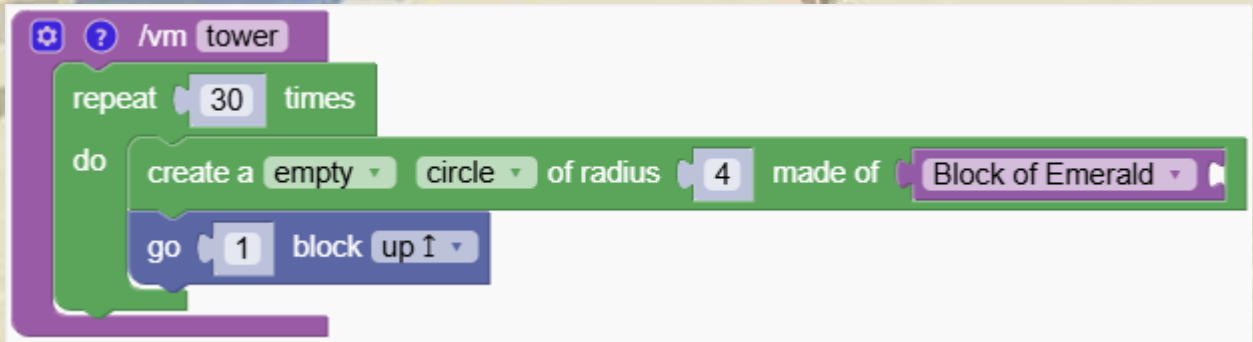
Inclination

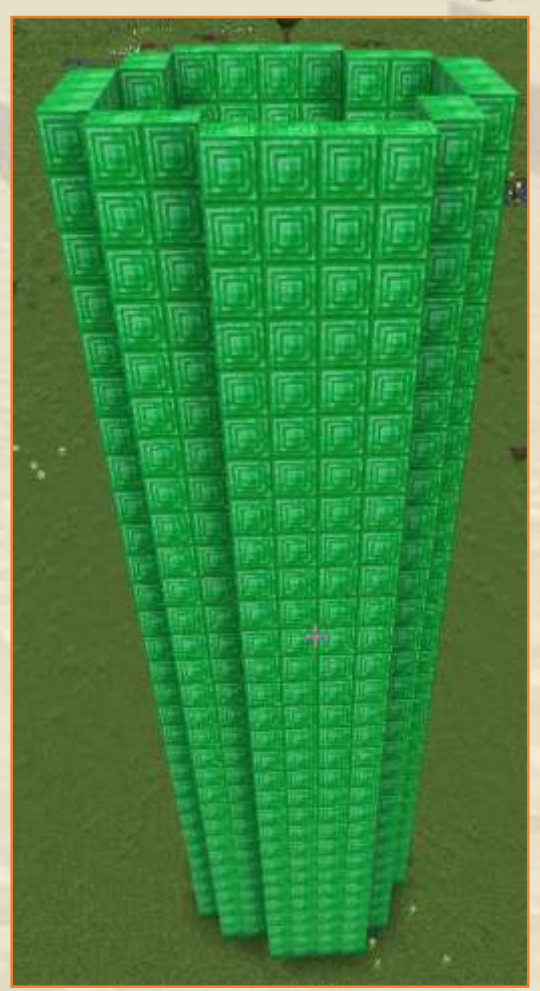
Learn how to tilt the robot at different angles.



Tilting towers

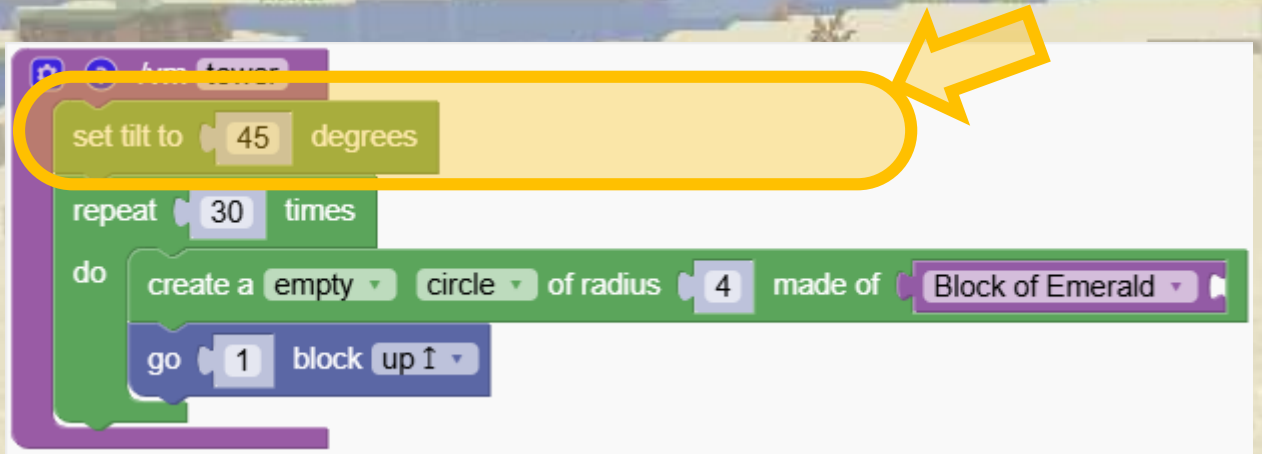
Let’s have fun with towers. We start with a simple tower

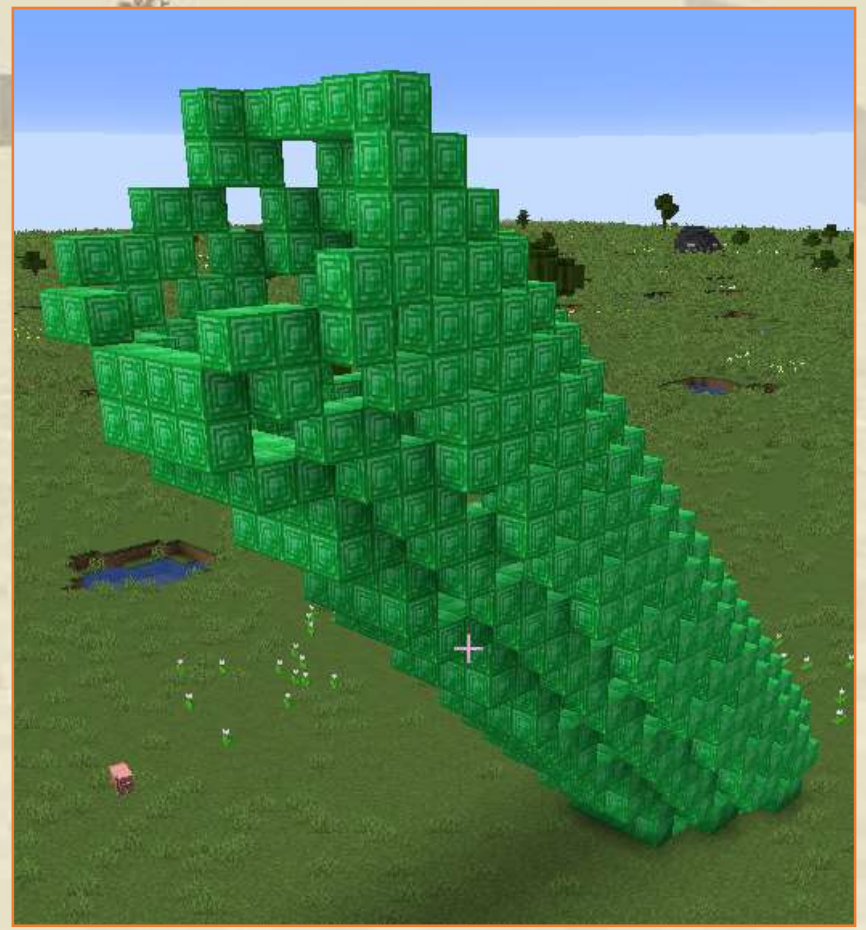




Tilting towers

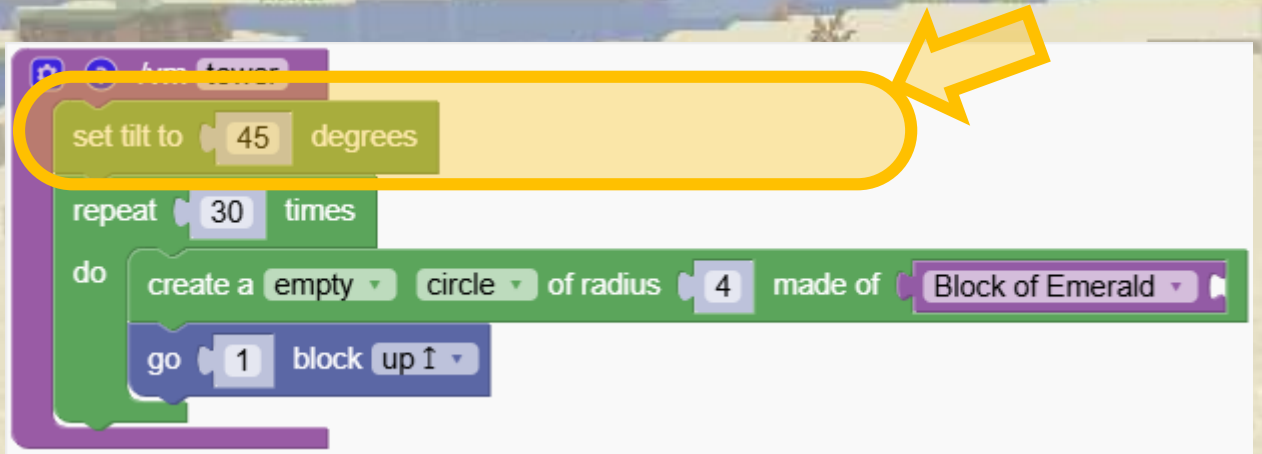
Construct a tower with a tilt. Use the block that sets the tilt





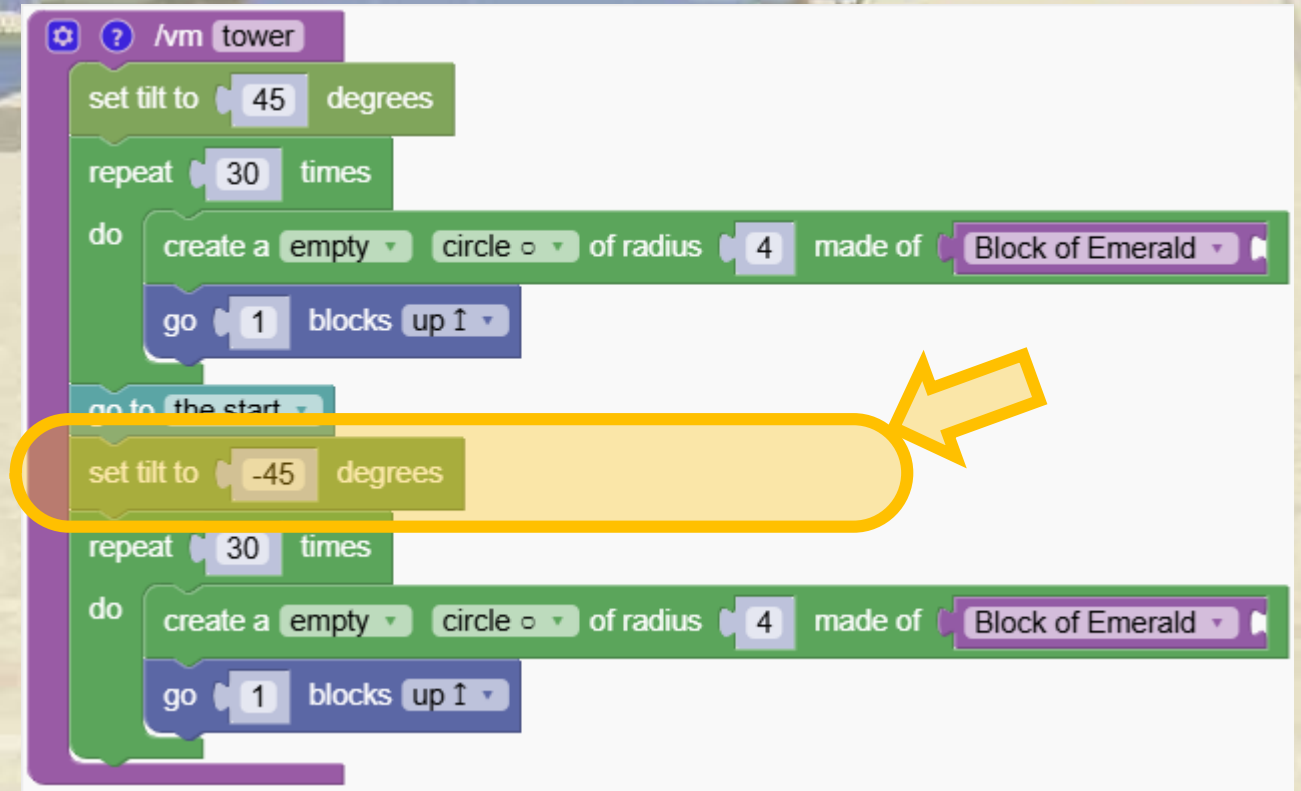
Tilting towers

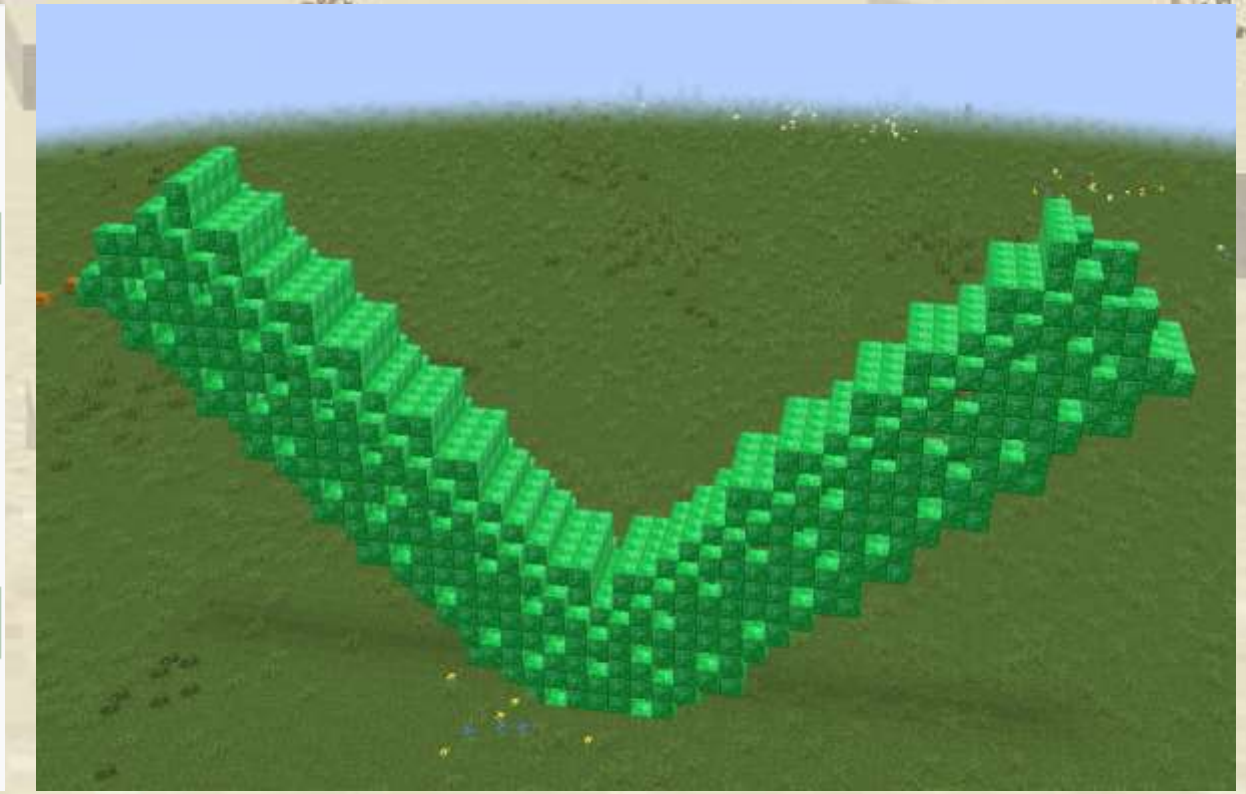
Can you add another tower in the other direction? (hint : The angle is -45 degrees)



Tilting towers

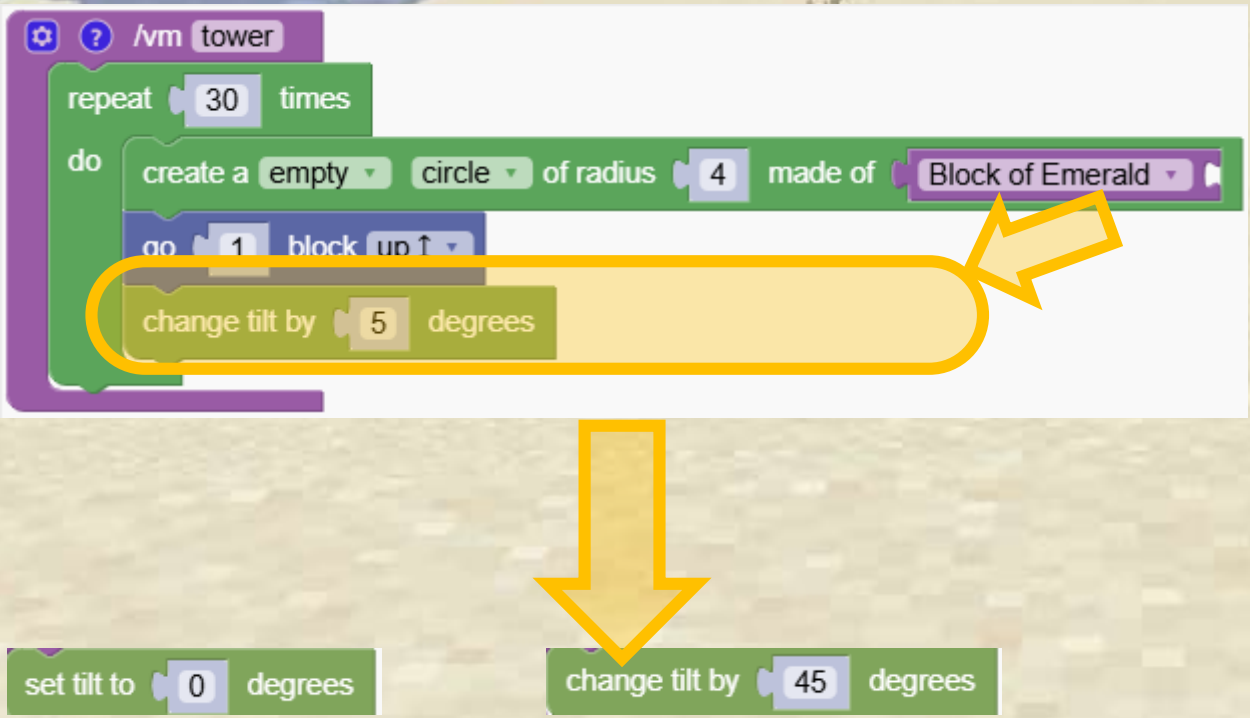
Now we replicate the tower but we set the tilt in the other direction





Tilting towers

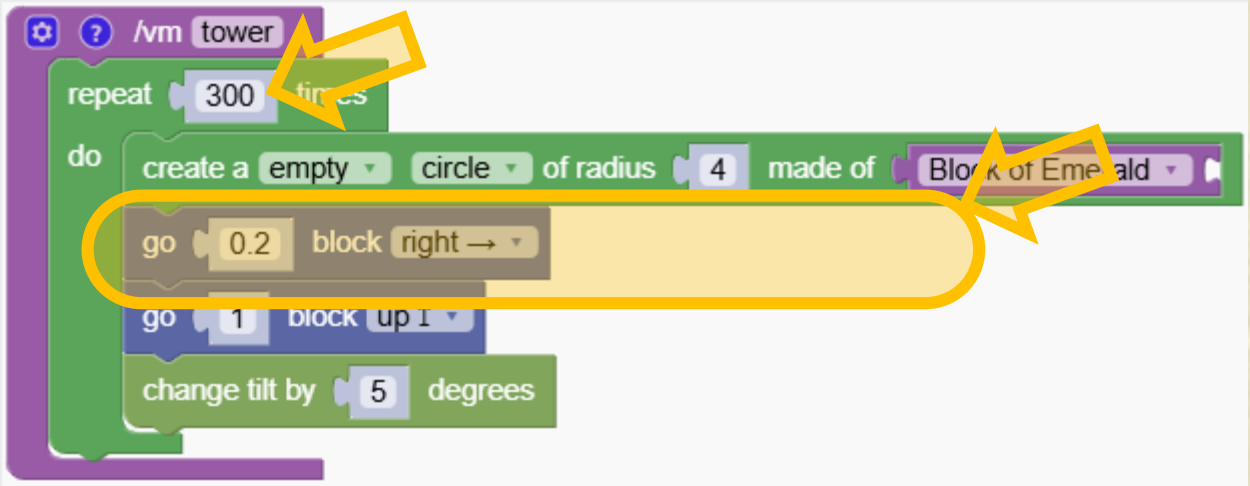
With continuous inclination we manage to curve a tower.
Use the block that changes the tilt inside the repetition.

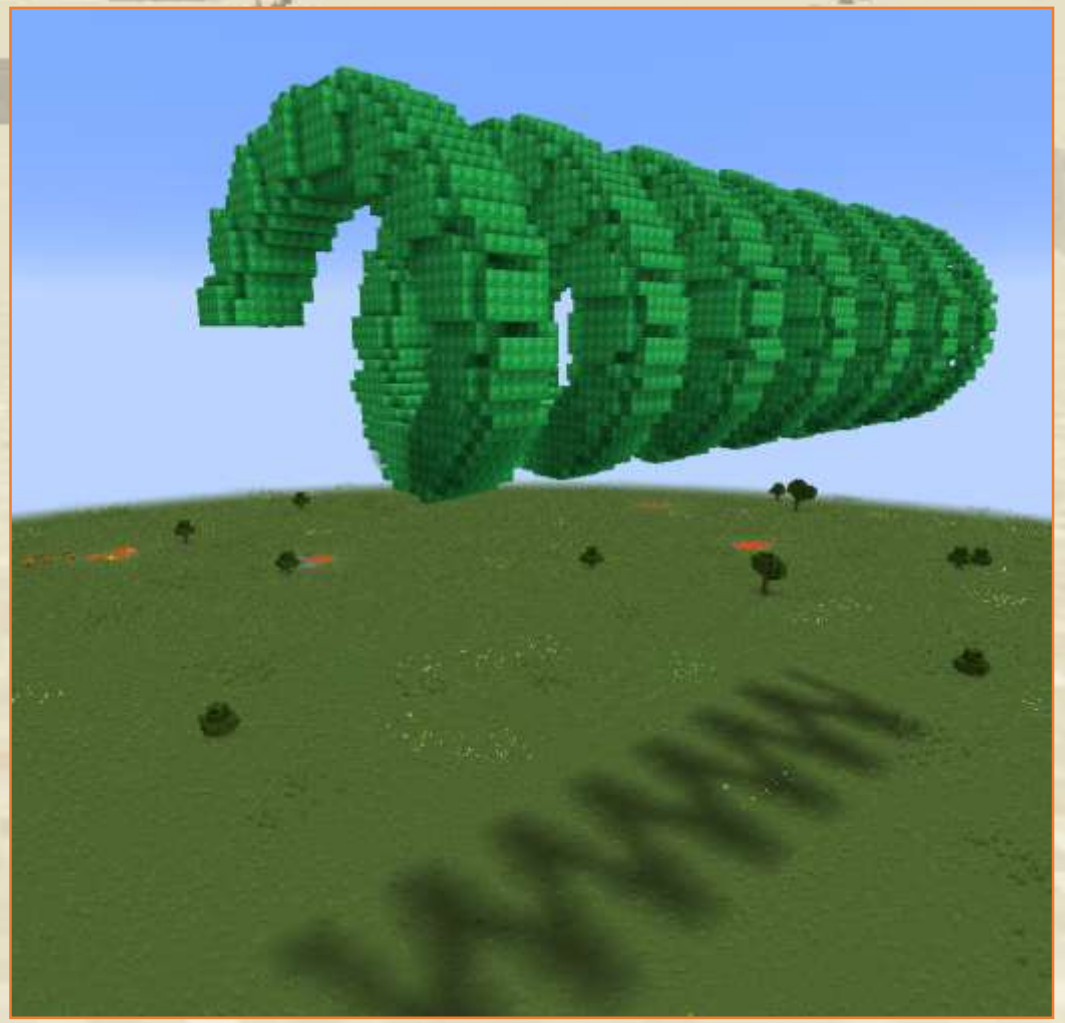


Tilting towers

Create a stunning spiraling tower by repeating the curvy tower design.

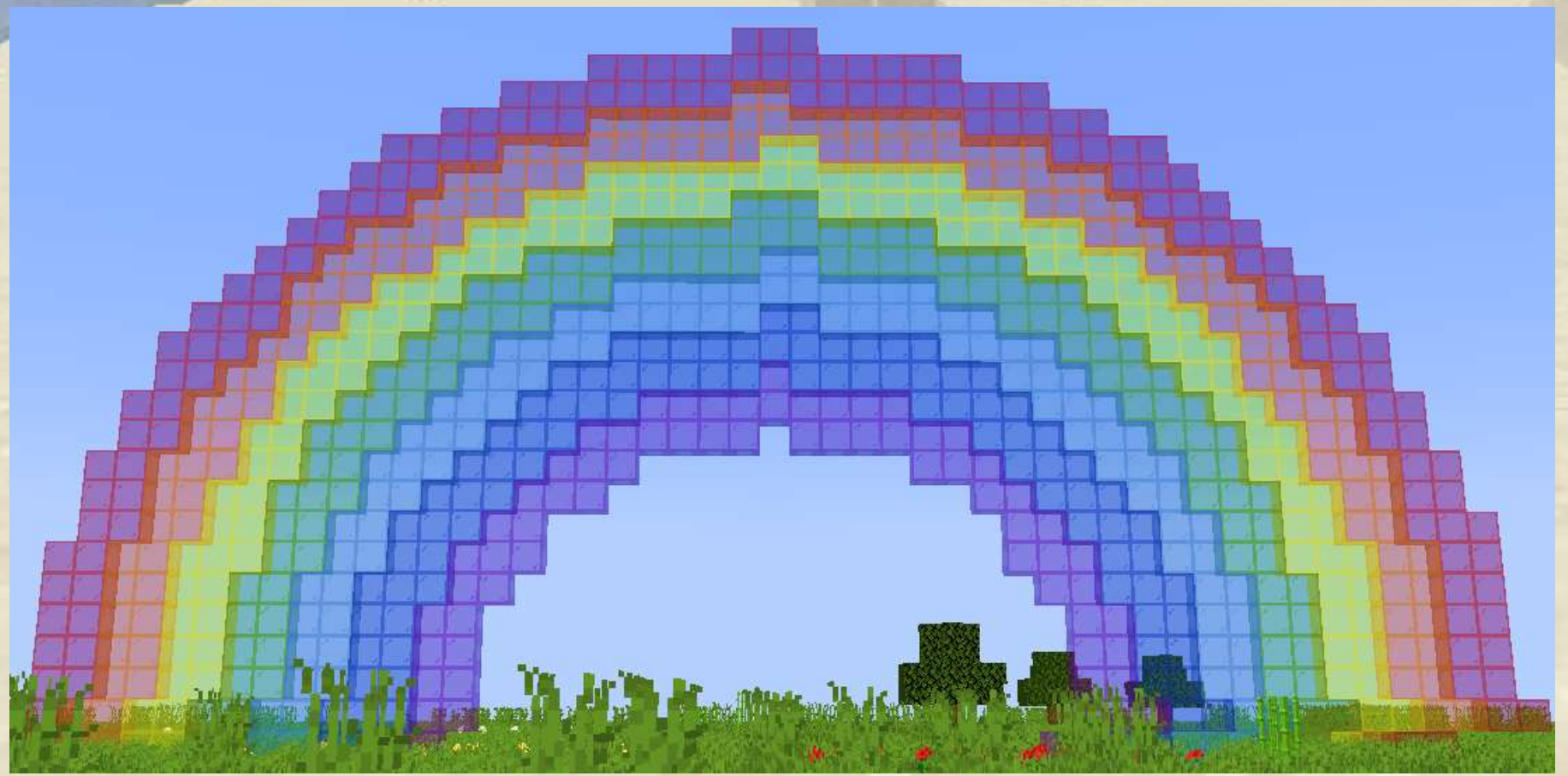
We move slowly sideways “0.2” blocks every time.





A rainbow in the sky

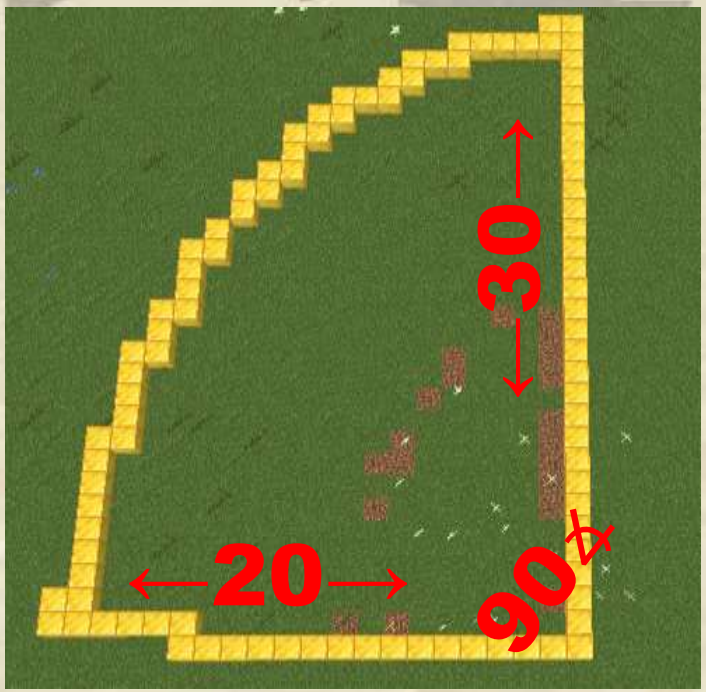
We are creating a rainbow with colored glass

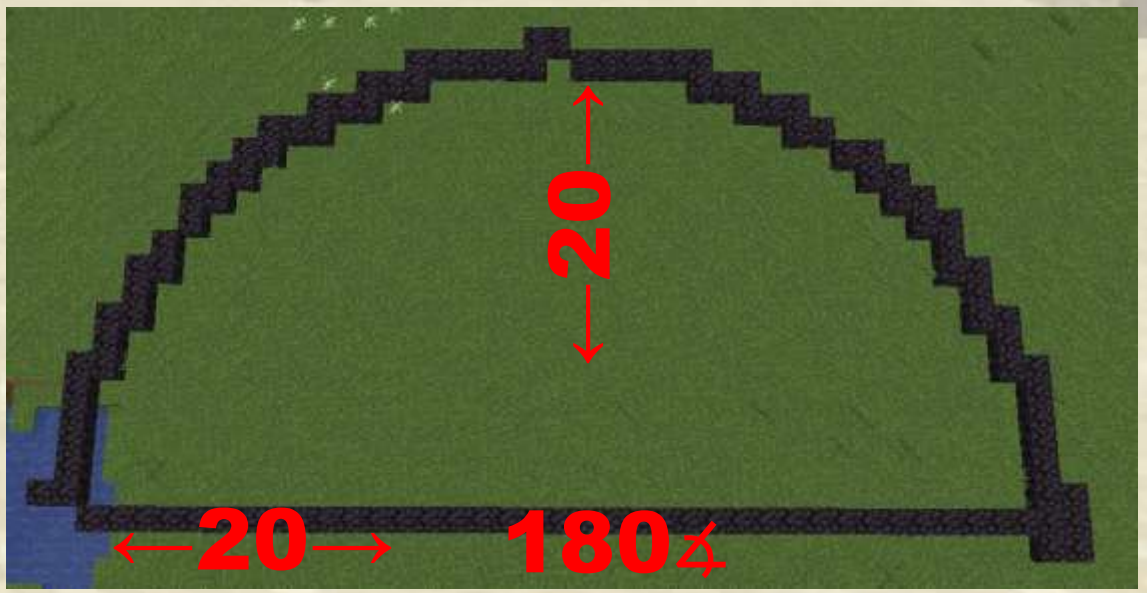


A rainbow in the sky

The block to create an arc has a width, a height and an angle

```
/vm arc
create a empty arc with radius X 20 radius Y 30 and angle 90 made of Block of Gold
```

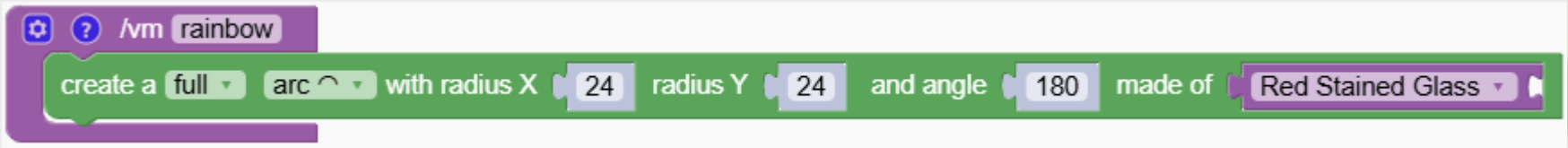


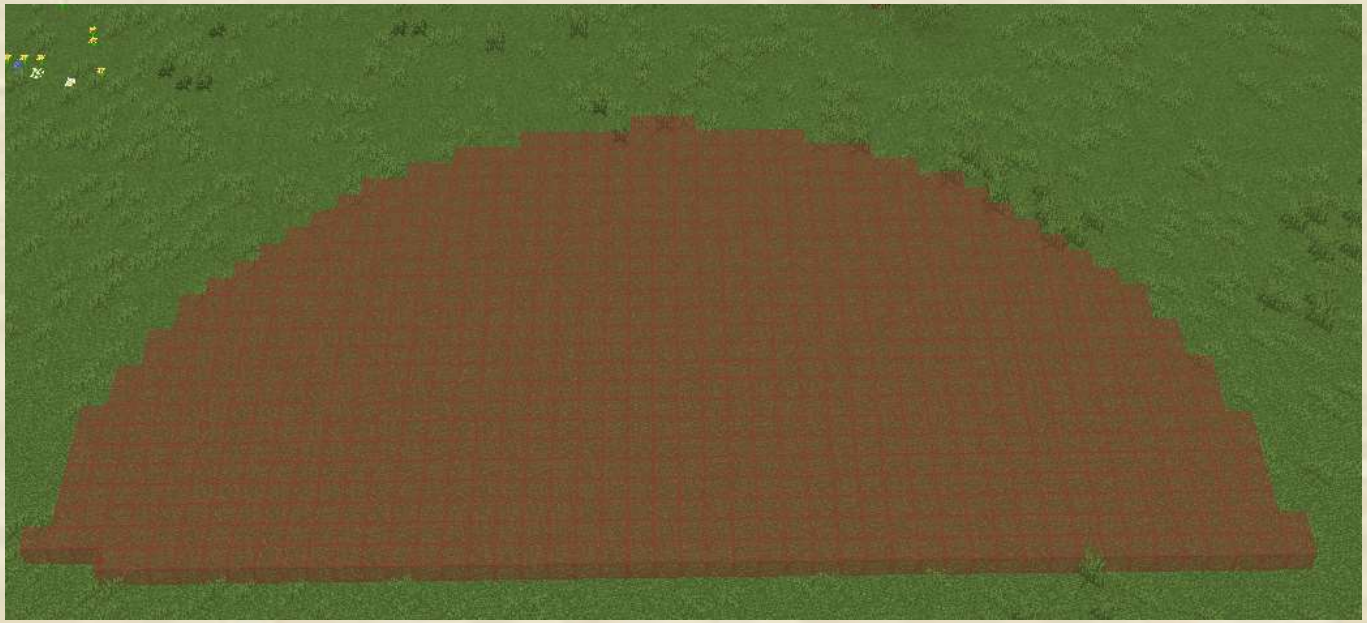



```
/vm arc
create a empty arc with radius X 20 radius Y 20 and angle 180 made of Blackstone
```

A rainbow in the sky

First we create the red arc

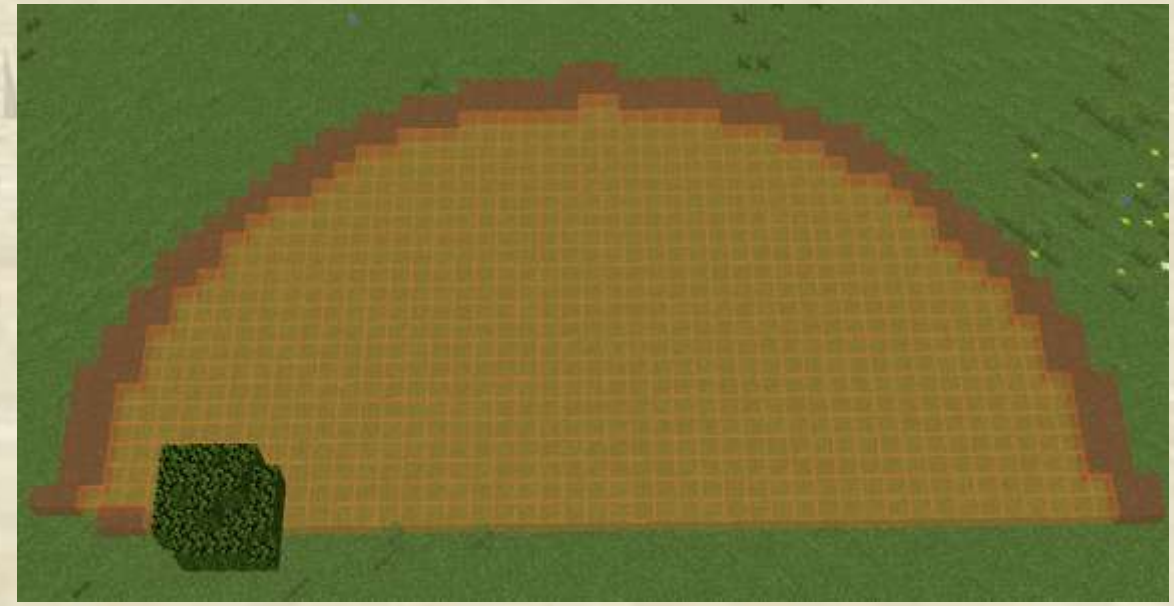




A rainbow in the sky

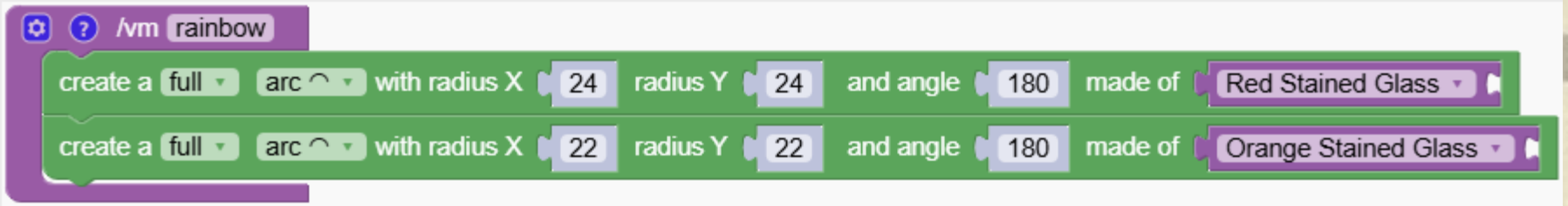
Then we add the orange arc

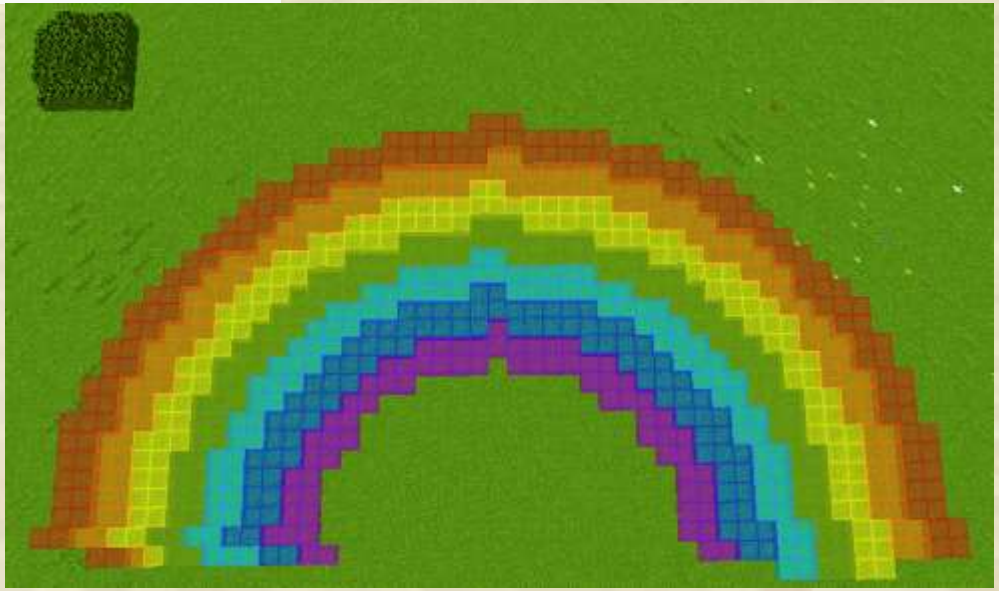
```
/vm rainbow
  create a full arc with radius X 24 radius Y 24 and angle 180 made of Red Stained Glass
  create a full arc with radius X 22 radius Y 22 and angle 180 made of Orange Stained Glass
```



A rainbow in the sky

Can you extend the program and add the missing arcs?



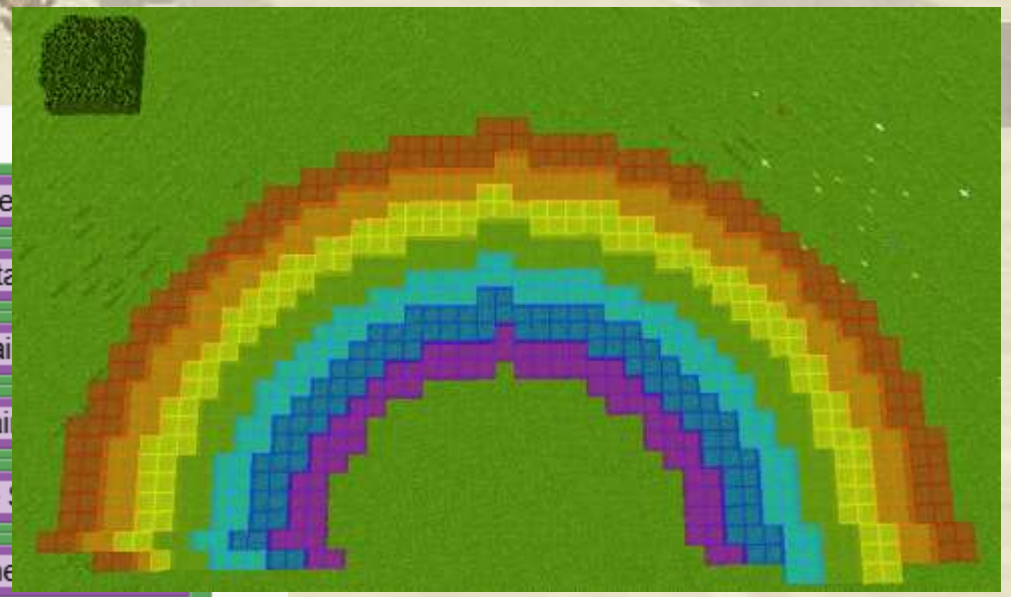


A rainbow in the sky

We are making many arcs. They are full so that no spaces are left behind.

The last smaller arc made of air make sure it looks like an arc

```
/vm rainbow
create a full arc with radius X 24 radius Y 24 and angle 180 made of Red Staine
create a full arc with radius X 22 radius Y 22 and angle 180 made of Orange Sta
create a full arc with radius X 20 radius Y 20 and angle 180 made of Yellow Stai
create a full arc with radius X 18 radius Y 18 and angle 180 made of Green Stai
create a full arc with radius X 16 radius Y 16 and angle 180 made of Light Blue
create a full arc with radius X 14 radius Y 14 and angle 180 made of Blue Staine
create a full arc with radius X 12 radius Y 12 and angle 180 made of Purple Stained Glass
create a full arc with radius X 10 radius Y 10 and angle 180 made of Air
```



A rainbow in the sky

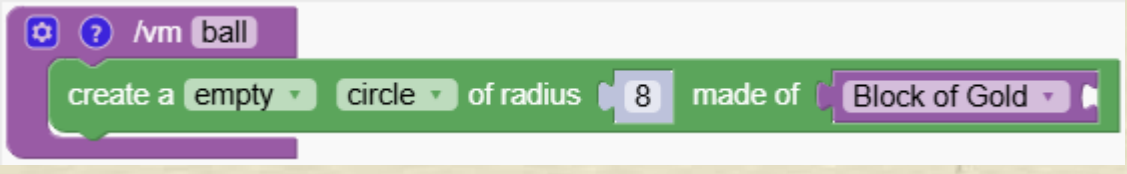
To make the arcs vertical we can simple change the tilt

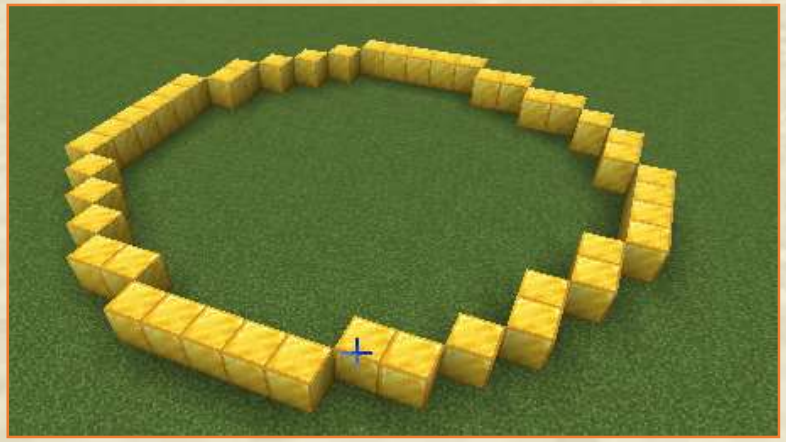
```
set tilt to 90 degrees
create a full arc with radius X 24 radius Y 24 and angle 180 made of Red Stained Glass
create a full arc with radius X 22 radius Y 22 and angle 180 made of Orange Stained Glass
create a full arc with radius X 20 radius Y 20 and angle 180 made of Yellow Stained Glass
create a full arc with radius X 18 radius Y 18 and angle 180 made of Green Stained Glass
create a full arc with radius X 16 radius Y 16 and angle 180 made of Light Blue Stained Glass
create a full arc with radius X 14 radius Y 14 and angle 180 made of Blue Stained Gla
create a full arc with radius X 12 radius Y 12 and angle 180 made of Purple Stained G
create a full arc with radius X 10 radius Y 10 and angle 180 made of Air
```

Creating a ball

Design a spherical shape by altering inclination.

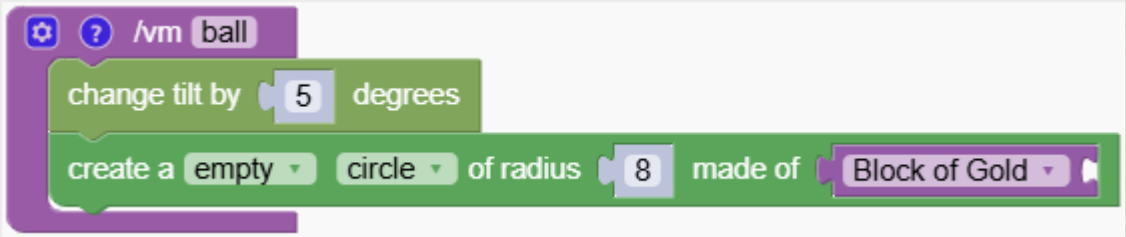
We start with a simple circle.

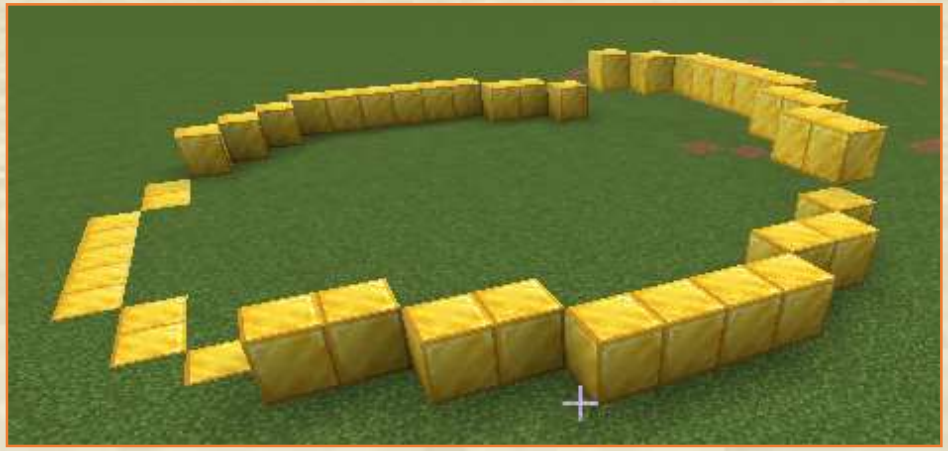




Creating a ball

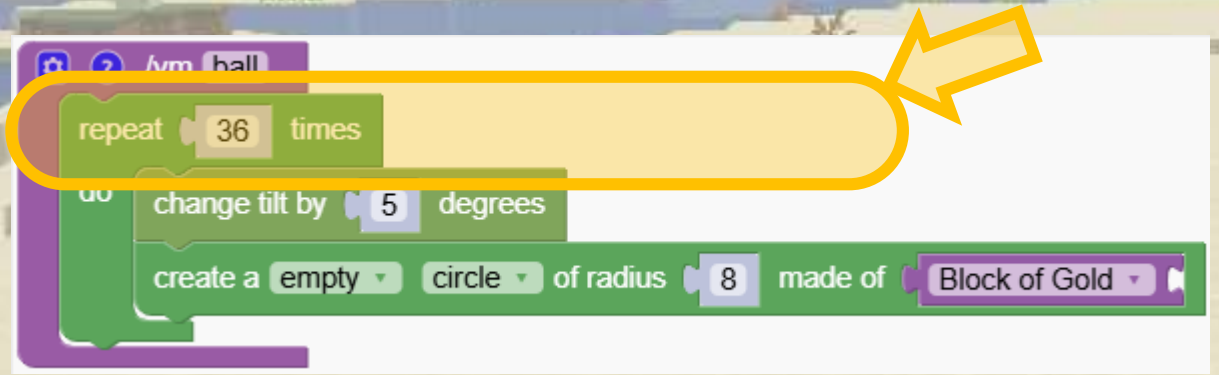
Now the tilt the circle by 5 degrees





Creating a ball

Just repeat it 36 times and you have a ball.
Why do we repeat 36 times? Because 180 degrees divided by 5 degrees makes 36



Can you create a cherry?

Combine the tower program with the ball program below

```
/vm tower
repeat 30 times
do
    create a empty circle of radius 4 made of Green Wool
    go 1 block up
    change tilt by 5 degrees
```

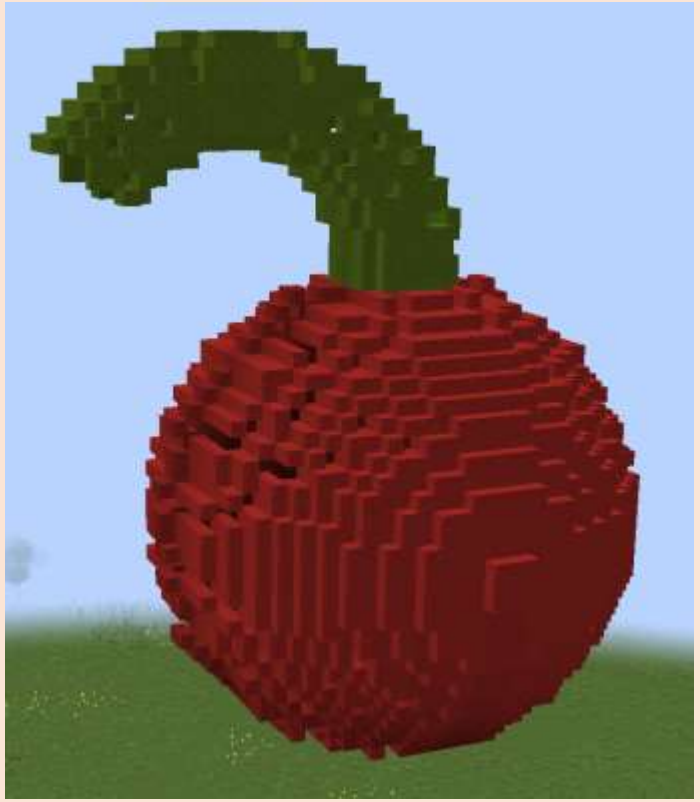
```
/vm ball
repeat 36 times
do
    change tilt by 5 degrees
    create a empty circle of radius 16 made of Red Wool
```

Quiz

Can you create a cherry?

Combine the tower program with the ball program below

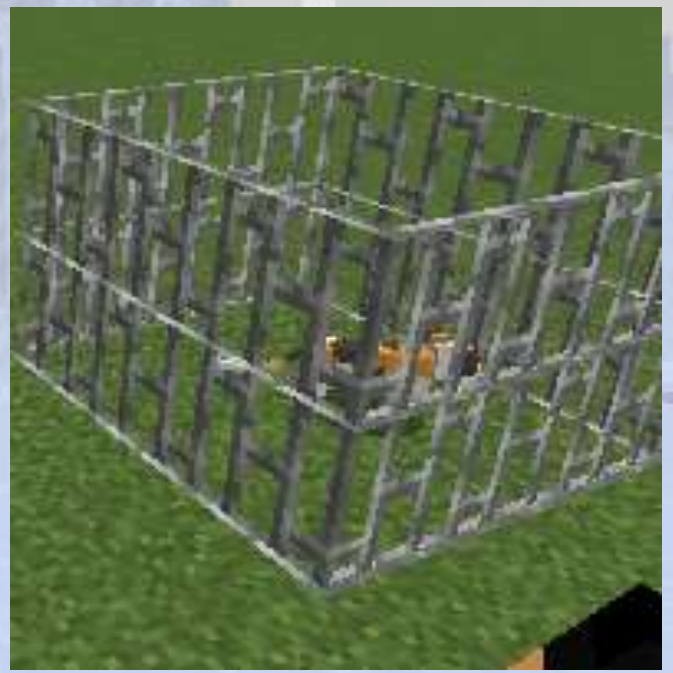
```
/vm cherry
go 20 block forward ↑
repeat 36 times
do
    change tilt by 5 degrees
    create a empty circle of radius 16 made of Red Wool
set tilt to 0 degrees
go 16 block up ↥
repeat 30 times
do
    create a empty circle of radius 4 made of Green Wool
    go 1 block up ↥
    change tilt by 5 degrees
```



Quiz

Functions

Organize code into functions



Functions

🔍 Section Overview

Complex structures need complex programs. We create advanced structures that profit from splitting the code into functions

🎯 Objectives

Organize code into reusable functions to make it easier to understand and maintain.

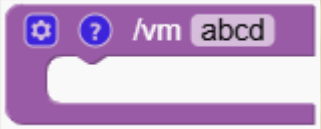
👌 Expected Outcomes

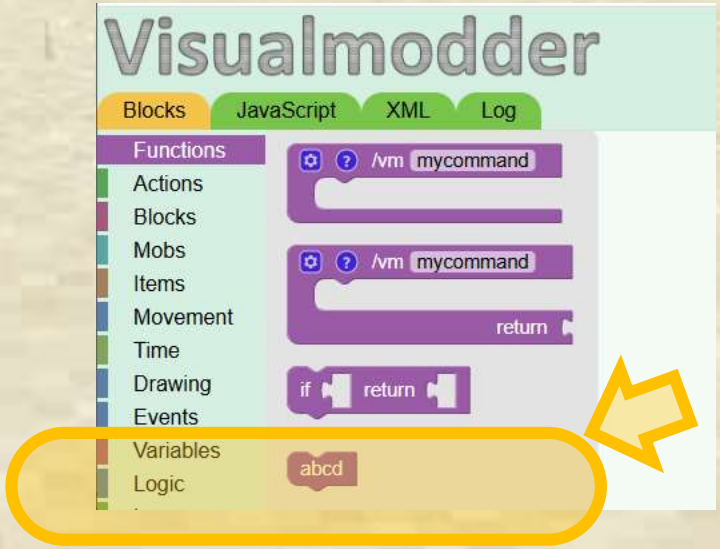
Students will be able to use functions to organize code, reduce repetition, and improve readability.

Purpose of defining functions

Learn the basics of creating and using functions in code.

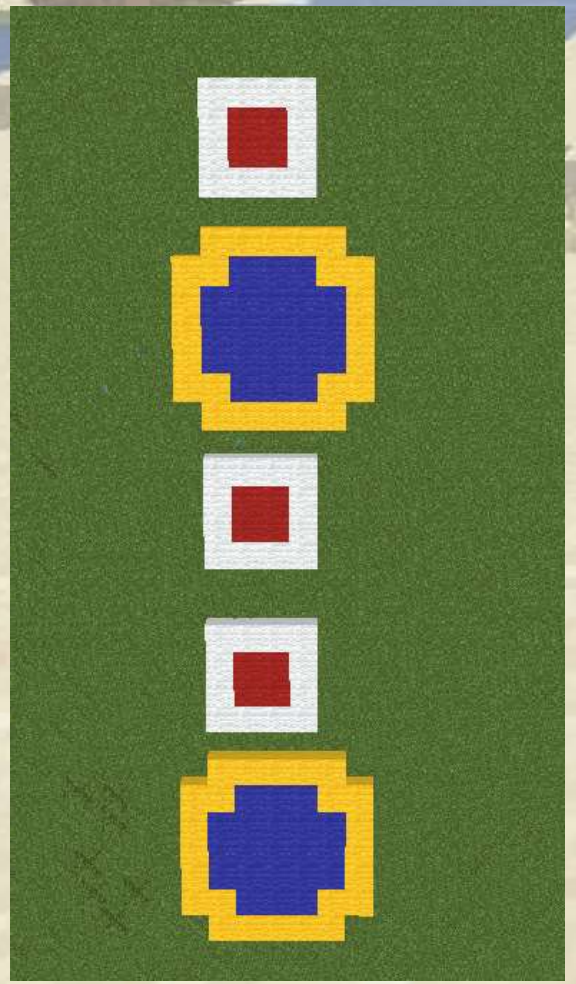
When we create a new function “abcd”, in the menu we find a block representing the new function “abcd”





Functions organize our code

Understand how functions simplify complex code.

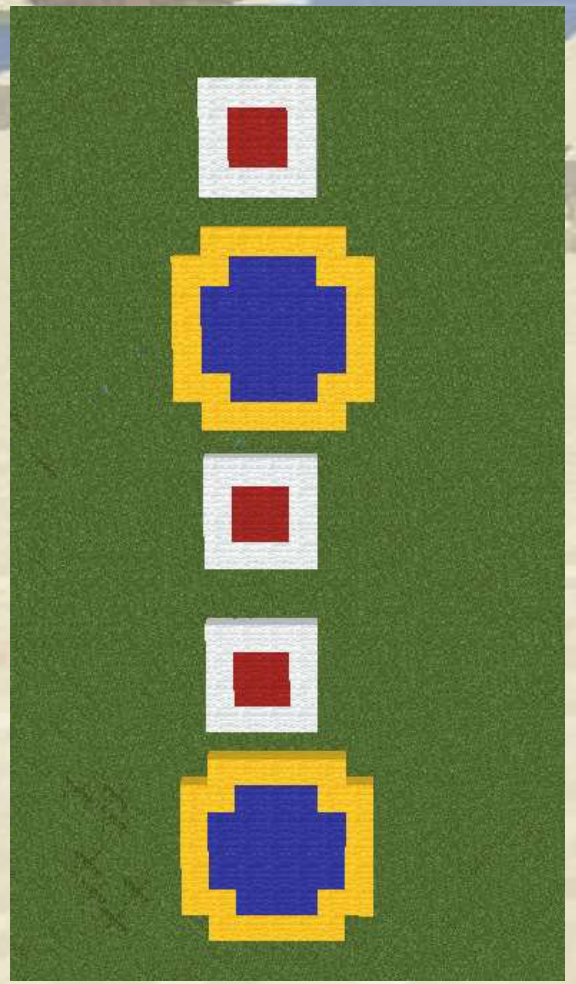


If I want to change the white border to another color, where do I have to modify the program?

```
/vm pic2
create a full square of width 4 made of Red Wool
create a empty square of width 4 made of White Wool
go 6 block forward ↑
create a full circle of radius 4 made of Blue Wool
create a empty circle of radius 4 made of Yellow Wool
go 7 block forward ↑
create a full square of width 4 made of Red Wool
create a empty square of width 4 made of White Wool
go 6 block forward ↑
create a full square of width 4 made of Red Wool
create a empty square of width 4 made of White Wool
go 6 block forward ↑
create a full circle of radius 4 made of Blue Wool
create a empty circle of radius 4 made of Yellow Wool
go 7 block forward ↑
```

Functions organize our code

Understand how functions simplify complex code.

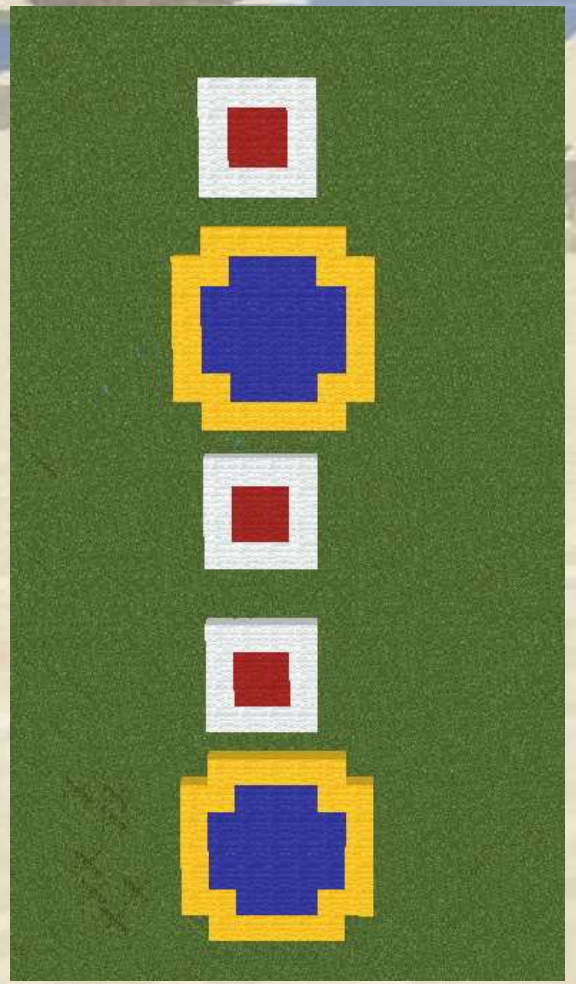


I fount the 3 places to change and it wasn't too difficult, but imagine what would happen if your program was much longer.

```
/vm pic2
create a full square of width 4 made of Red Wool
create a empty square of width 4 made of White Wool
go 6 block forward ↑
create a full circle of radius 4 made of Blue Wool
create a empty circle of radius 4 made of Yellow Wool
go 7 block forward ↑
create a full square of width 4 made of Red Wool
create a empty square of width 4 made of White Wool
go 6 block forward ↑
create a full square of width 4 made of Red Wool
create a empty square of width 4 made of White Wool
go 6 block forward ↑
create a full circle of radius 4 made of Blue Wool
create a empty circle of radius 4 made of Yellow Wool
go 7 block forward ↑
```

Functions organize our code

Understand how functions simplify complex code.



We can reorganize the code using functions like this!

```
/vm pic
  square
  circle
  square
  square
  circle
```

```
/vm circle
  create a full circle of radius 4 made of Blue Wool
  create a empty circle of radius 4 made of Yellow Wool
  go 7 block forward ↑
```

```
/vm square
  create a full square of width 4 made of Red Wool
  create a empty square of width 4 made of White Wool
  go 6 block forward ↑
```

Functions organize our code

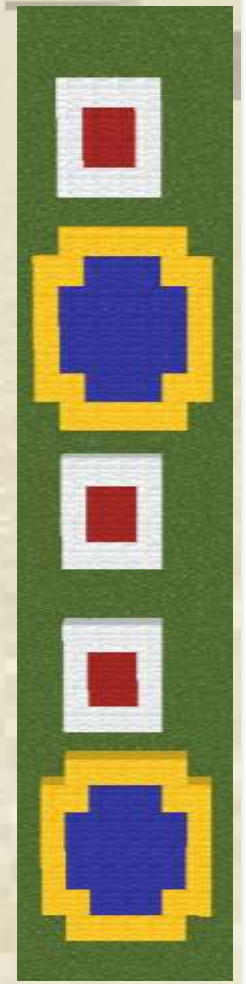
Simplify complex code.

```
/vm pic
  square
  circle
  square
  square
  circle
```

This code is easier to understand

```
/vm circle
  create a full circle of radius 4 made of Blue Wool
  create a empty circle of radius 4 made of Yellow Wool
  go 7 block forward ↑
```

```
/vm square
  create a full square of width 4 made of Red Wool
  create a empty square of width 4 made of White Wool
  go 6 block forward ↑
```



```
/vm pic2
  create a full square of width 4 made of Red Wool
  create a empty square of width 4 made of White Wool
  go 6 block forward ↑
  create a full circle of radius 4 made of Blue Wool
  create a empty circle of radius 4 made of Yellow Wool
  go 7 block forward ↑
  create a full square of width 4 made of Red Wool
  create a empty square of width 4 made of White Wool
  go 6 block forward ↑
  create a full square of width 4 made of Red Wool
  create a empty square of width 4 made of White Wool
  go 6 block forward ↑
  create a full circle of radius 4 made of Blue Wool
  create a empty circle of radius 4 made of Yellow Wool
  go 7 block forward ↑
```

Functions organize our code

Avoid repeating code

```
/vm pic
  square
  circle
  square
  square
  circle
```

If I want to change the color of the squares I do it only in one place

```
/vm circle
  create a full circle of radius 4 made of Blue Wool
  create a empty circle of radius 4 made of Yellow Wool
  go 7 block forward ↑
```

```
/vm square
  create a full square of width 4 made of Red Wool
  create a empty square of width 4 made of White Wool
  go 6 block forward ↑
```

```
/vm pic2
  create a full square of width 4 made of Red Wool
  create a empty square of width 4 made of White Wool
  go 6 block forward ↑
  create a full circle of radius 4 made of Blue Wool
  create a empty circle of radius 4 made of Yellow Wool
  go 7 block forward ↑
  create a full square of width 4 made of Red Wool
  create a empty square of width 4 made of White Wool
  go 6 block forward ↑
  create a full square of width 4 made of Red Wool
  create a empty square of width 4 made of White Wool
  go 6 block forward ↑
  create a full circle of radius 4 made of Blue Wool
  create a empty circle of radius 4 made of Yellow Wool
  go 7 block forward ↑
```

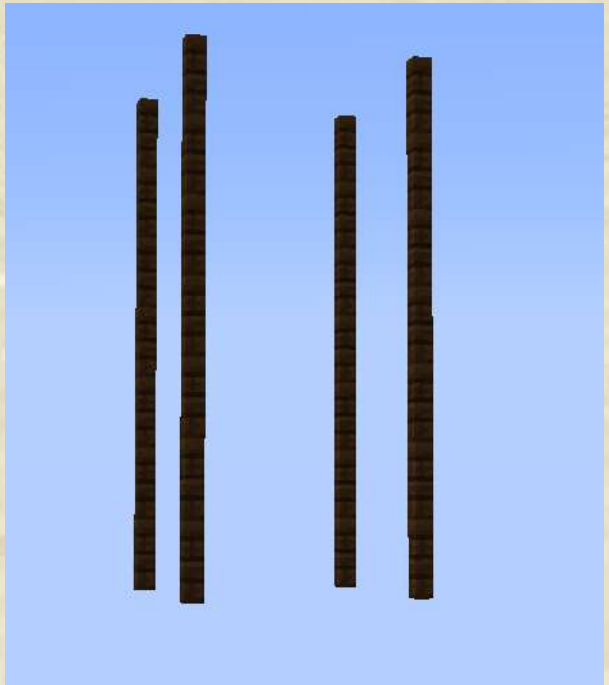
Hot Air Balloon

Create a hot air balloon and organize the code using functions

Hot Air Balloon

We need 3 functions, one for the Air ball, one for the ropes, and one for the chest.

Can you write this programs?



Hot Air Balloon

First we make a chest for the people traveling in the hot air balloon

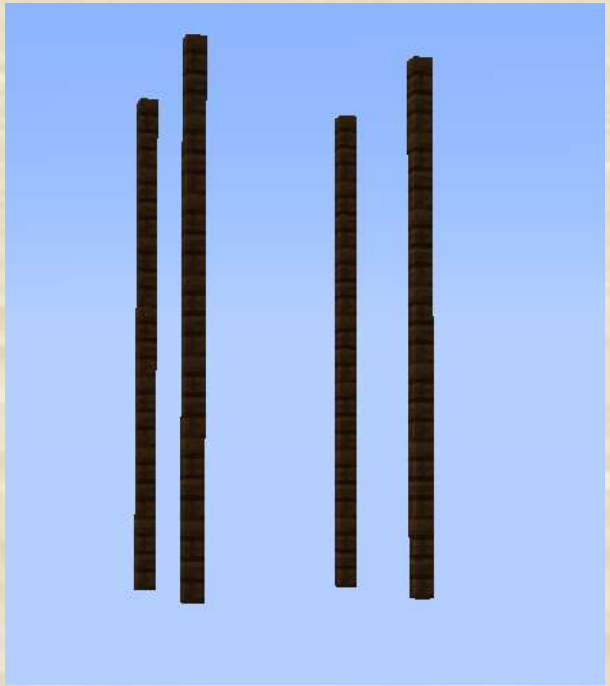
```
/vm chest
create a full rectangle of width 4 and length 4 made of Oak Wood
go 1 blocks up ↑
repeat 3 times
do
    create a empty rectangle of width 4 and length 4 made of Oak Wood
    go 1 blocks up ↑
```

Hot Air Balloon

We prepare the ropes to attach the chest to the hot air balloon

```
/vm chest
create a full rectangle of width 4 and length 4 made of Oak Wood
go 1 blocks up ↑
repeat 3 times
do
    create a empty rectangle of width 4 and length 4 made of Oak Wood
    go 1 blocks up ↑
```

```
/vm rope
repeat 7 times
do
    create a empty rectangle of width 4 and length 4 made of Dark Oak Fence 2 of Air
    go 1 blocks up ↑
```



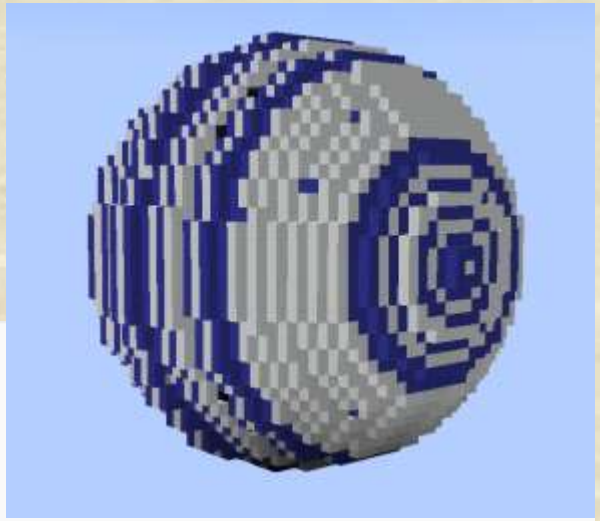
Hot Air Balloon

We make the hot air balloon

```
/vm chest
create a full rectangle of width 4 and length 4 made of Oak Wood
go 1 blocks up ↑
repeat 3 times
do
    create a empty rectangle of width 4 and length 4 made of Oak Wood
    go 1 blocks up ↑
```

```
/vm rope
repeat 7 times
do
    create a empty rectangle of width 4 and length 4 made of Dark Oak Fence 2 of Air
    go 1 blocks up ↑
```

```
/vm ball
go 16 blocks up ↑
repeat 60 times
do
    change tilt by 3 degrees
    create a empty circle ○ of radius 18 made of Blue Wool White Wool
```



Hot Air Balloon

And now we can put it all together!

```
/vm balloon
  chest
  rope
  ball
```

```
/vm chest
  create a full rectangle of width 4 and length 4 made of Oak Wood
  go 1 blocks up ↑
  repeat 3 times
  do
    create a empty rectangle of width 4 and length 4 made of Oak Wood
    go 1 blocks up ↑
```

```
/vm rope
  repeat 7 times
  do
    create a empty rectangle of width 4 and length 4 made of Dark Oak Fence 2 of Air
    go 1 blocks up ↑
```

```
/vm ball
  go 16 blocks up ↑
  repeat 60 times
  do
    change tilt by 3 degrees
    create a empty circle ○ of radius 18 made of Blue Wool White Wool
```

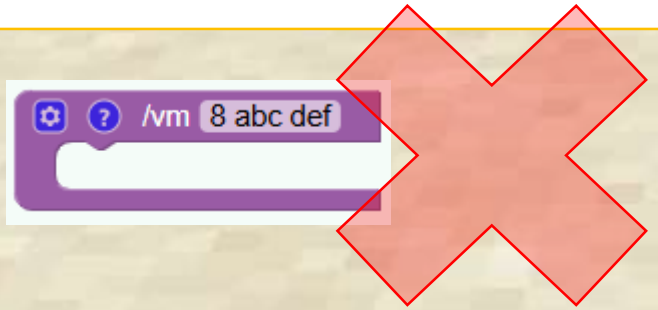
Functions naming

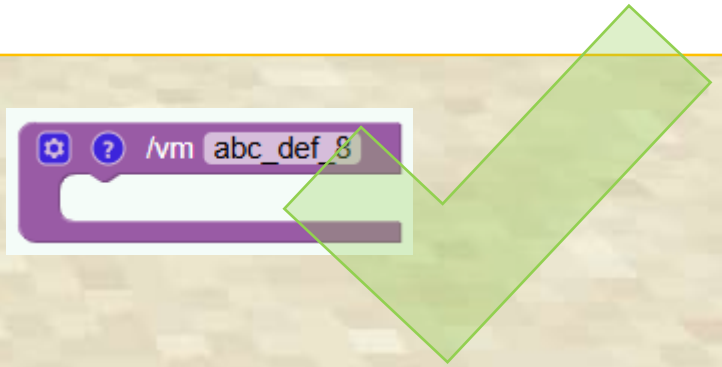
Learn how to properly name functions to avoid errors.

Function names:

Use letters, digits or the characters '–' and '_ ' but don't start with a digit

The function below has no valid name because it starts with a number and contains spaces. It should be rewritten using _ and the number can be moved to the end.

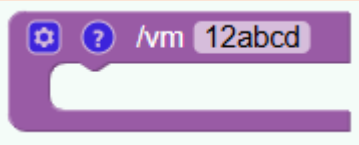




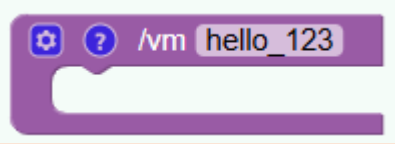
Which function names are valid?

Look at the examples and decide which function names are valid

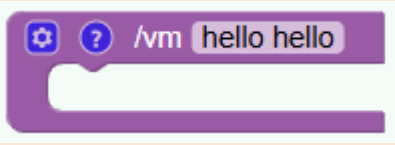
A ?



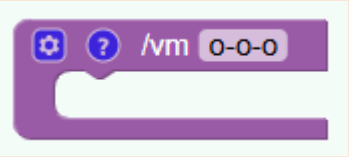
B ?



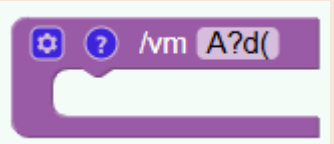
C ?



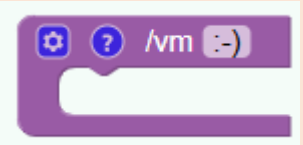
D ?



E ?



F ?

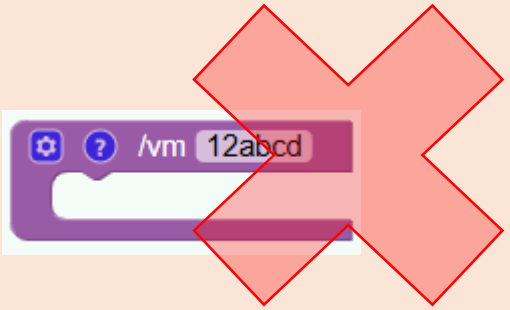


Quiz

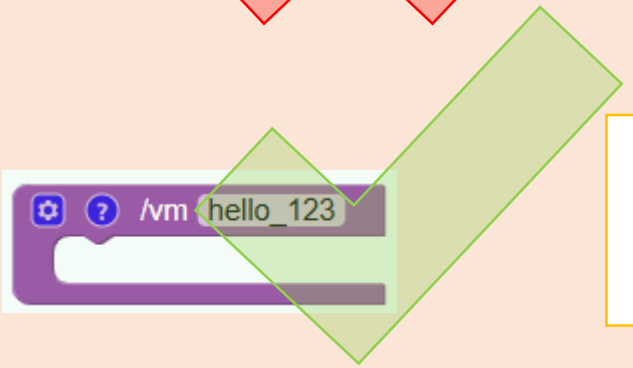
Which function names are valid?

Solution:

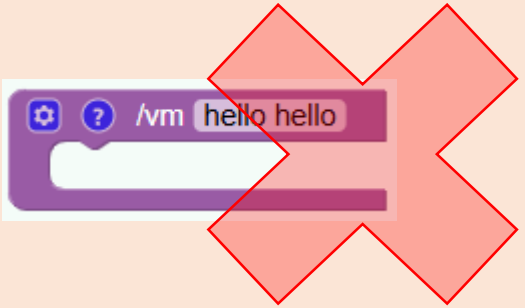
A Starts with a digit



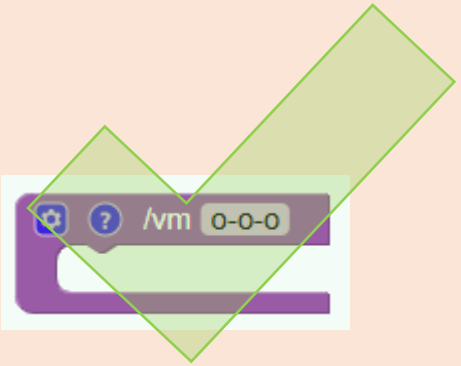
B



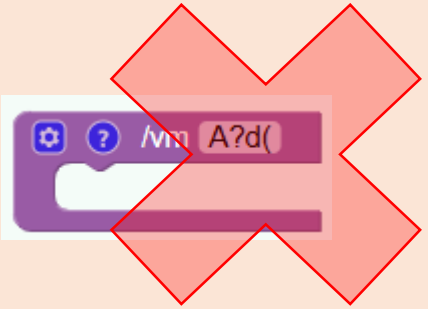
C Contains a space



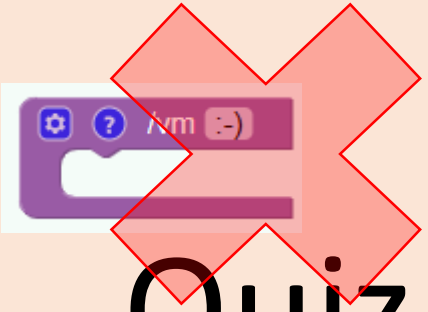
D



E Contains invalid characters



F Contains invalid characters



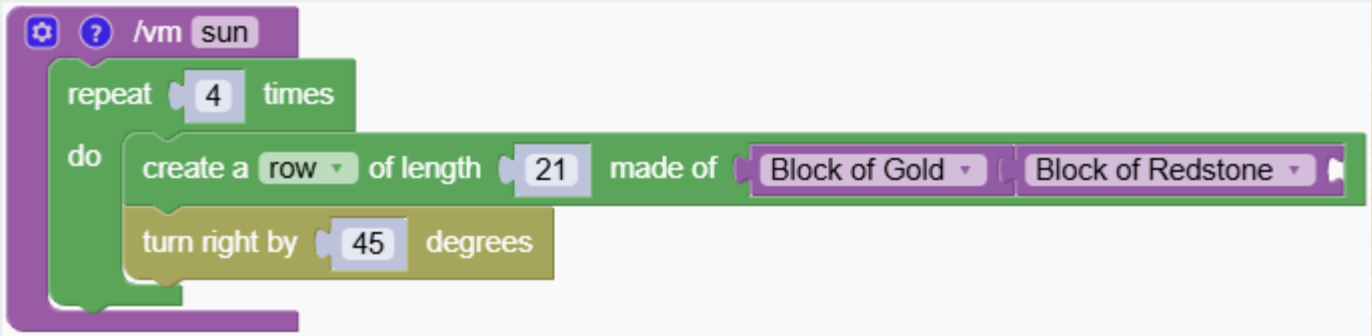
Quiz

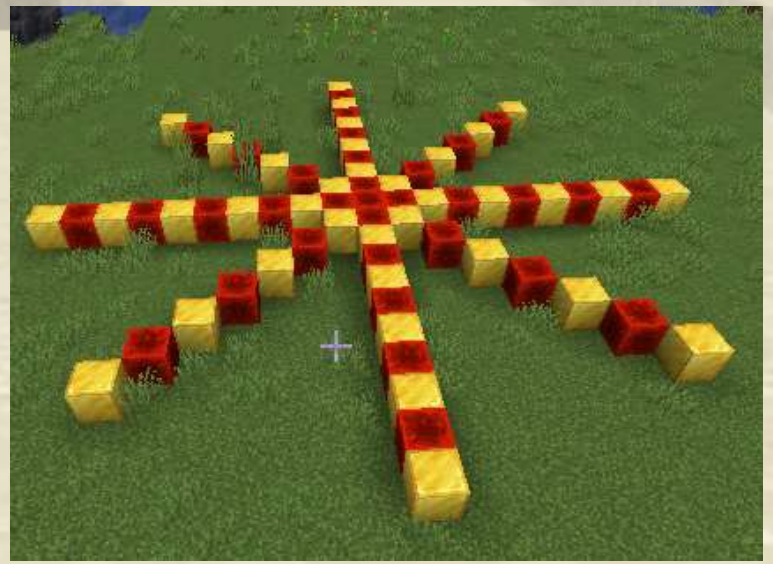
Castle with towers

Create a beautiful castle surrounded by towers.

Castle with towers

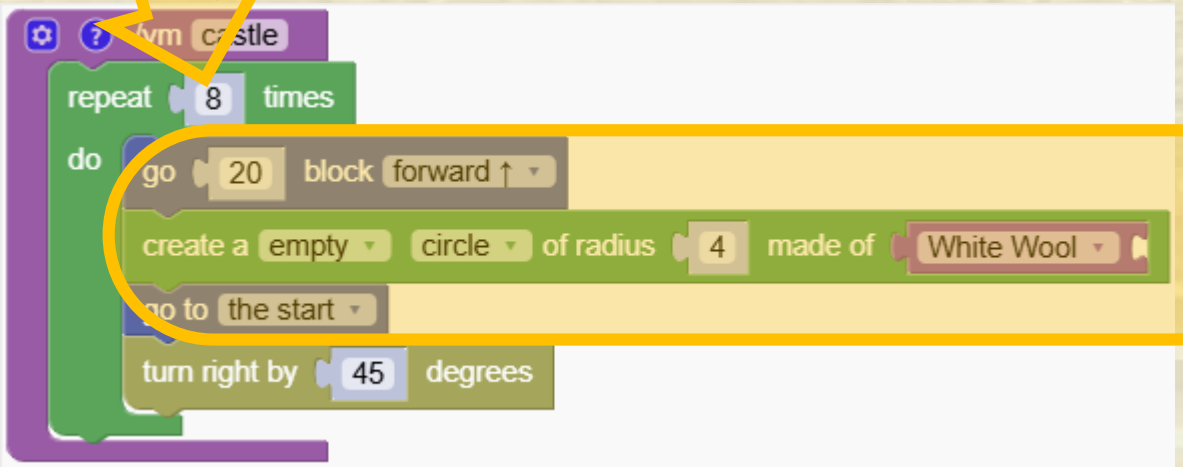
Previously we saw this program.
Now we can adapt it to generate an amazing castle

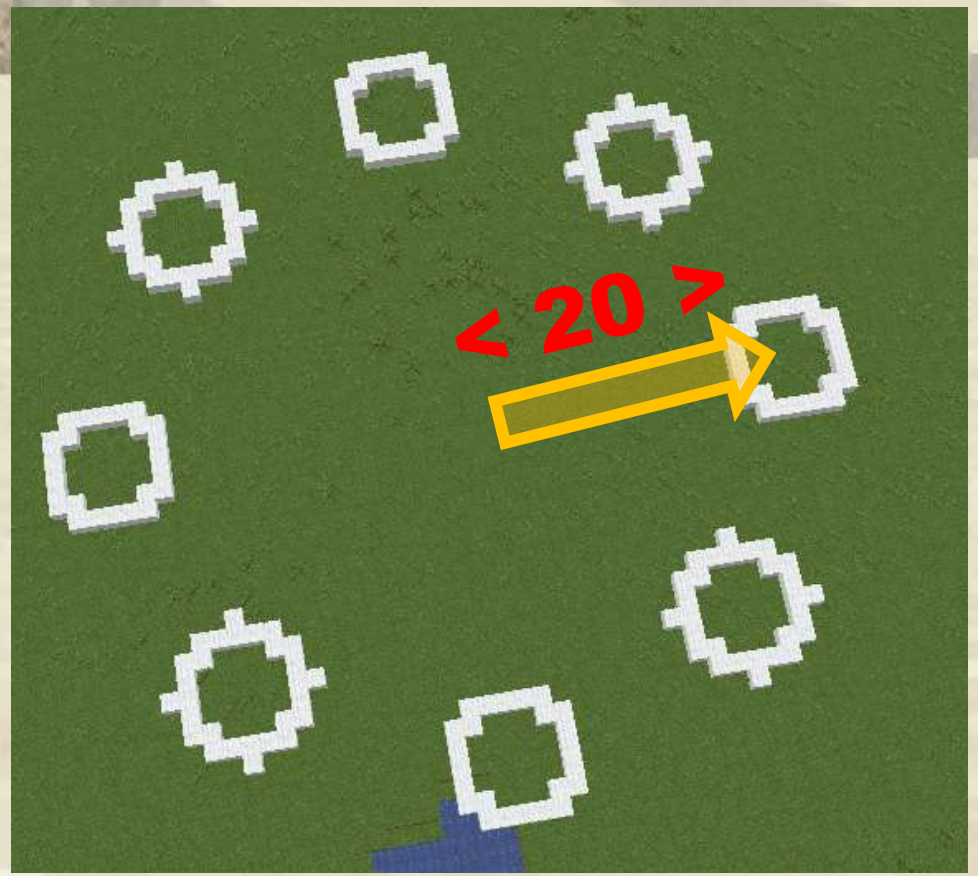




Castle with towers

This program is similar to the previous one. Instead of creating a line of blocks, we put a circle.





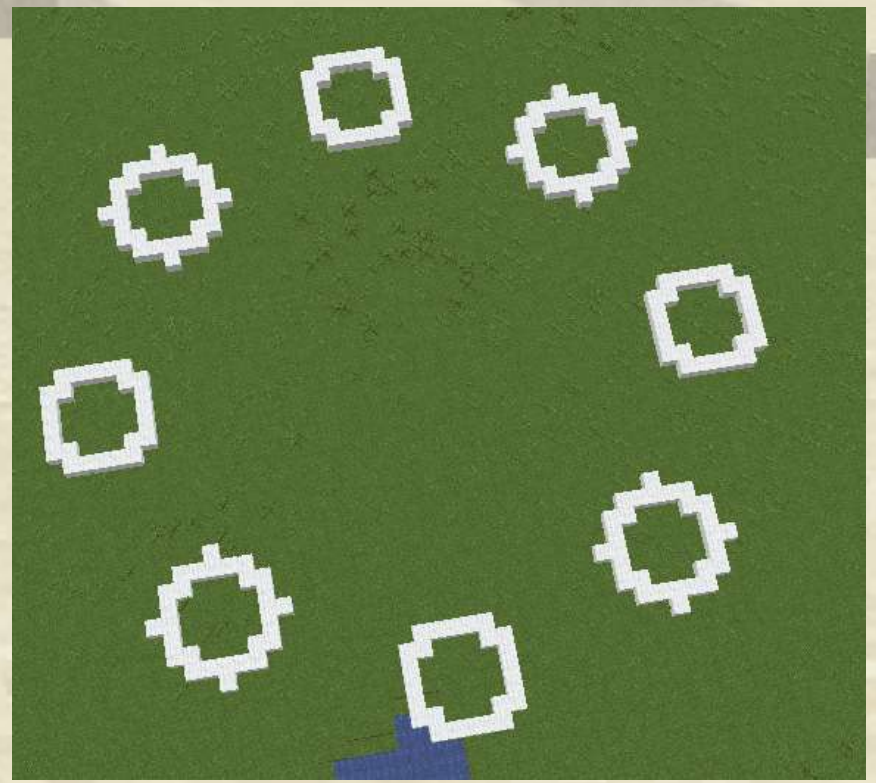
Castle with towers

We clean up our code by creating a function “tower1”.

The program makes the same circles as before

```
/vm castle
repeat 8 times
do tower1
   turn right by 45 degrees
```

```
/vm tower1
go 20 block forward ↑
create a empty circle of radius 4 made of White Wool
go to the start
```

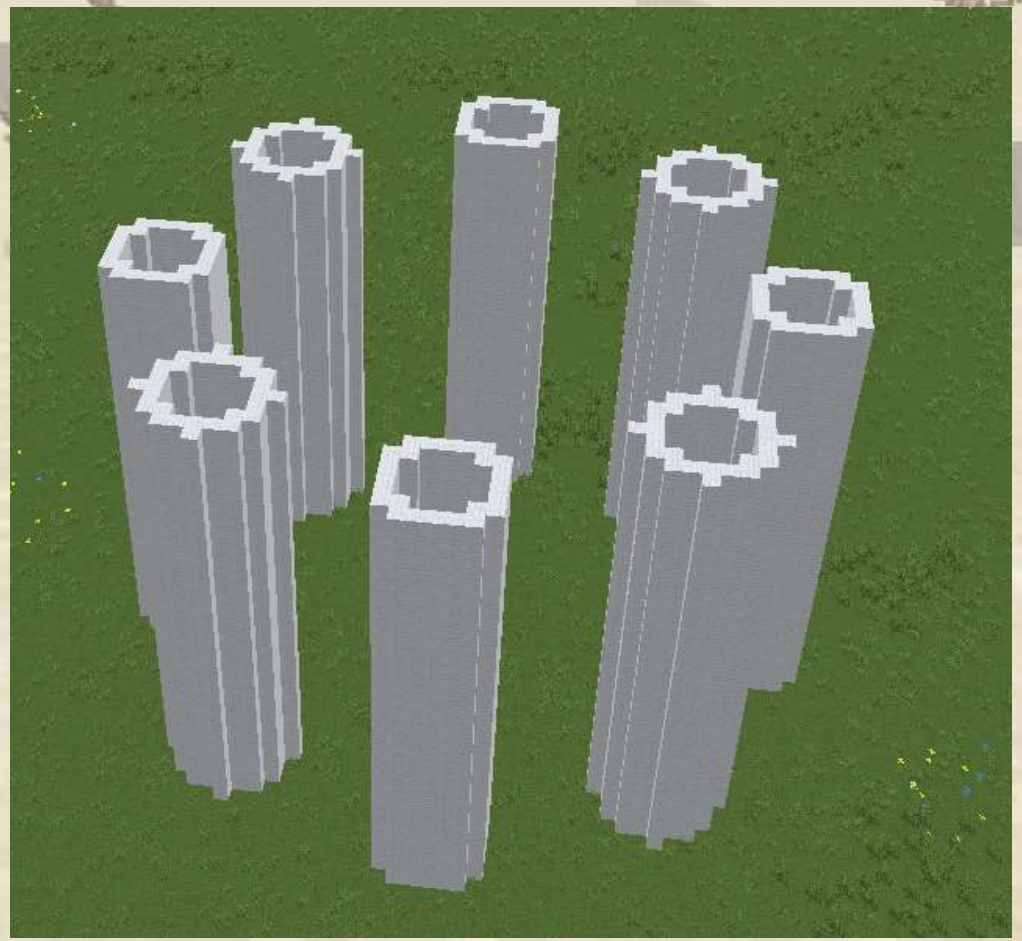


Castle with towers

Instead of making a simple circle now we create a tower.

```
/vm castle
repeat 8 times
do tower1
   turn right by 45 degrees
```

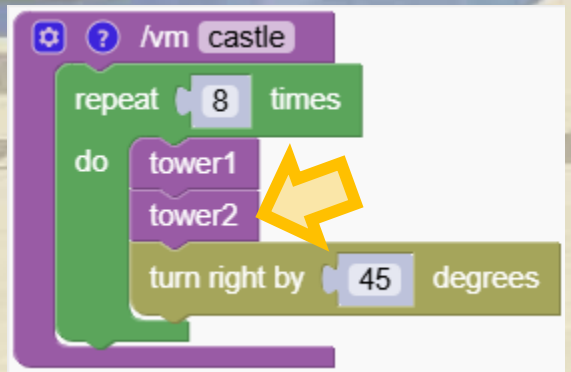
```
/vm tower1
go 20 block forward ↑
repeat 30 times
do create a empty circle of radius 4 made of White Wool
   go 1 block up ↥
go to the start
```

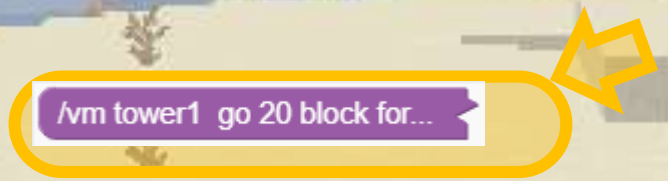


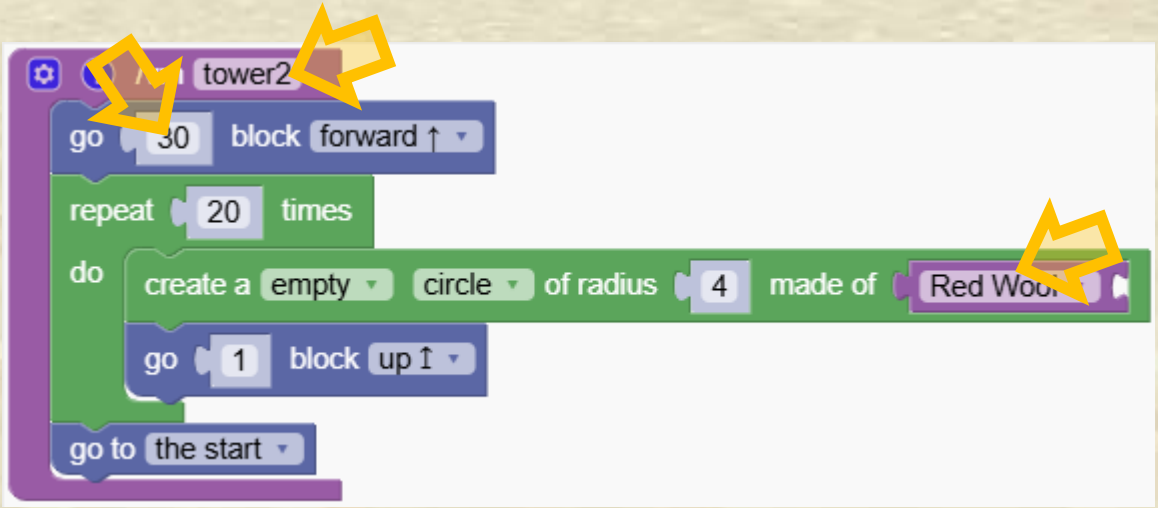
Castle with towers

We cloned the “tower1” function and compressed it

Now we have a new function “tower2” and we call it every time together with “tower1”

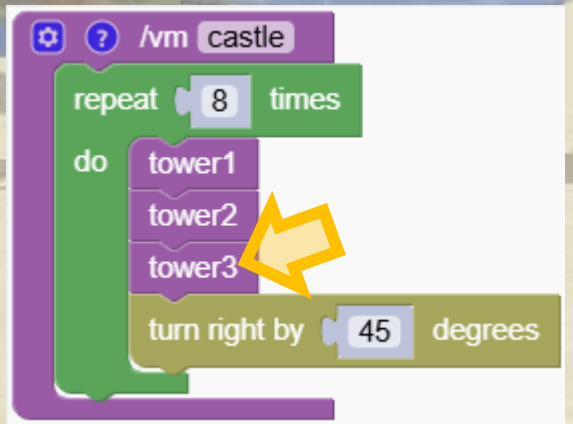


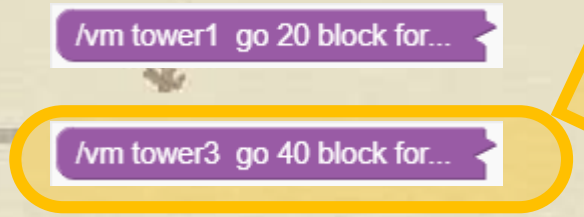




Castle with towers

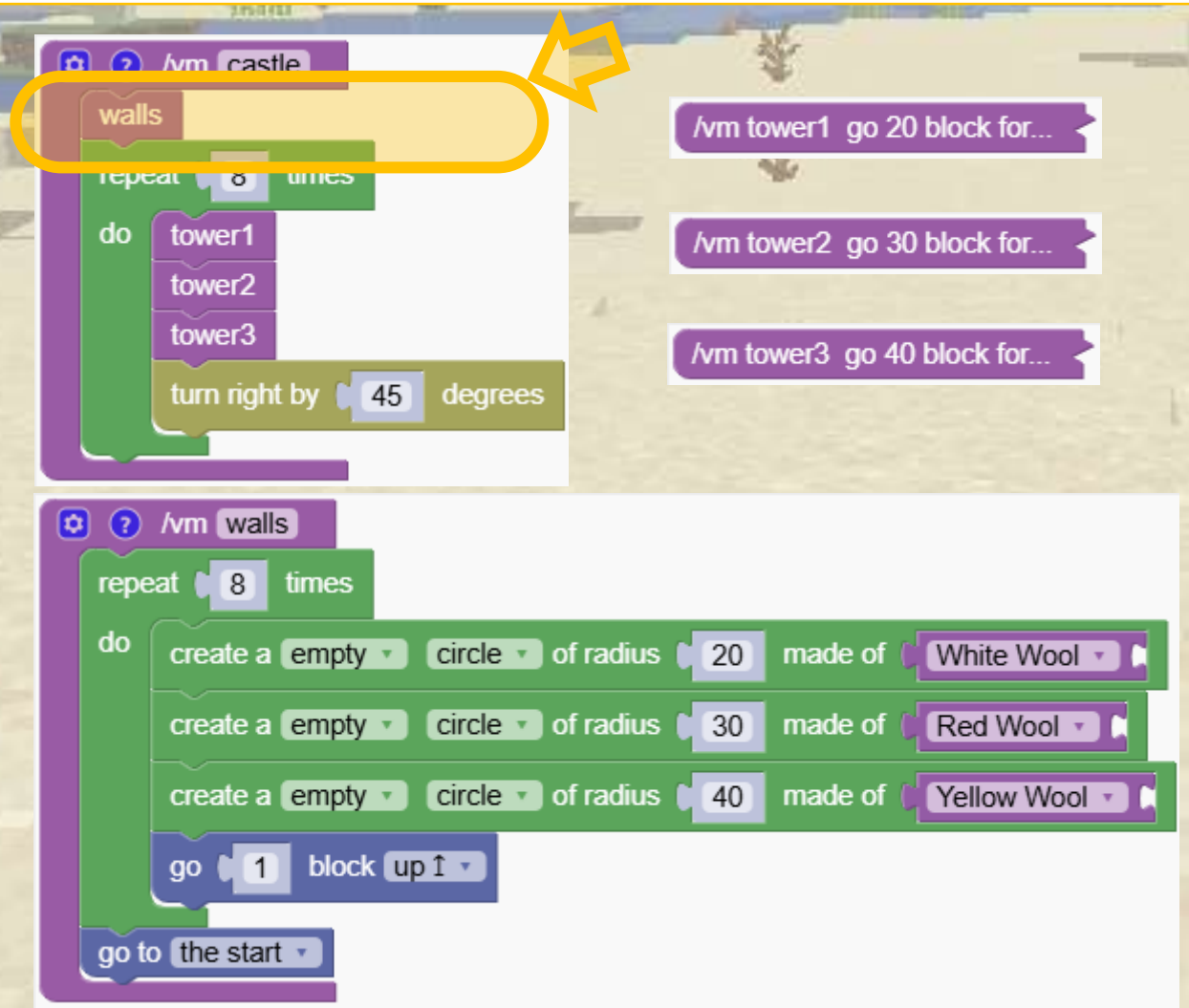
We repeated the previous step and now we have 3 functions for the towers.





Castle with towers

To finish, we made a function “walls” that creates 3 walls using simple circles



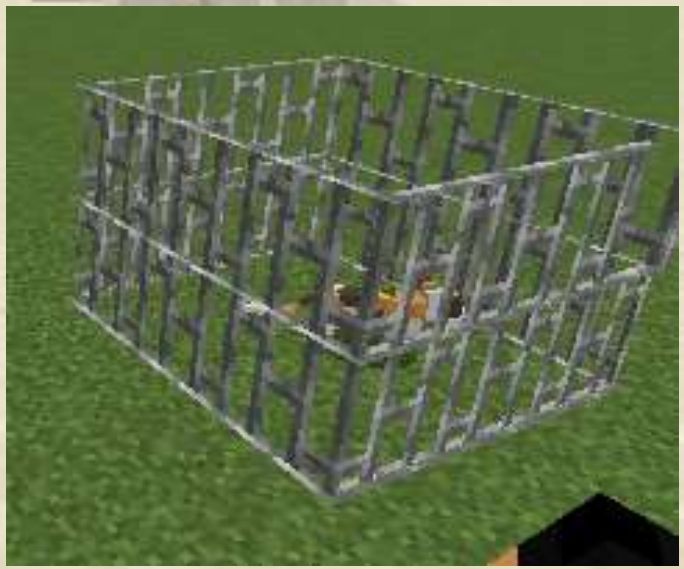
Make your own circles and towers

Experiment with creating your own castles.

Programmable potions

Learn how functions can be used to create programmable potions.

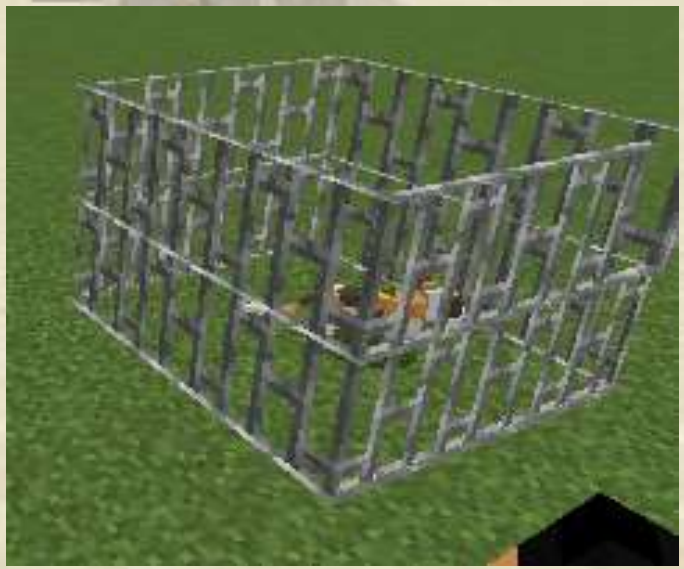
First we create a simple function that creates a cage



Programmable potions

Now we create a second command that gives us a potion that, when thrown, calls the previous function

```
/vm cage
  create a empty square of width 4 made of Iron Bars
  go 1 blocks up
  create a empty square of width 4 made of Iron Bars
```



```
/vm trap
  give me splash potion with function cage
```

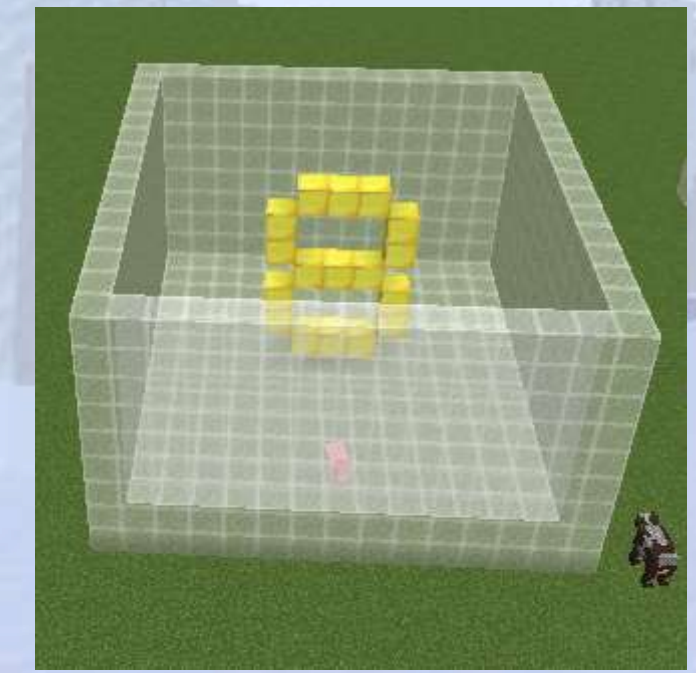
Put here the name of the function you want to call

Fun ⚡ Catch each other in Minecraft

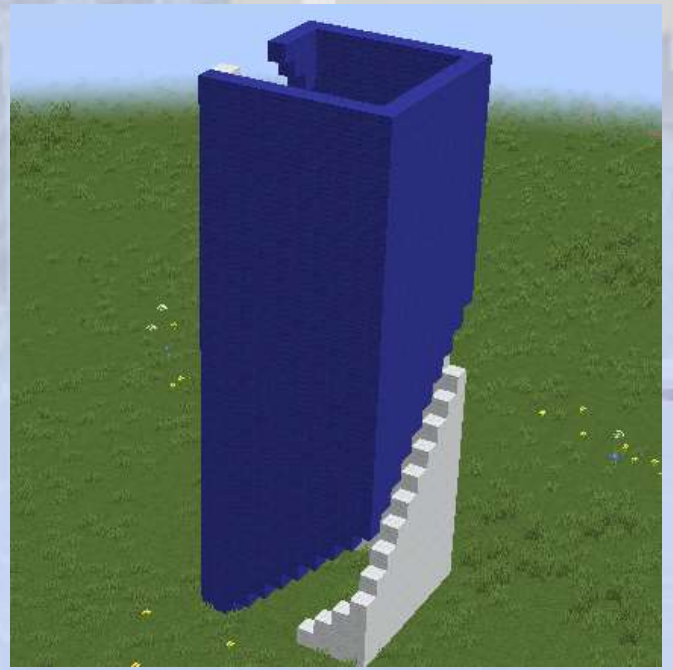
Enjoy a group activity that involves catching each other using your programmed potions.

Customize the function so that they do different actions, like making mobs appear or build instant towers. There are no limits to your ideas!

Variables



Understand what variables are and why we need them



Variables

🔍 Section Overview

We introduce the concept of variables and see some basic usages for creating fun structures

🎯 Objectives

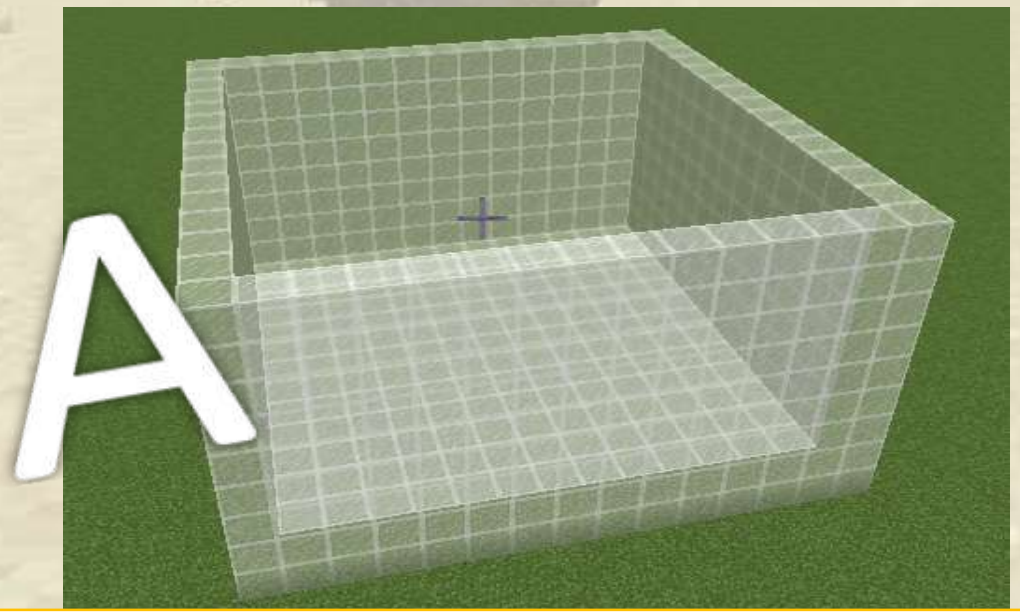
The concept of variables can be difficult to understand, so it is important to explain how they are used, and their applications in coding.

👌 Expected Outcomes

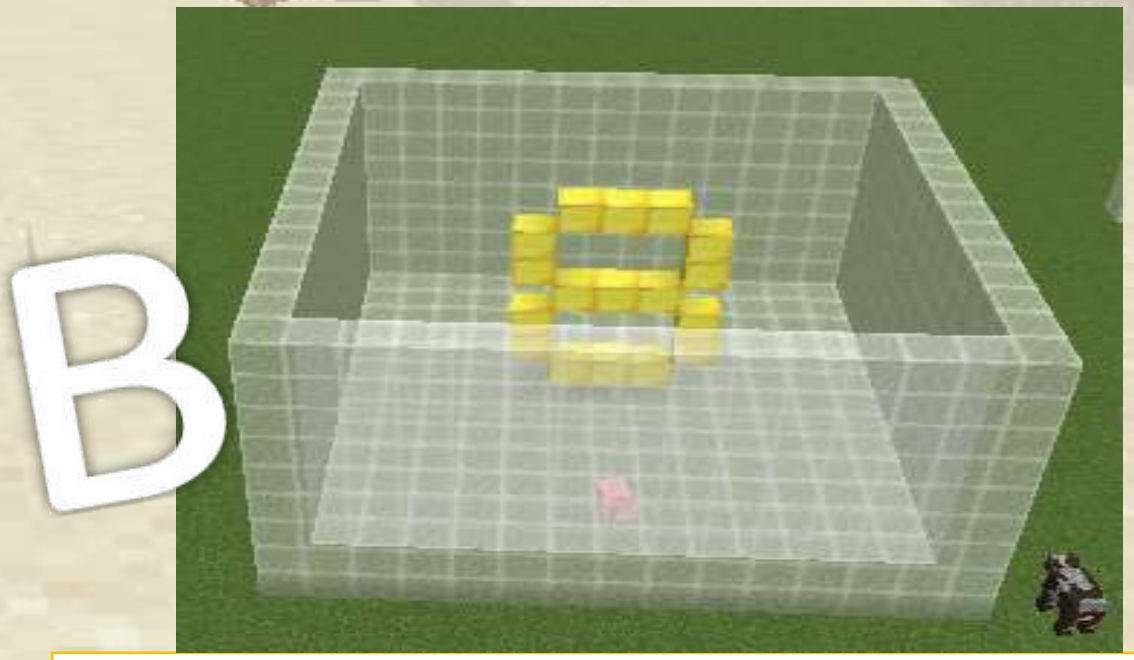
Students will have an understanding of what variables are and how they help in coding.

What Is a Variable?

For the computer a variable is like a box or a chest in Minecraft.
- A variable can contain can contain only one thing.
- The computer can have many variables, so we have to give them a name.



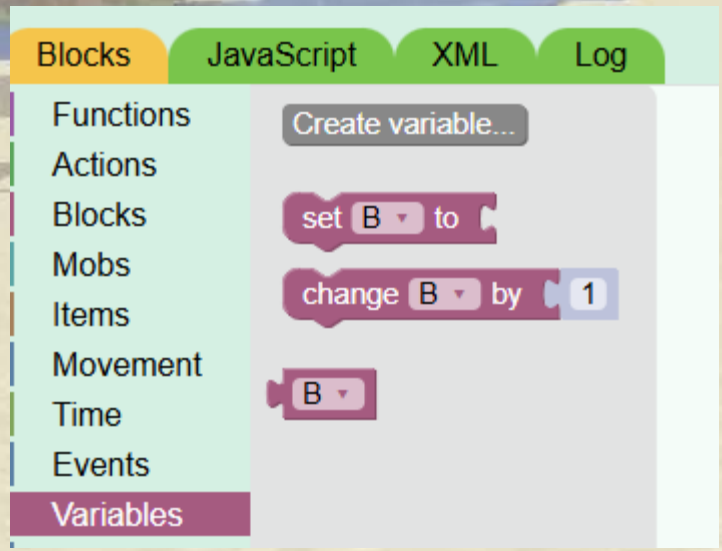
This variable is called “A” and doesn’t contain anything

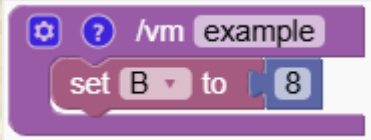


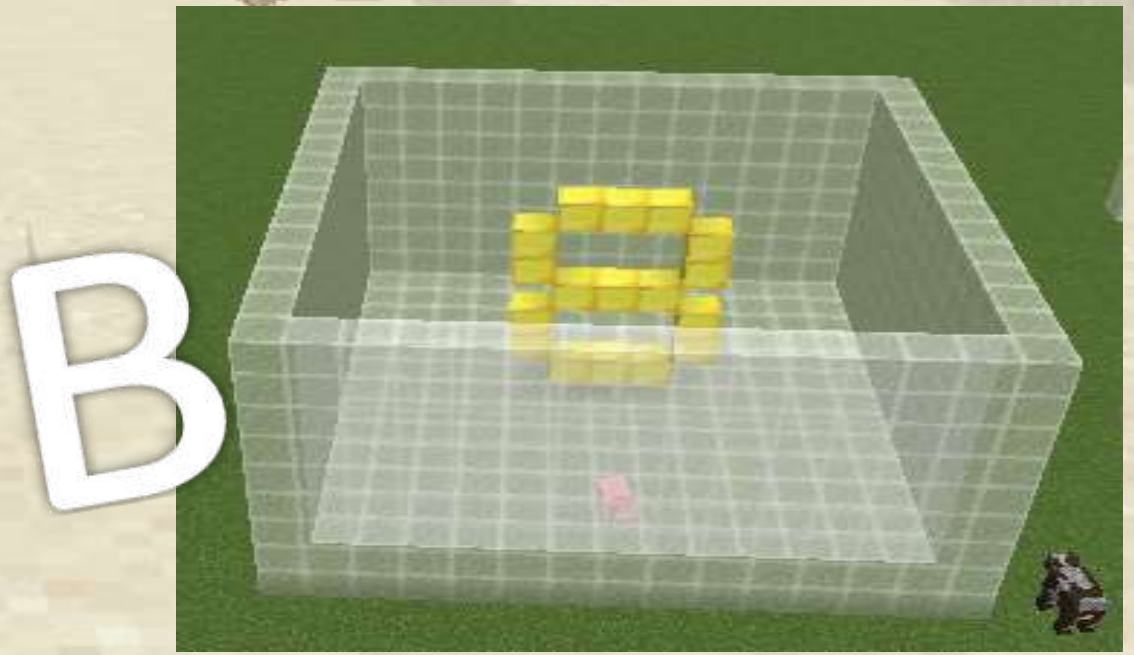
This variable is called “B” and contains the number 8

How to Create a Variable in the Editor

In the side menu under ‘variables’ there is the “create variable” option.
Once the variable is created you’ll be able to set or change it’s value



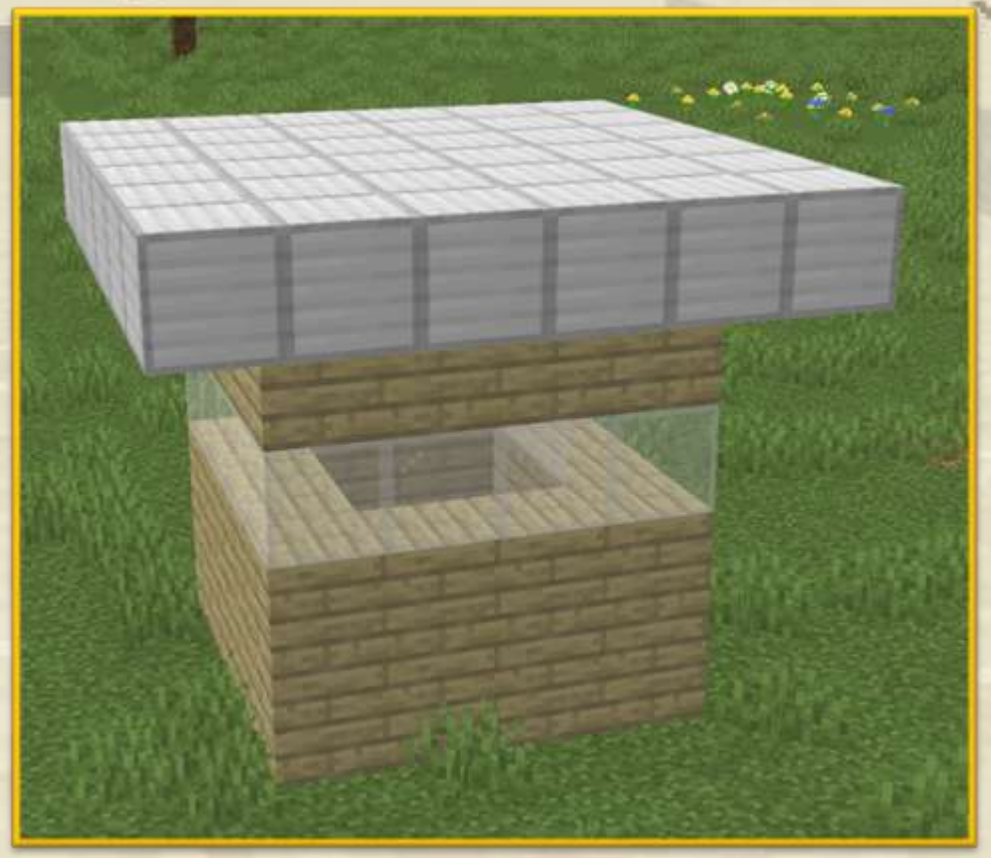




Make a House with Variable Size and Material

We are now going to see one of the advantages of using variables in defining the size and material of a house.

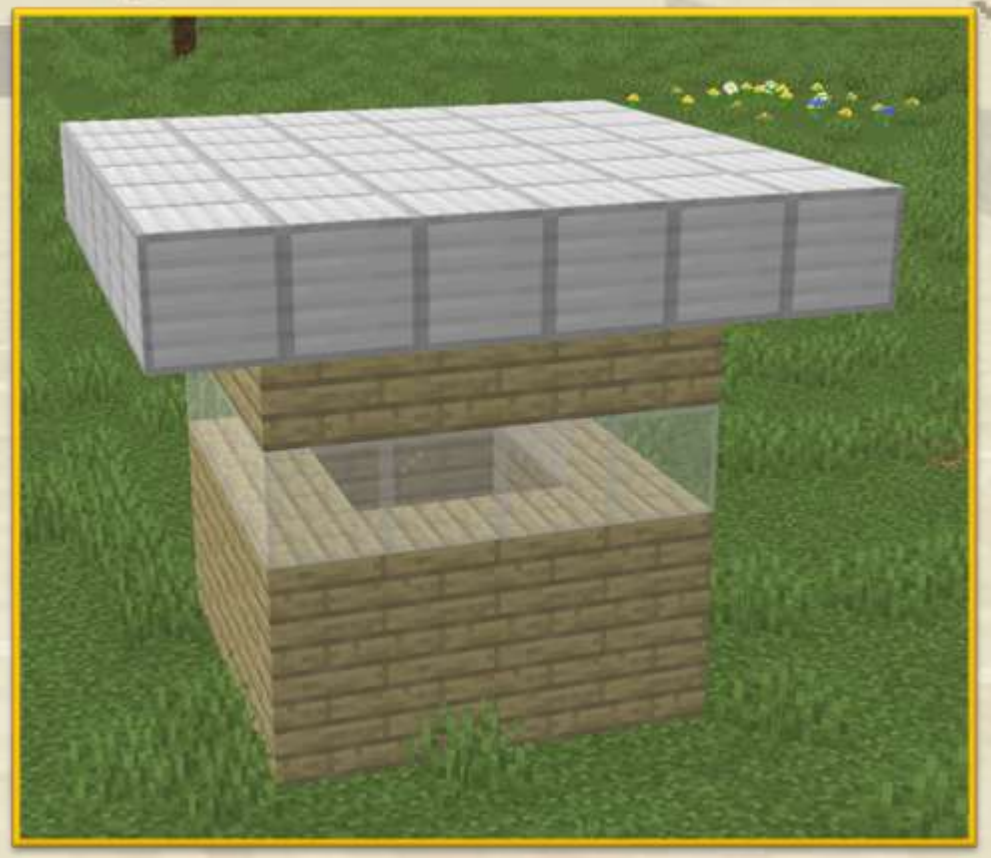
Code a house similar to this one.



Make a House with Variable Size and Material

This is the code for our house

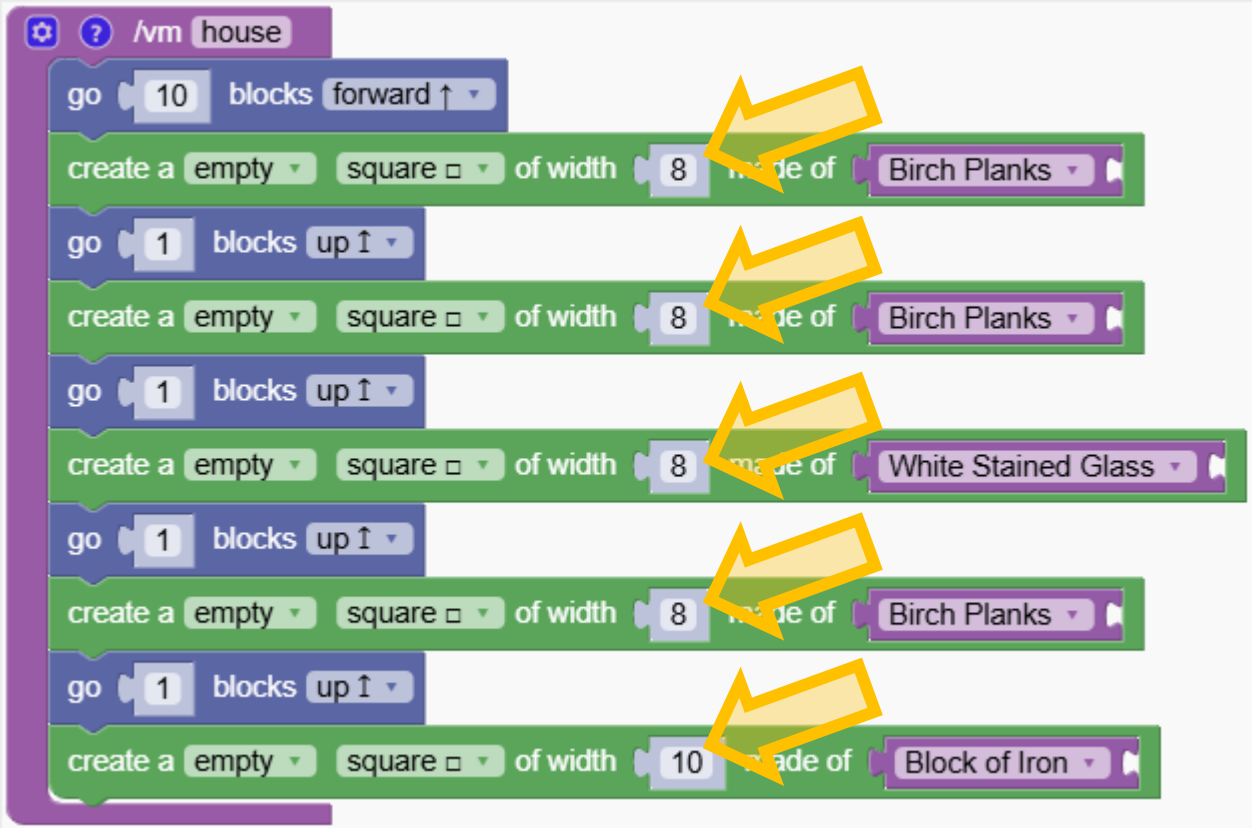
```
/vm house
go 10 blocks forward
create a empty square of width 4 made of Birch Planks
go 1 blocks up
create a empty square of width 4 made of Birch Planks
go 1 blocks up
create a empty square of width 4 made of White Stained Glass
go 1 blocks up
create a empty square of width 4 made of Birch Planks
go 1 blocks up
create a empty square of width 4 made of Block of Iron
```

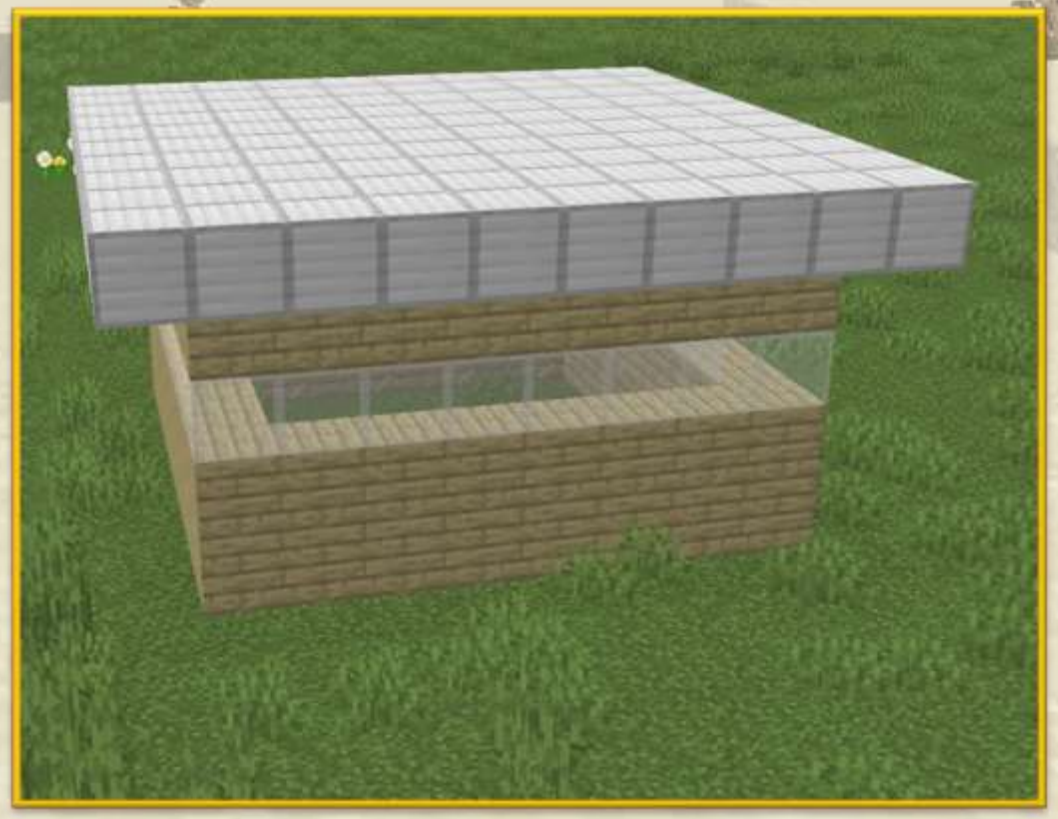


Make a House with Variable Size and Material

If I decide later that the house should be 8 blocks wide, I have to change the values everywhere.

What if the later I change my mind again?

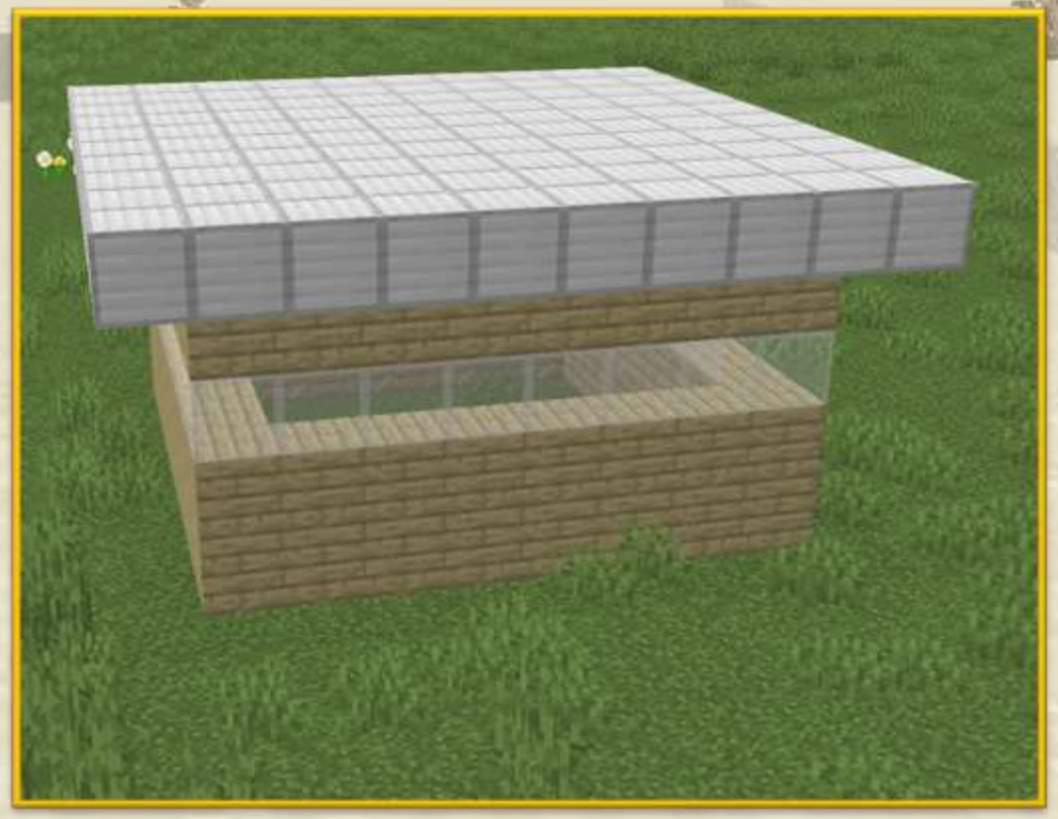




Make a House with Variable Size and Material

By rewriting the program using the variable “side” I can easily update the program

```
/vm house
go 10 blocks forward
set side to 8
create a empty square of width side made of Birch Planks
go 1 blocks up
create a empty square of width side made of Birch Planks
go 1 blocks up
create a empty square of width side made of White Stained Glass
go 1 blocks up
create a empty square of width side made of Birch Planks
go 1 blocks up
change side by 2
create a empty square of width side made of Block of Iron
```

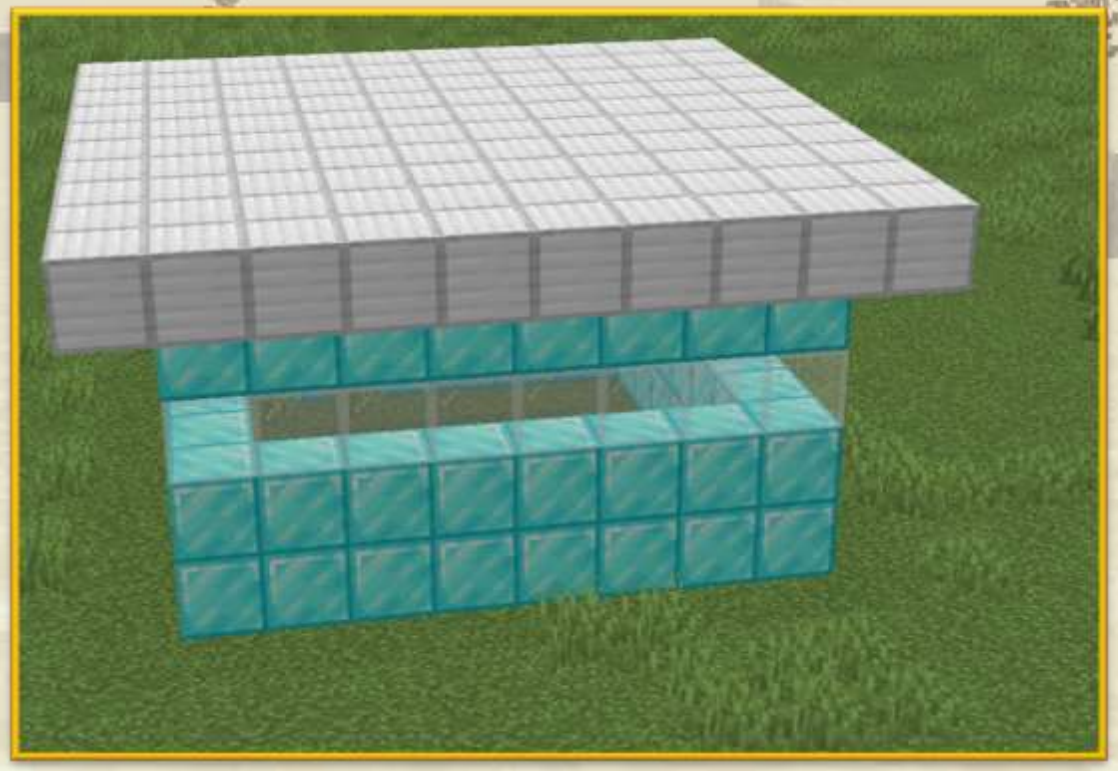


Make a House with Variable Size and Material

I can do the same with the blocks for the walls.

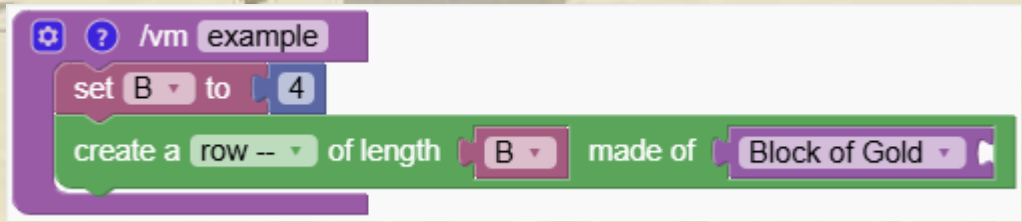
I just created a variable “mat” and put it into the program

```
/vm house
go 10 blocks forward ↑
set side to 8
set mat to Block of Diamond
create a empty square □ of width side made of mat
go 1 blocks up ↥
create a empty square □ of width side made of mat
go 1 blocks up ↥
create a empty square □ of width side made of White Stained Glass
go 1 blocks up ↥
create a empty square □ of width side made of mat
go 1 blocks up ↥
change side by 2
create a empty square □ of width side made of Block of Iron
```

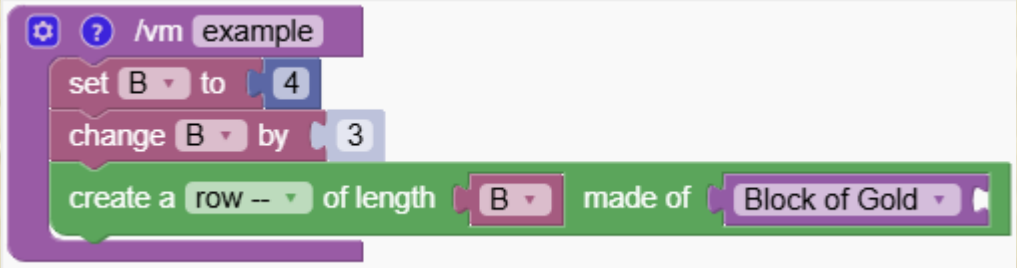


Basic Example with a Row of Blocks

The value contained in the variable with name ‘B” is the number 4



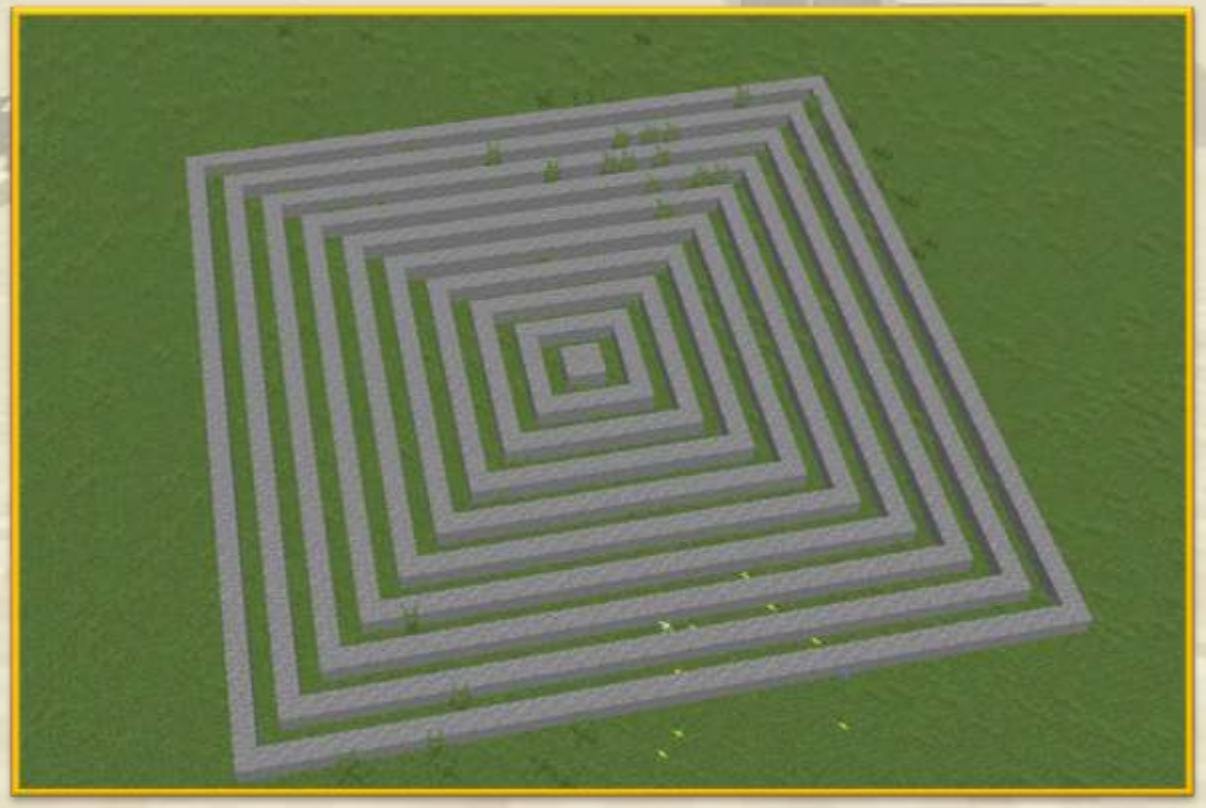
Now we added the number 3 to the number 4. Now B contains the number 7



Make Concentric Squares

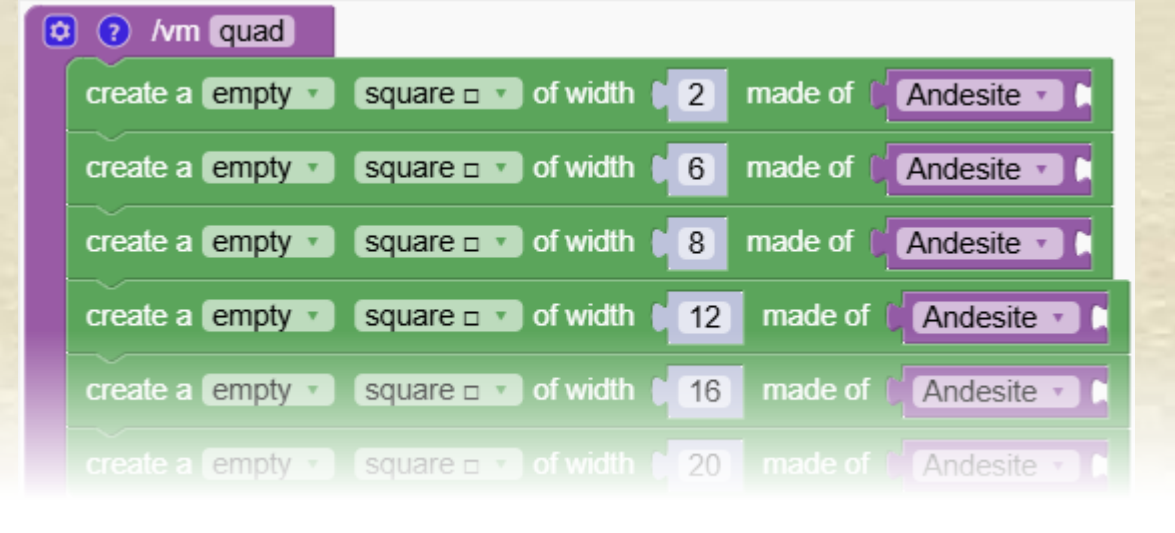
Use variables to avoid repetitive tasks.

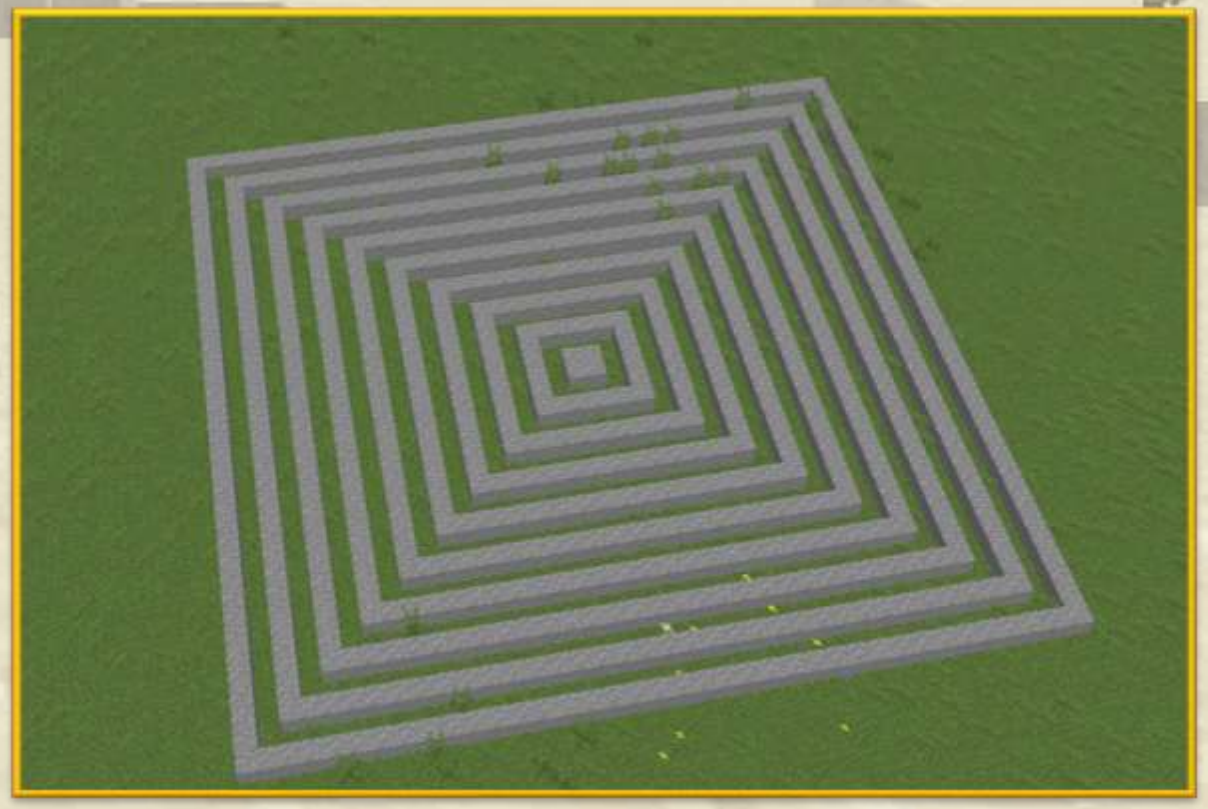
We want to create the following shape. How shall we do it?



Make Concentric Squares

This is a slow, repetitive and poor solution

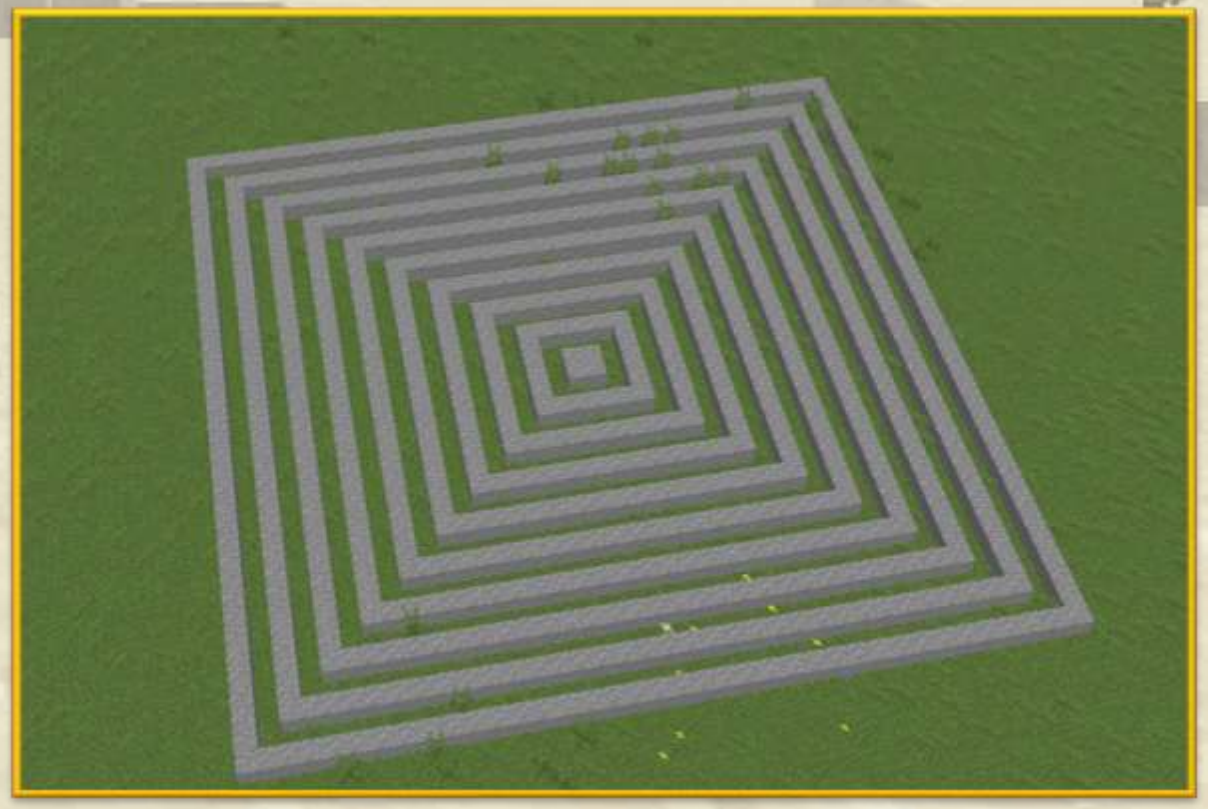




Make Concentric Squares

Now we use a variable but this doesn't help. The program is still too long.

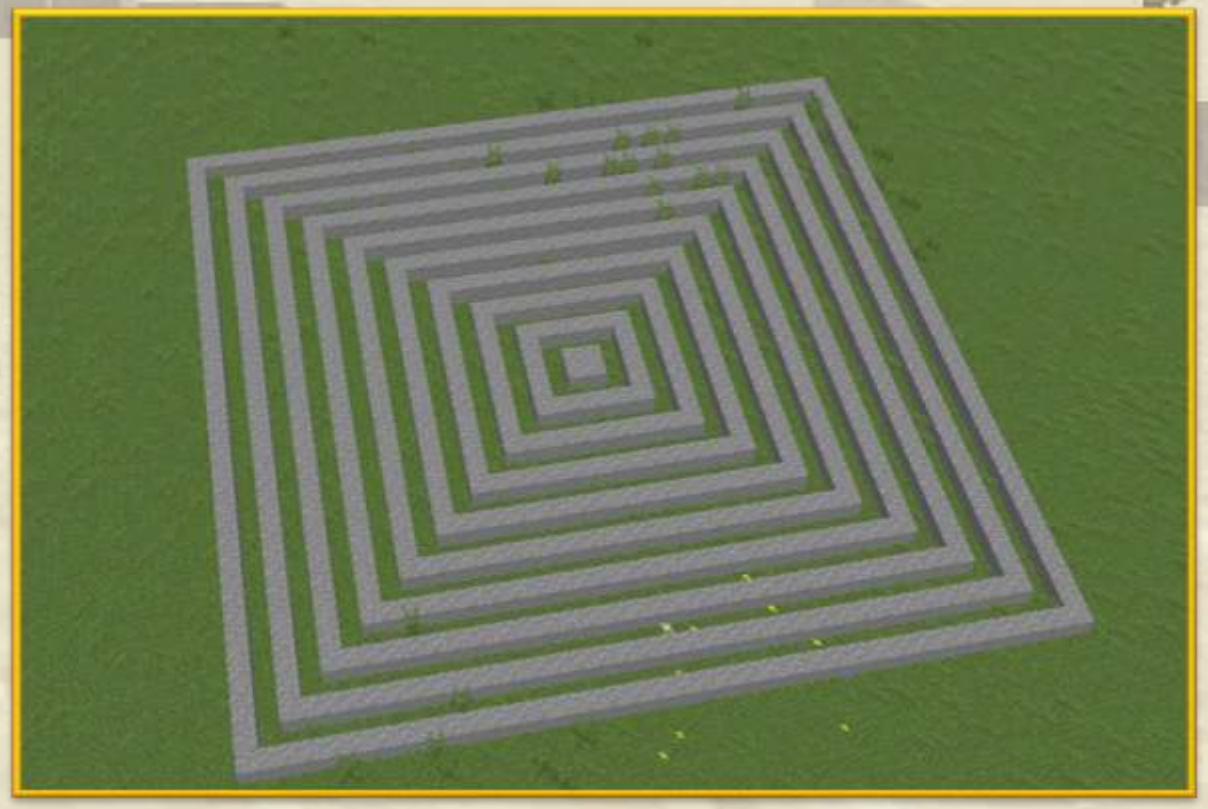
```
/vm quad
set side to 2
create a empty square of width side made of Andesite
change side by 4
create a empty square of width side made of Andesite
change side by 4
create a empty square of width side made of Andesite
change side by 4
create a empty square of width side made of Andesite
change side by 4
create a empty square of width side made of Andesite
change side by 4
create a empty square of width side made of Andesite
```



Make Concentric Squares

This is a much better program.

```
/vm quad
  set side to 2
  repeat 10 times
  do
    create a empty square □ of width side made of Andesite
    change side by 4
```



What Numbers Are Generated by This Code?

Practice modifying values in variables.

```
/vm math
set a to 2
print a
```

```
/vm math2
set a to 2
set a to 3 + 1
print a
```

```
/vm math4
set a to 2
set a to 3 + 1
set a to a - 2
print a
```

```
/vm math5
set a to 2
set a to 3 + 1
set a to a - 2
set a to a × a
print a
```

```
/vm math6
set a to 2
set a to 3 + 1
set a to a - 2
set a to a × a
change a by 1
print a
```

Quiz

What Numbers Are Generated by This Code?

Practice modifying values in variables.

```
/vm math
set a to 2
print a
```

2

```
/vm math2
set a to 2
set a to 3 + 1
print a
```

4

```
/vm math4
set a to 2
set a to 3 + 1
set a to a - 2
print a
```

2

```
/vm math5
set a to 2
set a to 3 + 1
set a to a - 2
set a to a × a
print a
```

4

```
/vm math6
set a to 2
set a to 3 + 1
set a to a - 2
set a to a × a
change a by 1
print a
```

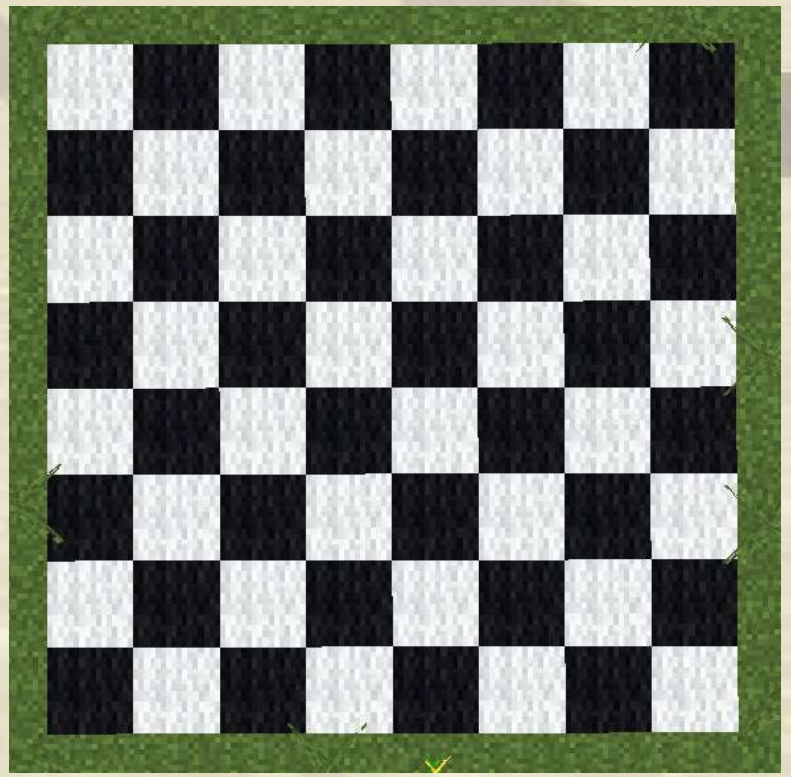
5

Quiz

Chess Board

Do you remember the chess board we created with 4 squares?

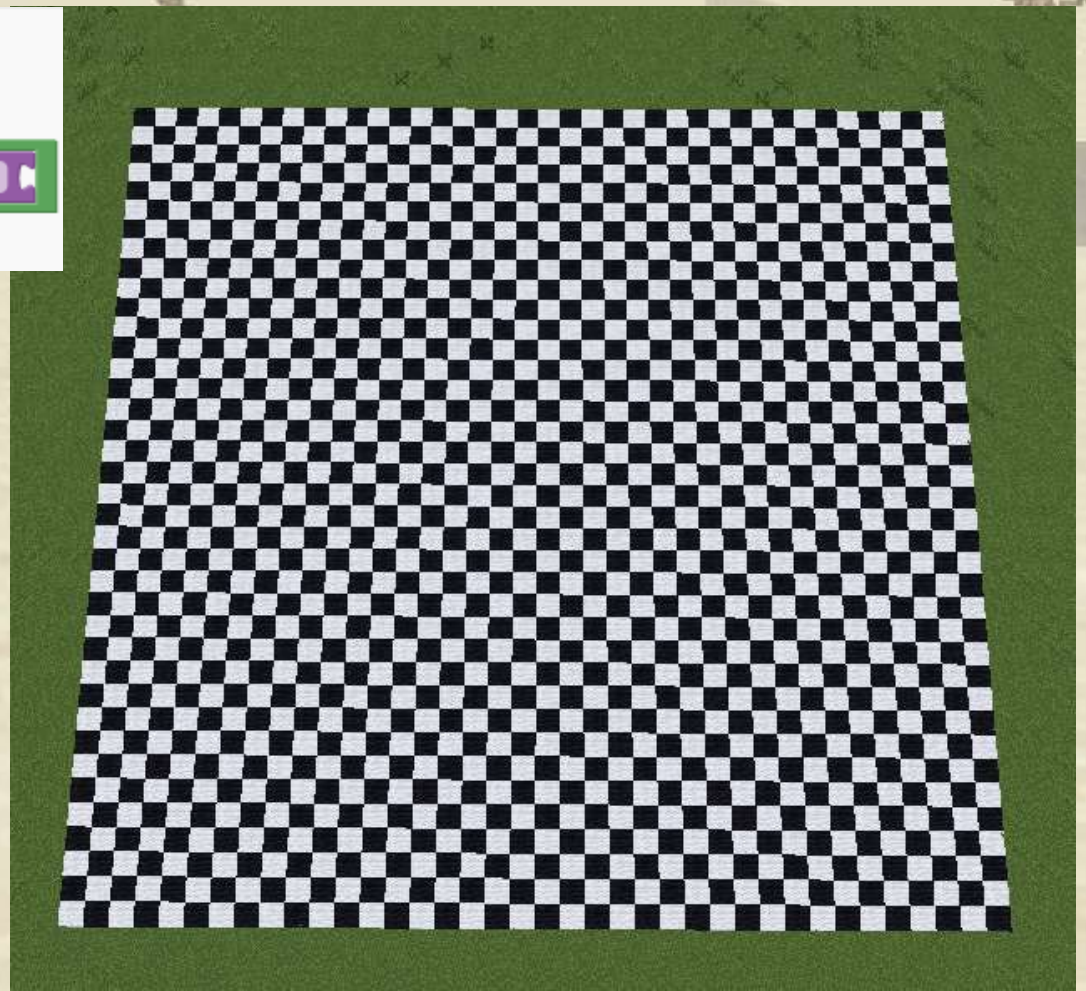
```
/vm chess
create a empty square □ of width 8 made of Black Carpet White Carpet
create a empty square □ of width 6 made of Black Carpet White Carpet
create a empty square □ of width 4 made of Black Carpet White Carpet
create a empty square □ of width 2 made of Black Carpet White Carpet
```



Chess Board

Change the program to make it much bigger using a loop and a variable.

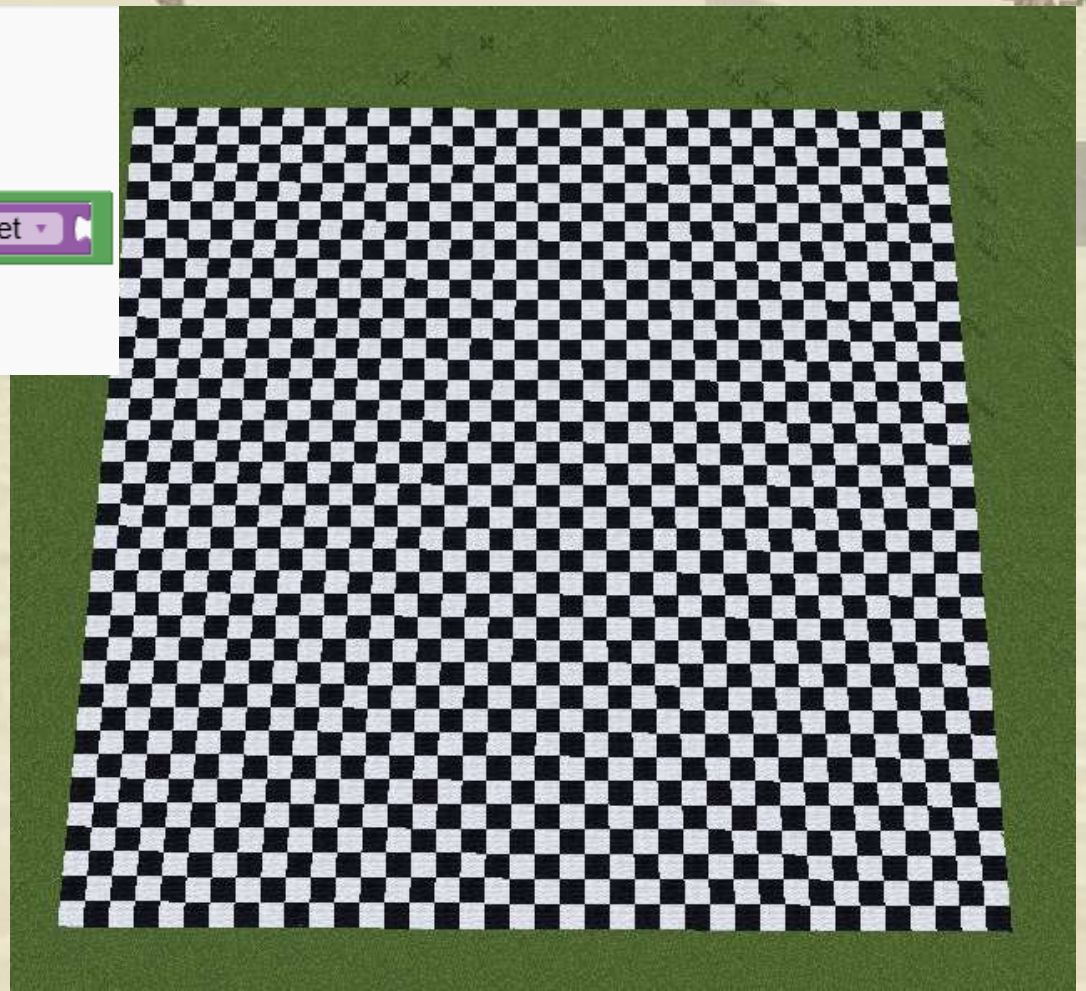
This doesn't work. We need a variable!



Chess Board

We added the variable “len”. The square will be bigger at every repetition

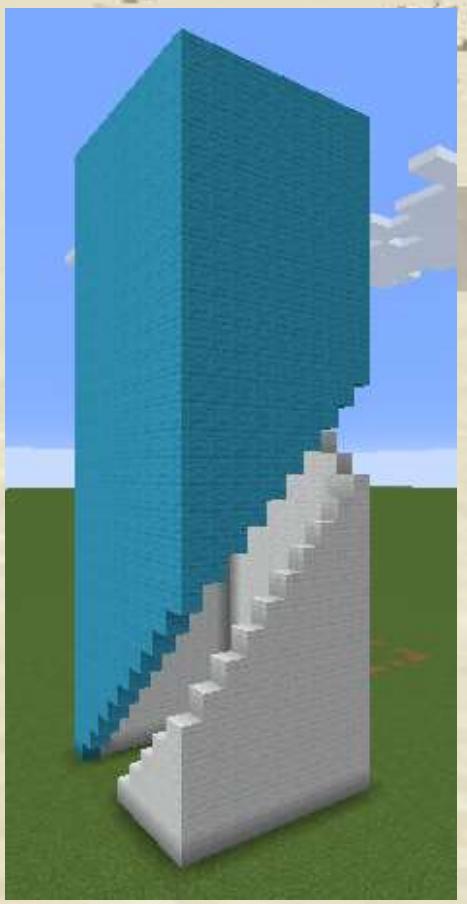
```
/vm bigchess
set len to 0
repeat 20 times
do
    create a empty square □ of width len made of Black Carpet White Carpet
    change len by 2
```



Create a Parkour

Transform towers into exciting parkour challenges using variables.

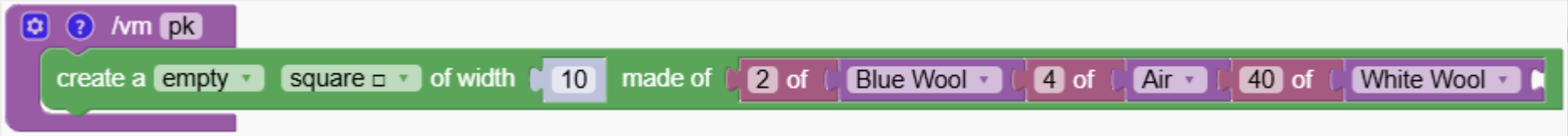
```
/vm pk
repeat 30 times
do
    create a empty square of width 10 made of 4 of Light Blue Wool 4 of Air 100 of White Wool
    go 1 blocks up
```

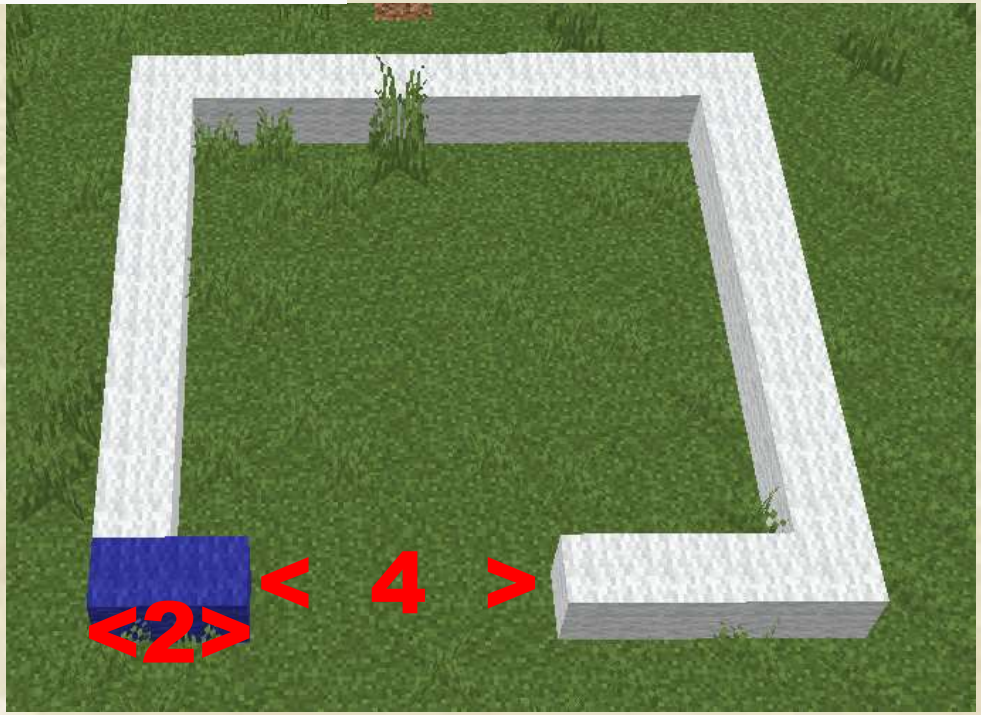


Create a Parkour

We start by making a square made of 2 blue blocks, followed by 4 blocks of air.

We also provide many white blocks to fill up the rest of the structure

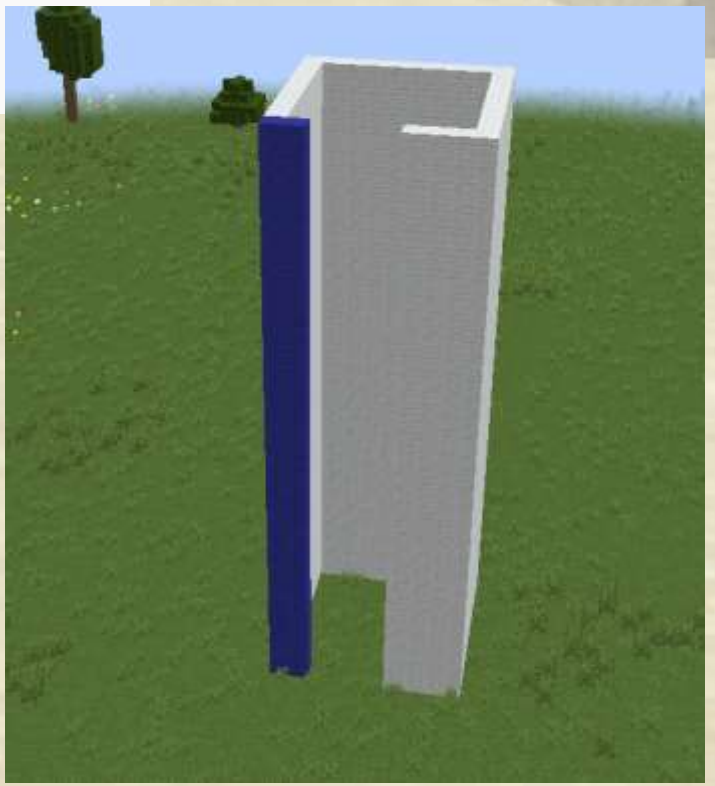




Create a Parkour

Now we make it into a tower by repeating it 30 times

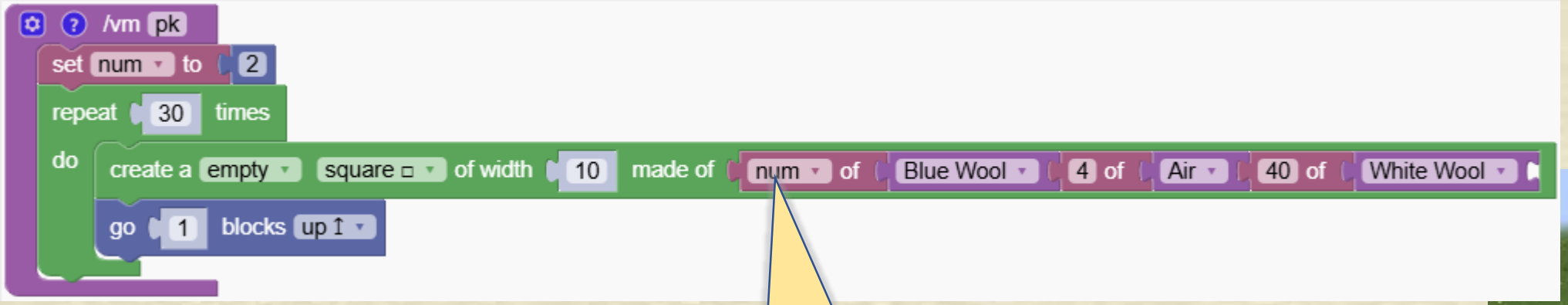
```
/vm pk
repeat 30 times
do
    create a empty square of width 10 made of 2 of Blue Wool 4 of Air 40 of White Wool
    go 1 blocks up
```



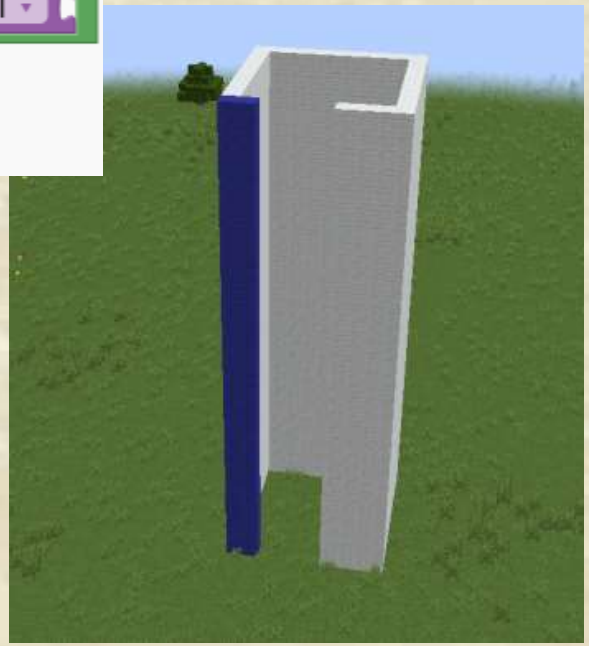
Create a Parkour

We want to add more blue blocks every time we go up one layer.

To prepare this, we replace the number “2” with a new variable called “num”.



Use the ‘num of’ block

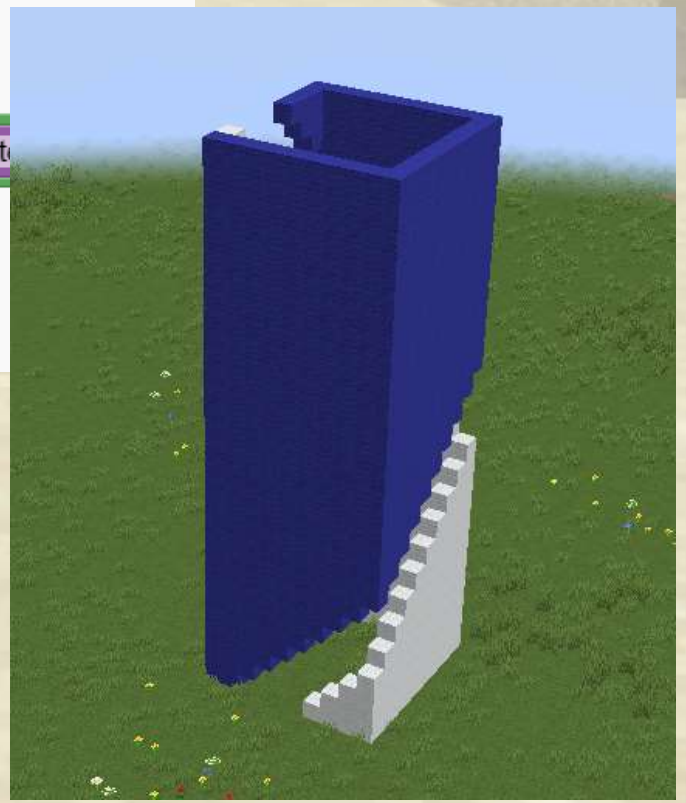


Create a Parkour

Now we change the value inside the variable ‘num’ so that at every new layer the number of blue blocks becomes bigger

```
/vm pk
set num to 2
repeat 30 times
do
    create a empty square of width 10 made of num of Blue Wool 4 of Air 40 of Whit
    go 1 blocks up
    change num by 1
```

Change the number inside ‘num’ at every level

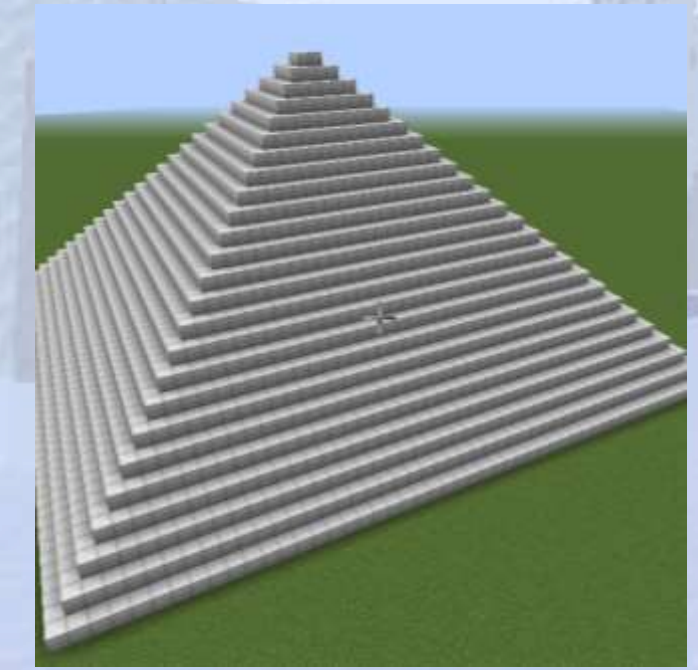


Create a Parkour

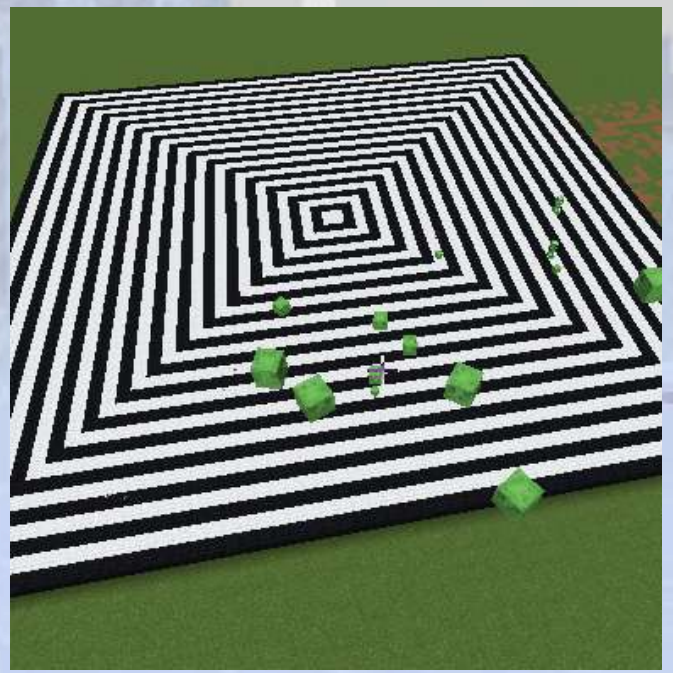
Let' add some challenge with spiders and a treasure !

```
/vm pk
set num to 2
repeat 30 times
do
    create a empty square of width 10 made of num of Blue Wool 4 of Air 40 of White Wool
    go 1 blocks up
    change num by 1
    create a row -- of length 6 made of White Wool
    go 1 blocks up
    create a row -- of length 5 made of Spider
    create chest with Golden Apple
```

Counting Loops



Learn to use the
“for” loop



Counting Loops

🔍 Section Overview

We are creating pyramids to illustrate the counting loop (‘for’ loop)

🎯 Objectives

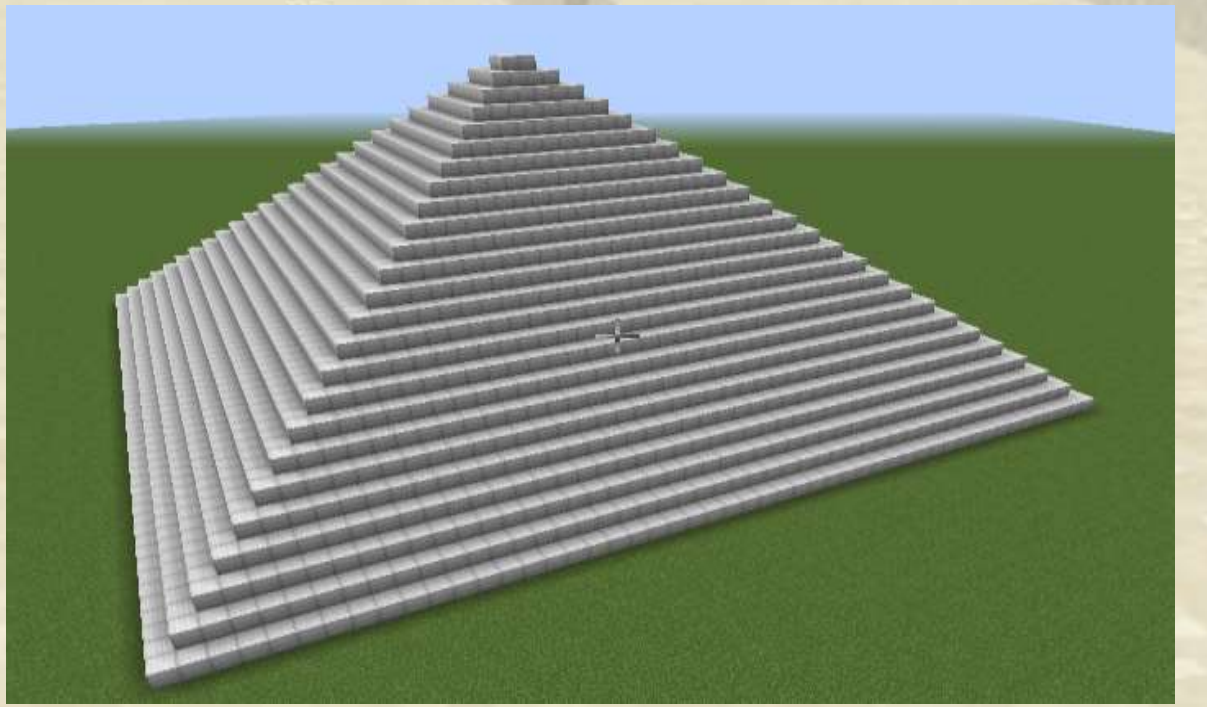
Explore how the for loops work and how to use them effectively.

👌 Expected Outcomes

The students will understand that the counting loop is a simplification, compared to creating a variable and modifying it

What Are We Going to Learn

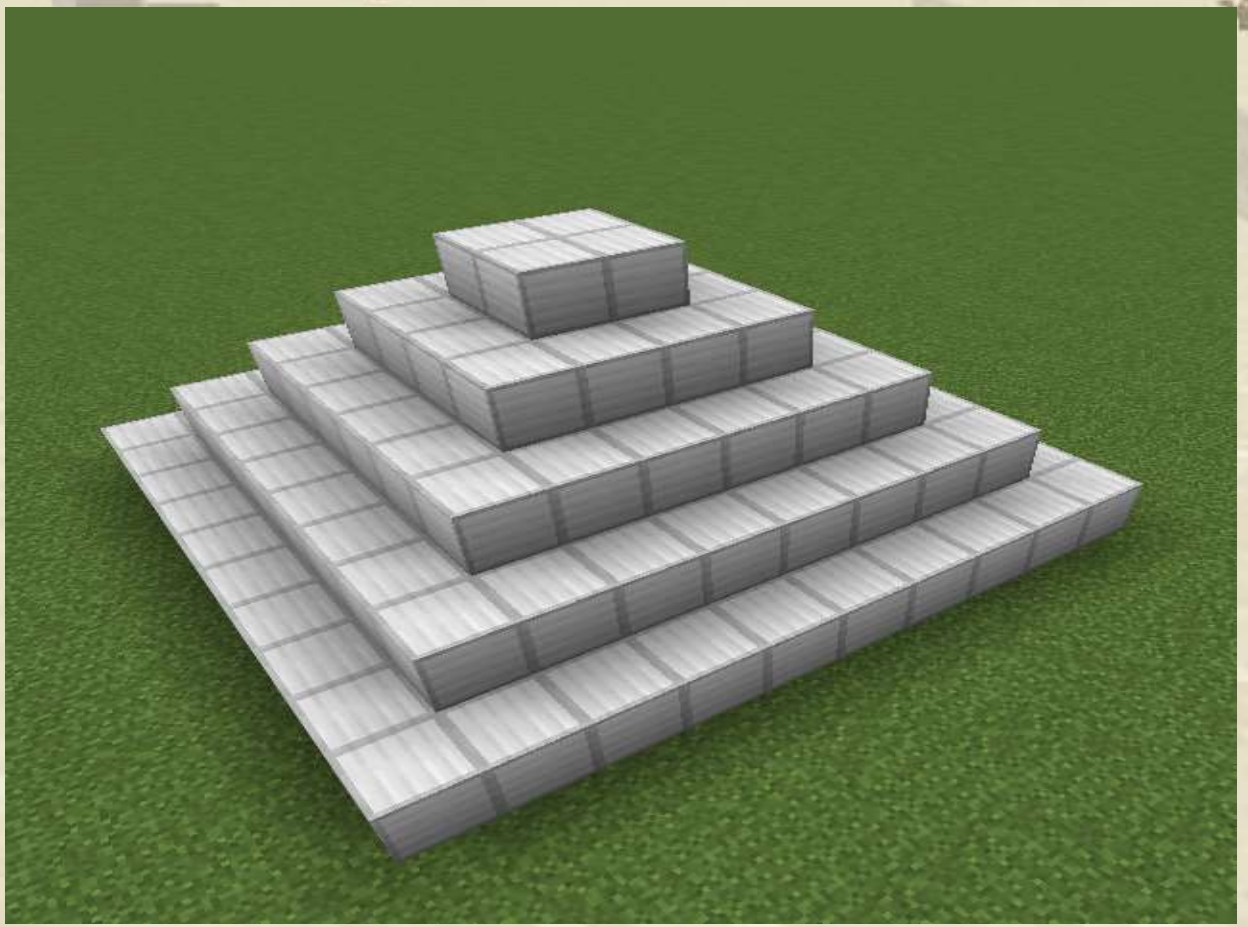
We focus on using loops to automate repetitive tasks and build efficient programs.



Coding a Pyramid

To create a pyramid we can use the following program but this is a poor solution if the pyramid should be much higher.

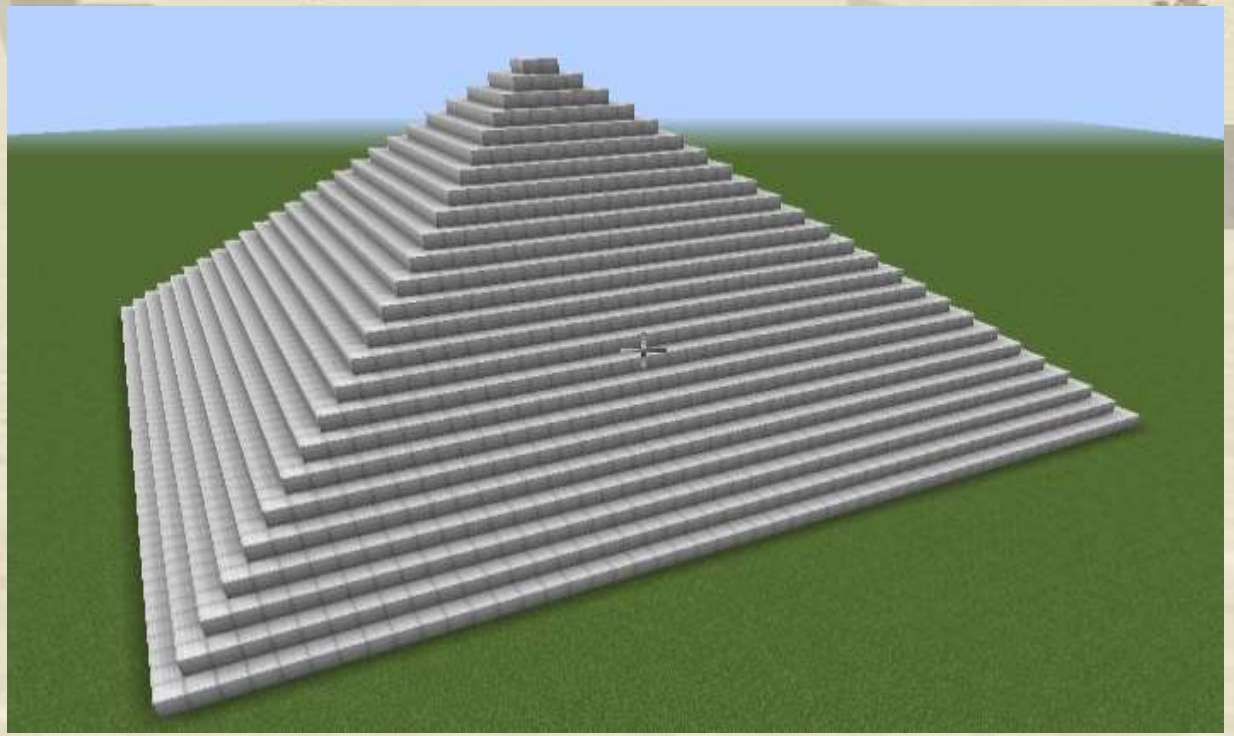
```
/vm pyramid
create a empty square of width 10 made of Block of Iron
go 1 blocks up
create a empty square of width 8 made of Block of Iron
go 1 blocks up
create a empty square of width 6 made of Block of Iron
go 1 blocks up
create a empty square of width 4 made of Block of Iron
go 1 blocks up
create a empty square of width 2 made of Block of Iron
```



Coding a Pyramid

Can you change the code below to use a repetition and create a huge pyramid?

```
/vm pyramid
create a empty square of width 10 made of Block of Iron
go 1 blocks up
create a empty square of width 8 made of Block of Iron
go 1 blocks up
create a empty square of width 6 made of Block of Iron
go 1 blocks up
create a empty square of width 4 made of Block of Iron
go 1 blocks up
create a empty square of width 2 made of Block of Iron
```

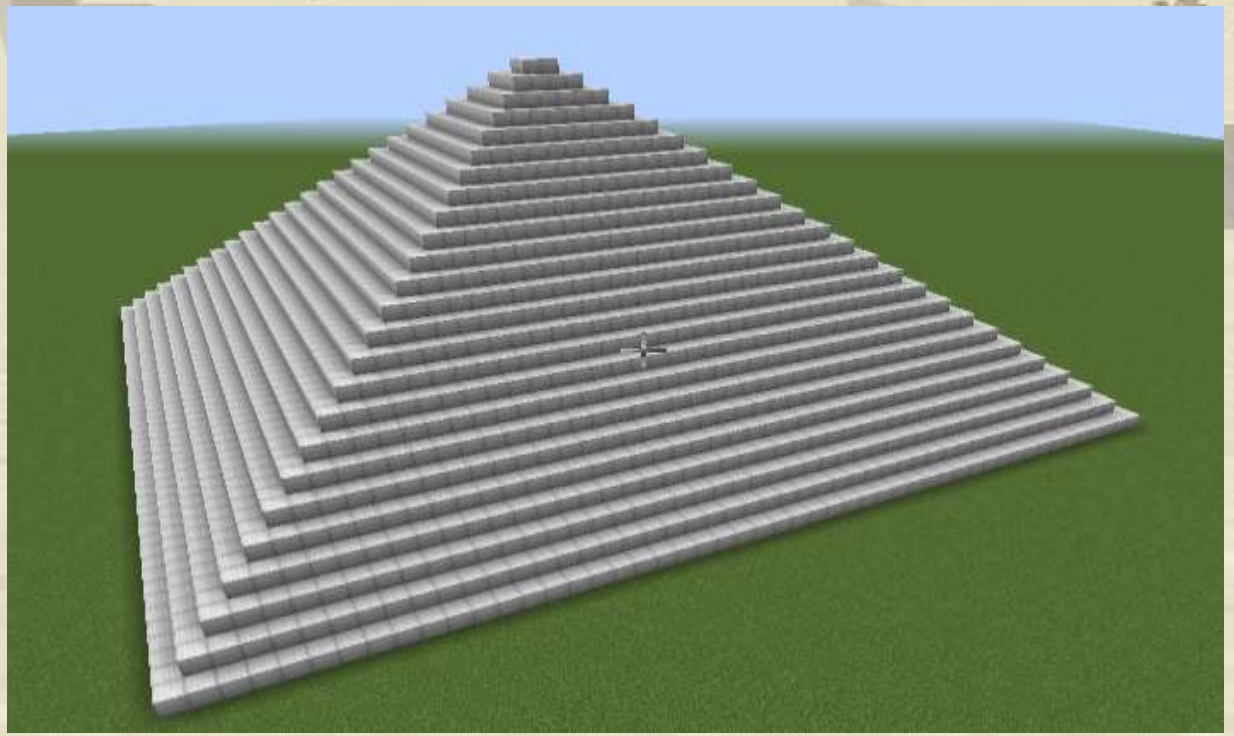


Coding a Pyramid

This solution is better. We use a variable to keep track of the width of the pyramid

After creating a level, we decrease the width by 2

```
/vm pyramid
  set width to 50
  repeat 25 times
  do
    create a empty square of width 2 made of Block of Iron
    go 1 blocks up
    change width by -2
```



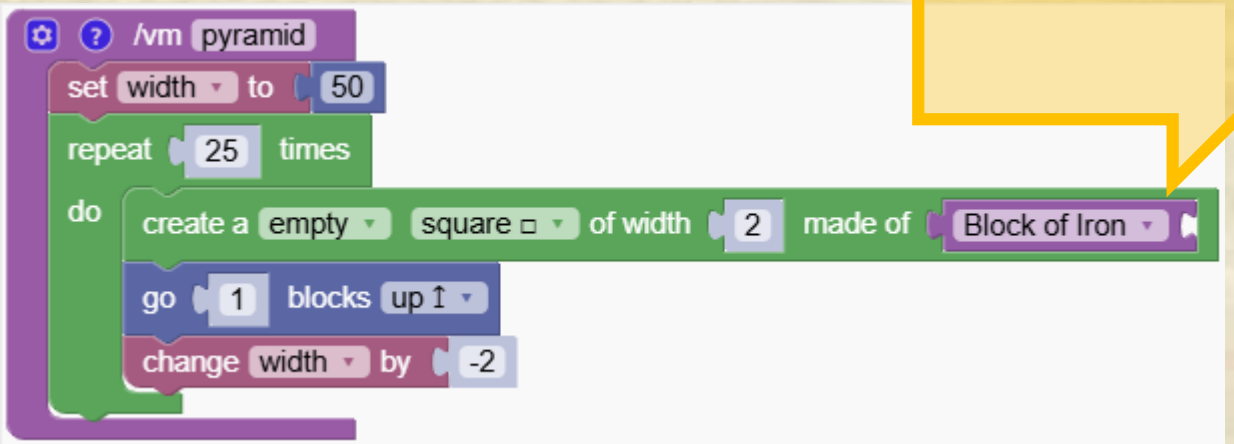
The counting loop

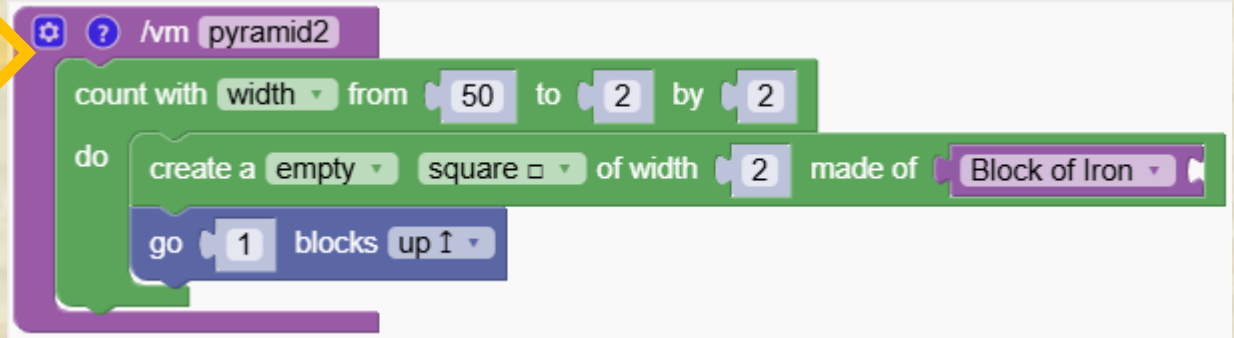
To create the pyramid we used the program on the left.

This type of program is very common in coding and therefore it exists a more advanced loop to support it.

The counting loop.

The program of the right does the same job of creating the pyramid by using the counting loop.

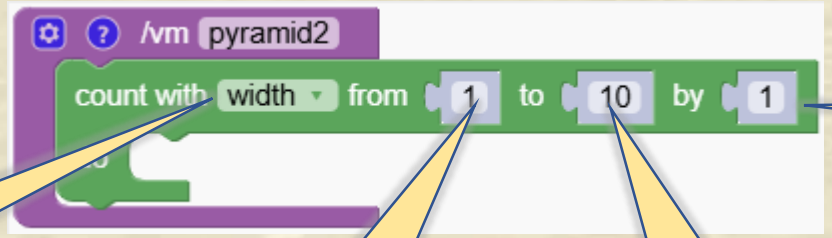




The counting loop

The counting loop is similar to our standard repeat loop but has the following values:

- Automatically creates a variable
- We can set the start and end value
- We can set the step to add when changing the variable



Variable name 'width'

Start value 1

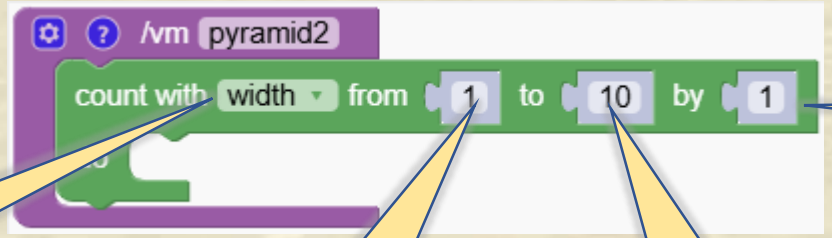
End value 10

Step to add 1

The counting loop

The counting loop is similar to our standard repeat loop but has the following values:

- Automatically creates a variable
- We can set the start and end value
- We can set the step to add when changing the variable



Variable name 'width'

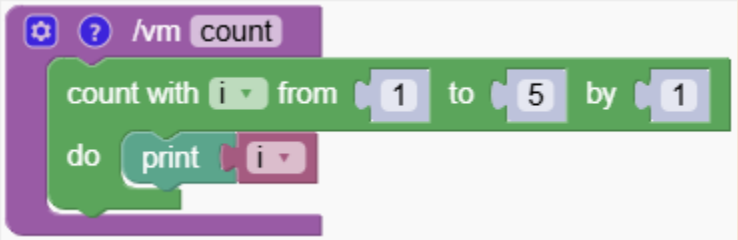
Start value 1

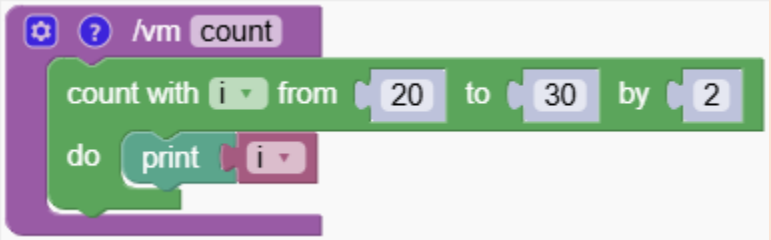
End value 10

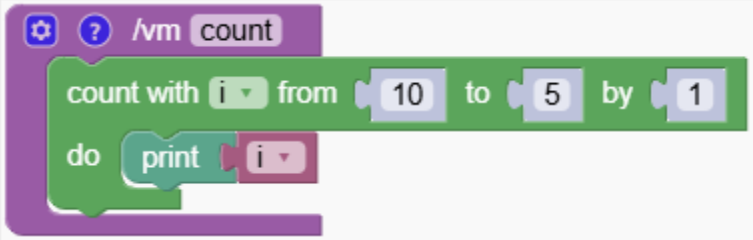
Step to add 1

Counting Loop Quiz

Here are some examples. Which numbers are printed when we run the programs?



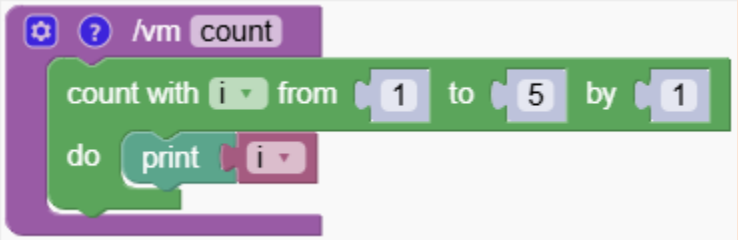


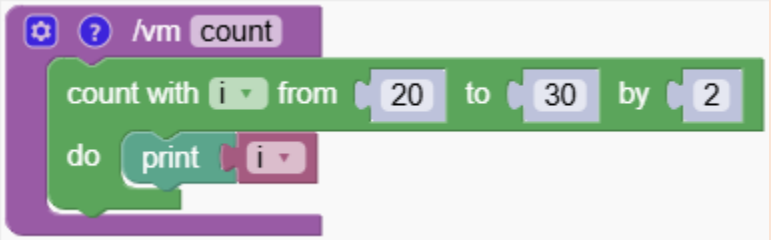


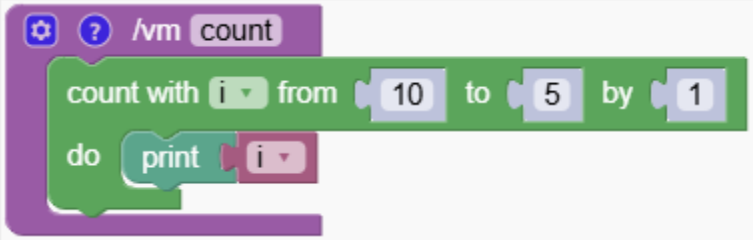
Quiz

Counting Loop Quiz

Here are some examples. Which numbers are printed when we run the programs?







Quiz

Counting Loop Quiz

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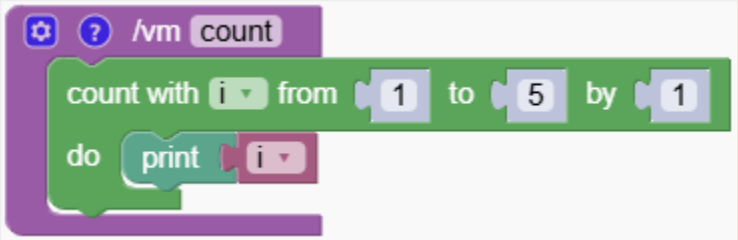
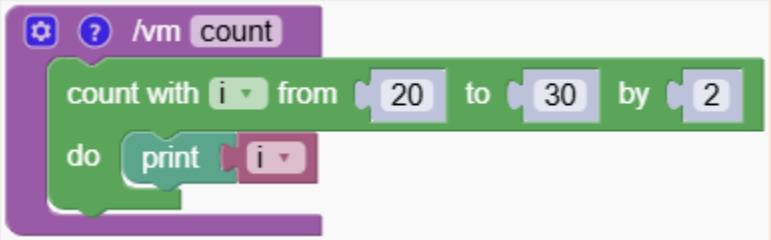
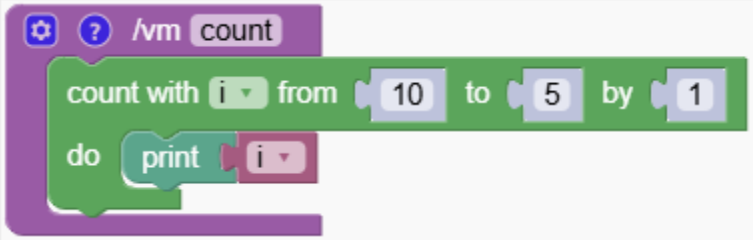




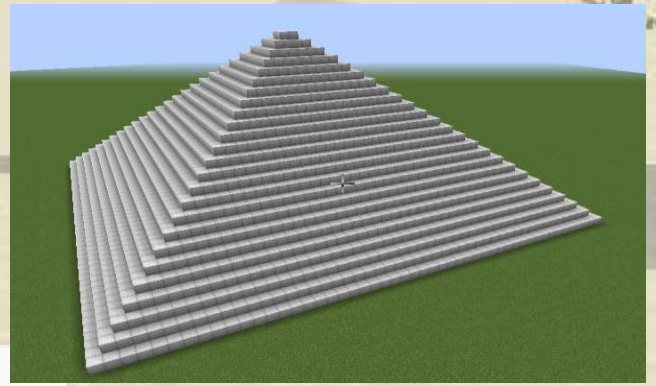


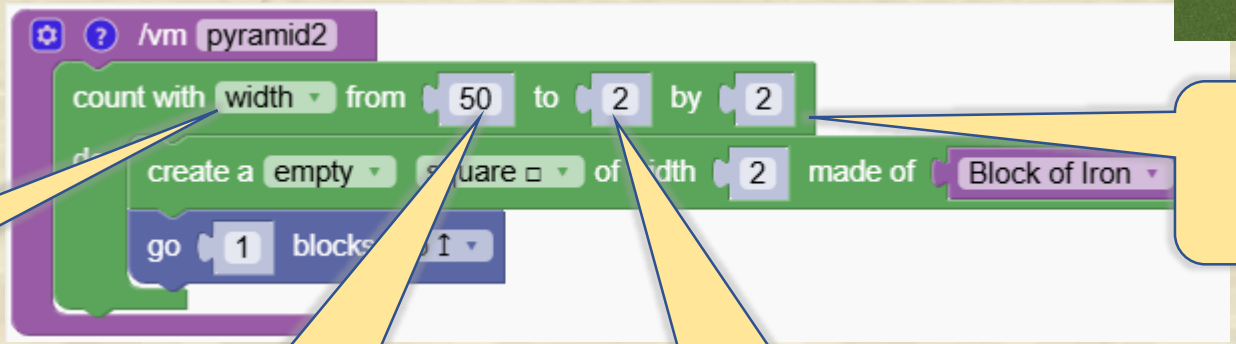
Quiz

The counting loop

Our pyramid was created starting at width 50 at the bottom and width 2 at the top.

We looped with a variable called ‘loop’ and at every cycle we reduced it by 2





Variable name ‘width’

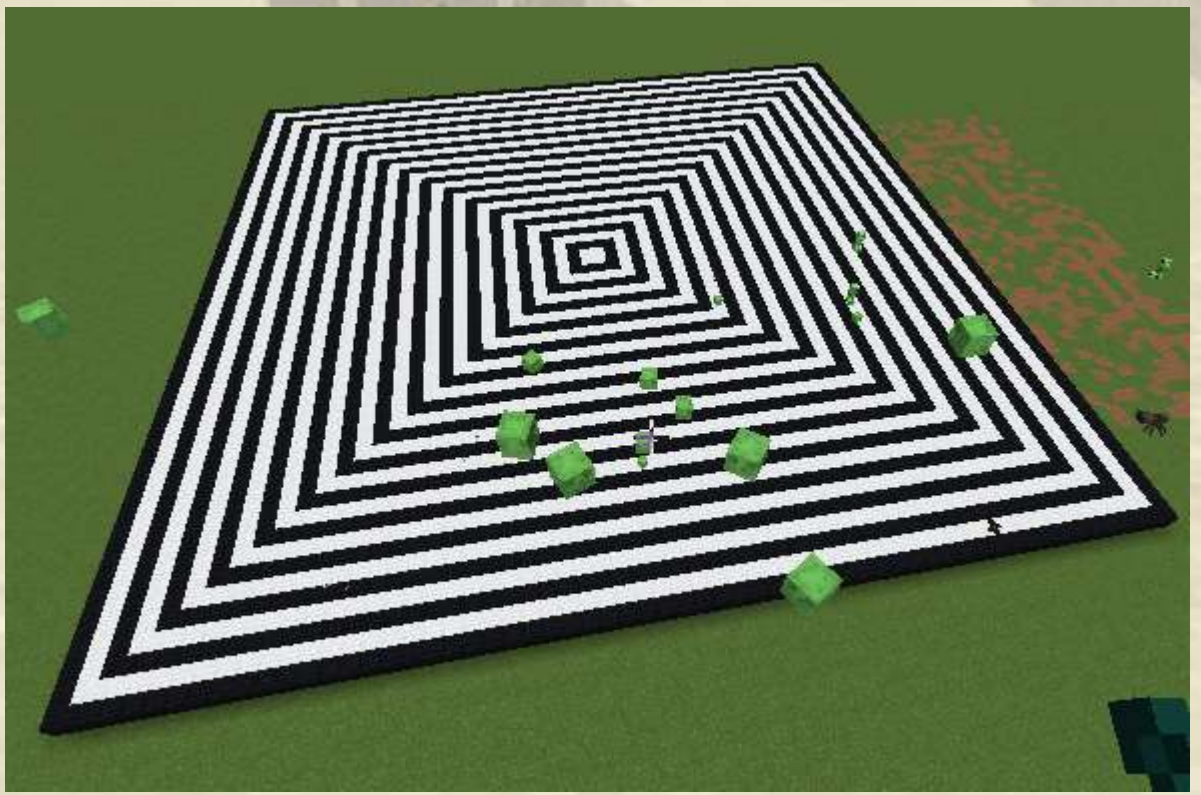
Start value 50

End value 2

Step to add 2

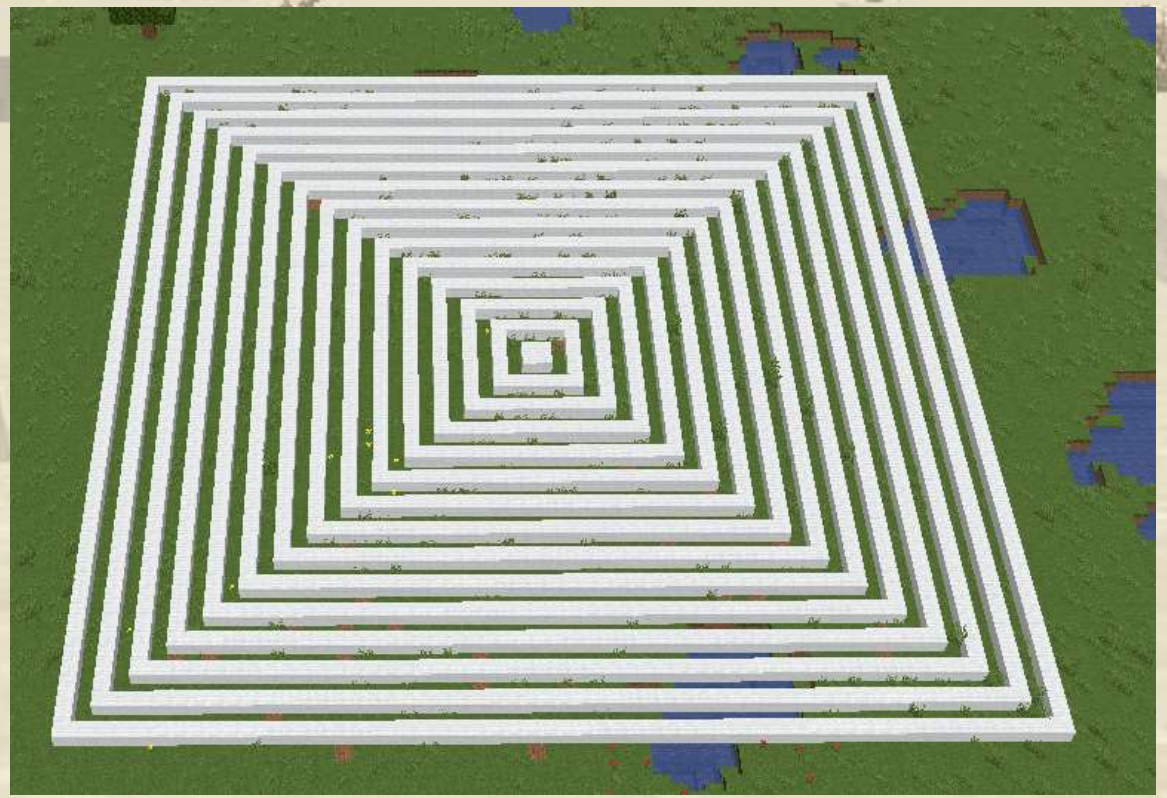
Fun Carpets

Have fun creating colorful carpets with simple loops.



Make Your Own Carpets

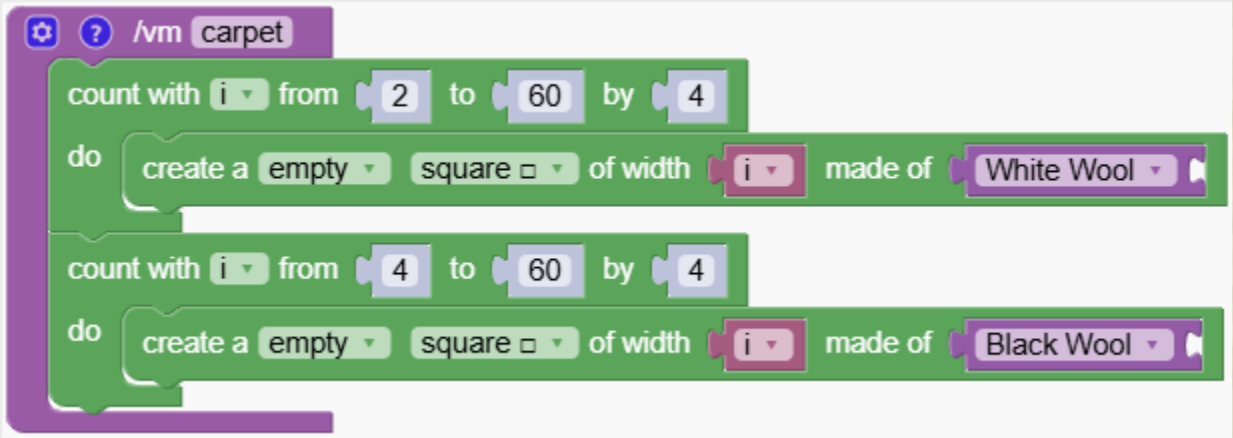
Create simple two-colored carpets using loops.

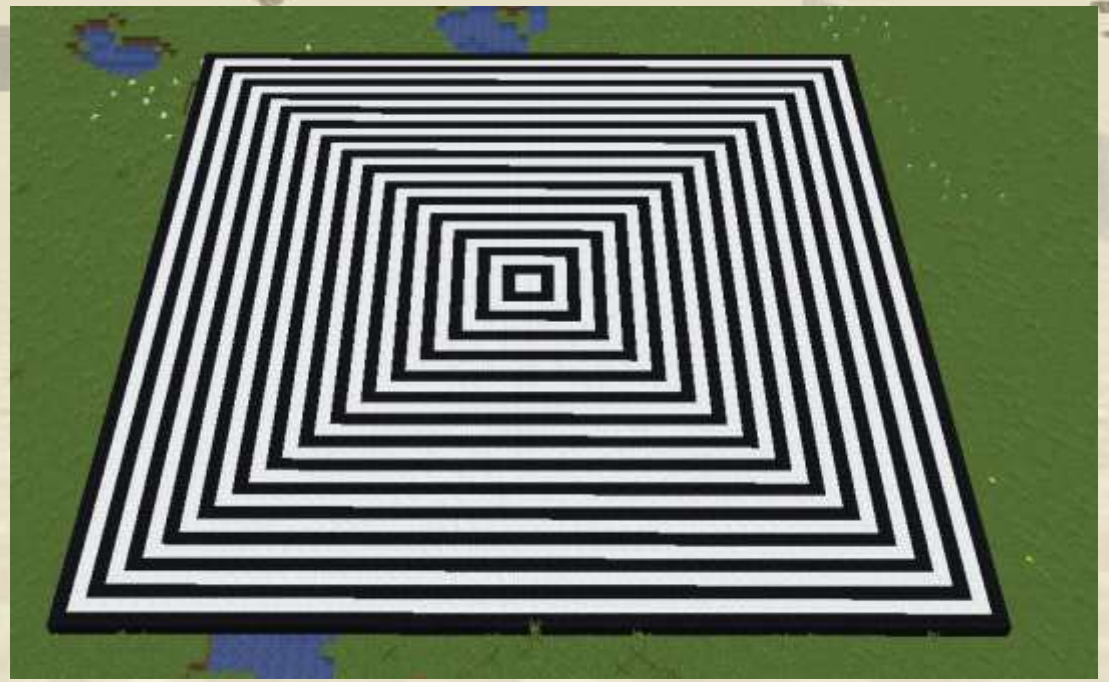


```
/vm carpet
count with i from 2 to 60 by 4
do create a empty square □ of width i made of White Wool
```

Make Your Own Carpets

Create simple two-colored carpets using loops.

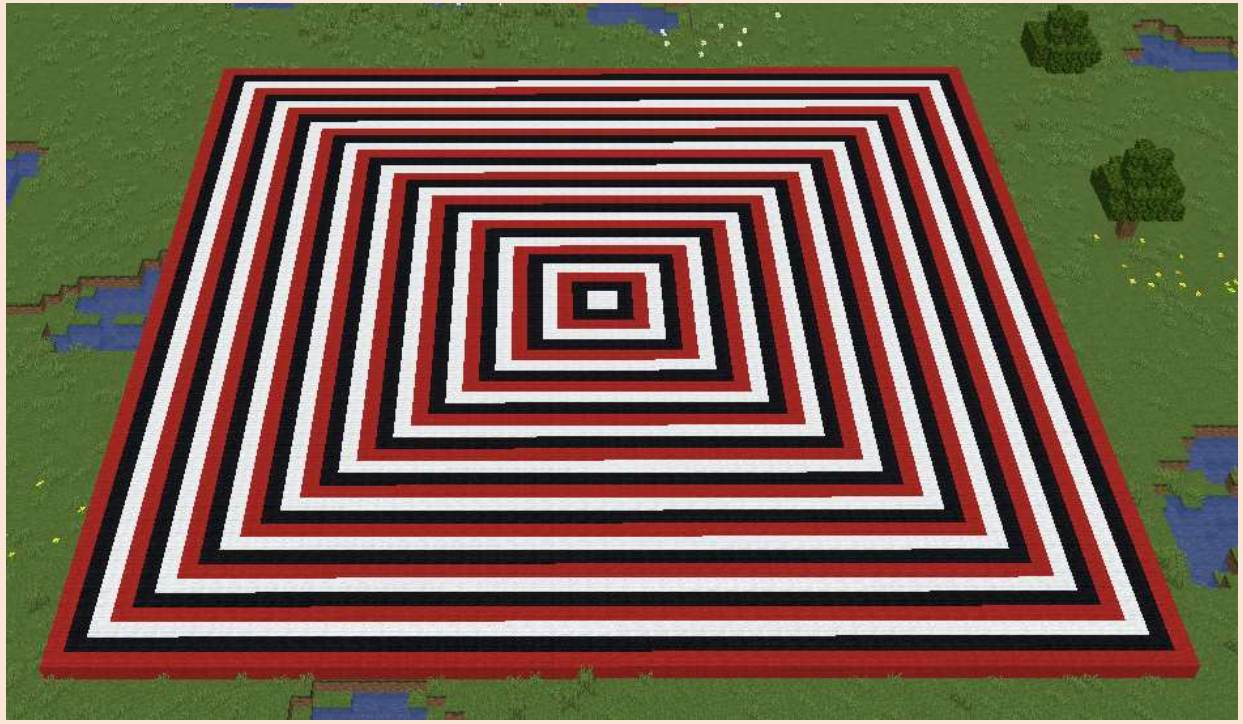




How do I add another color?

This time you must change not only the start value but also the step of the loop .

Can you add even more colors?



Quiz

How do I add another color?

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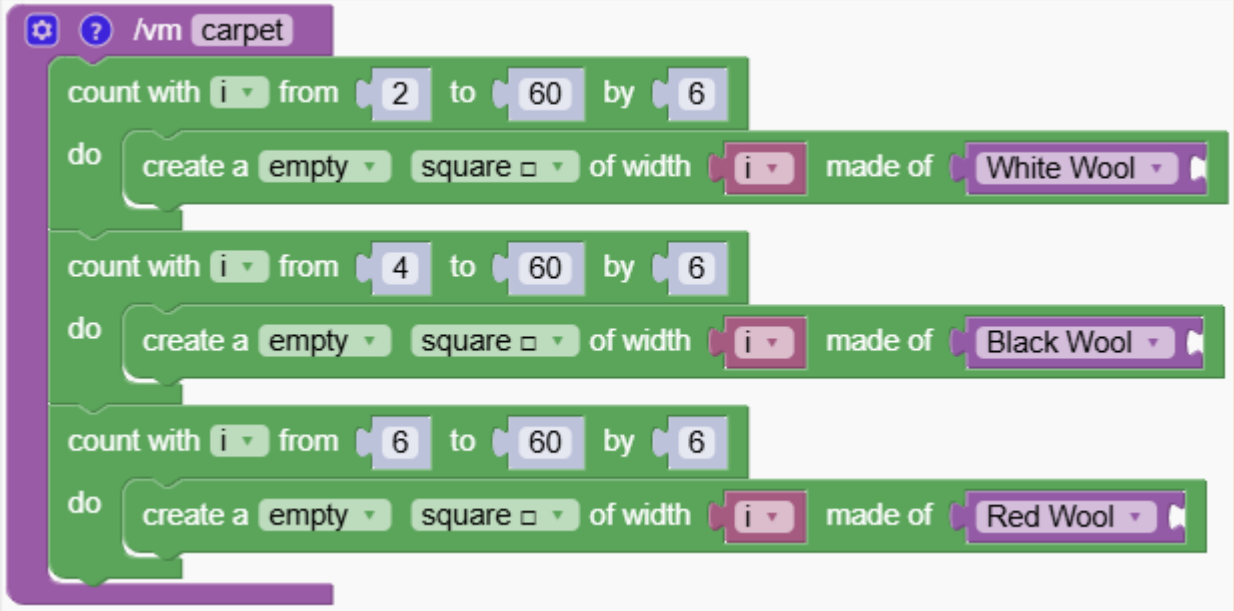
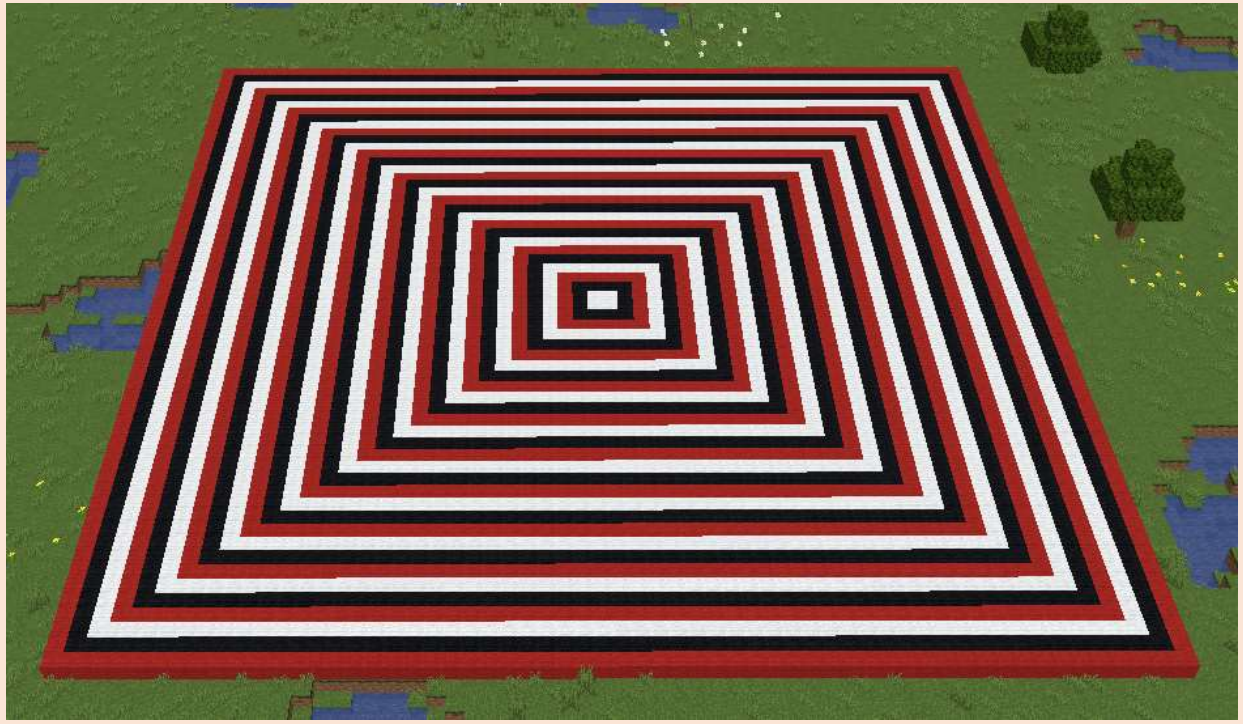
Can you add even more colors?





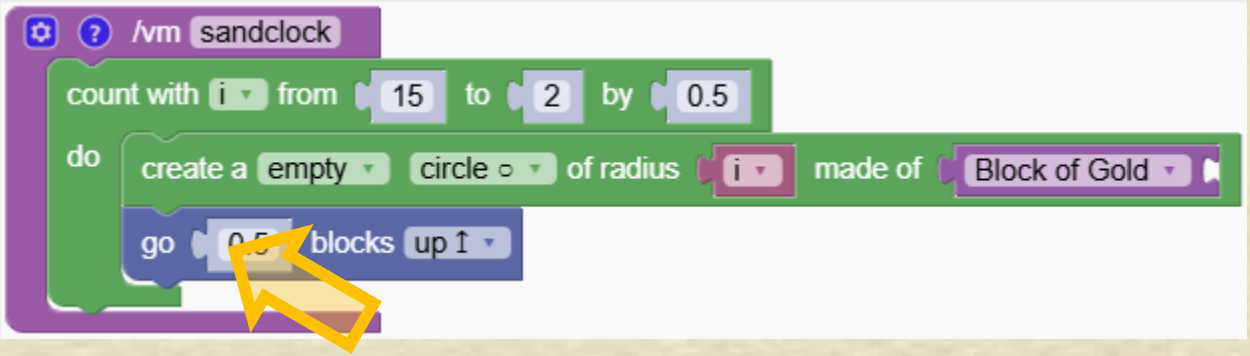
Quiz

The Hourglass

Use counting loops to create a hourglass.

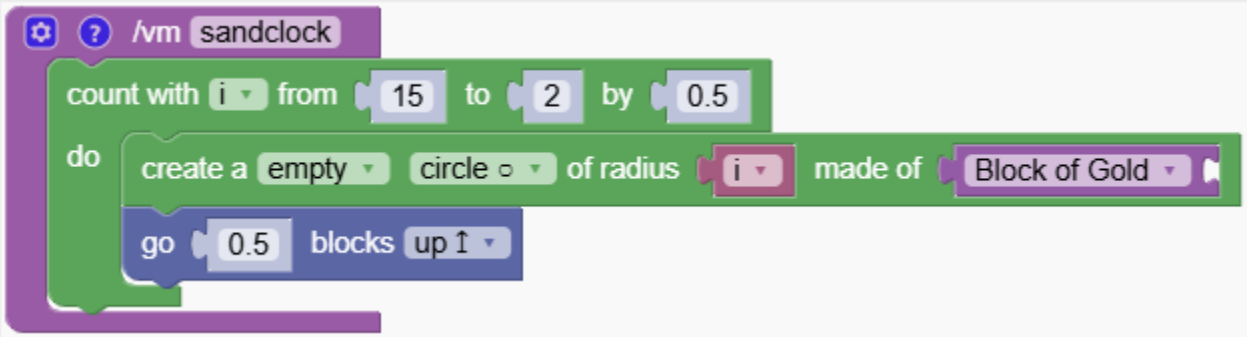
The Hourglass

First we create the bottom part.
We want the hourglass to grow wide, therefore we do smaller steps and we go up only in half steps (0.5)



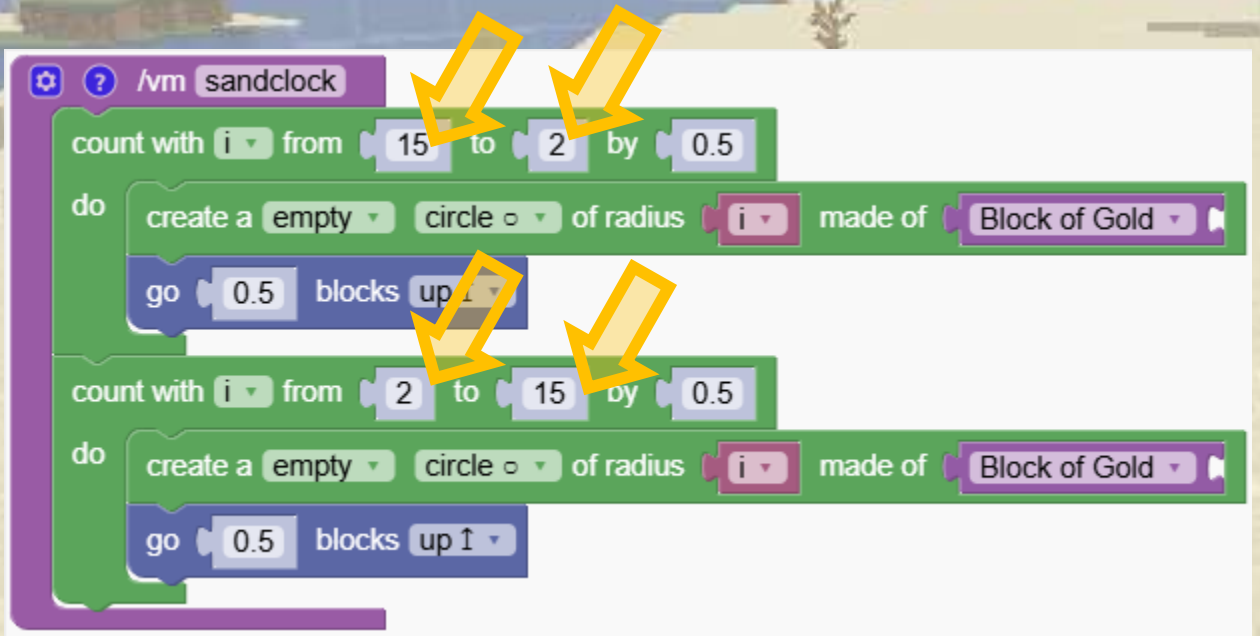
The Hourglass

Can you add the top part of the hourglass?



The Hourglass

We repeat the program, we just swap the start and end values of the loop



Logic and Conditionals

“If .. then .. Else” and random numbers

Logic and Conditionals

🔍 Section Overview

In this section, we will learn how to use logic blocks to introduce conditions and control the flow of a program. We'll introduce random numbers that are very useful to illustrate the concept of conditions

🎯 Objectives

We learn how to put rules in our code, using if-else statements and other logic to make decisions based on conditions.

Explanation of the block that generates random numbers, which can add unpredictability to our programs.

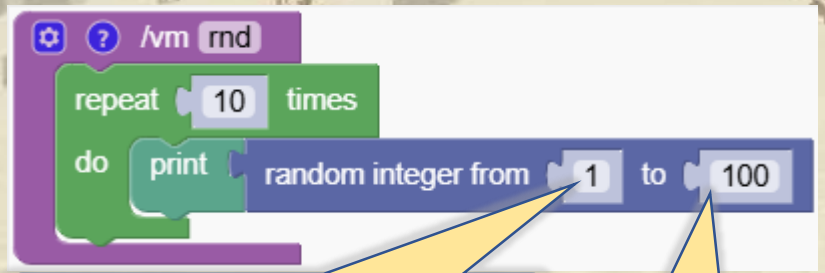
👌 Expected Outcomes

Random Numbers

A random number is a number chosen unpredictably, like rolling a dice.

The block picks a new number each time you run the program!

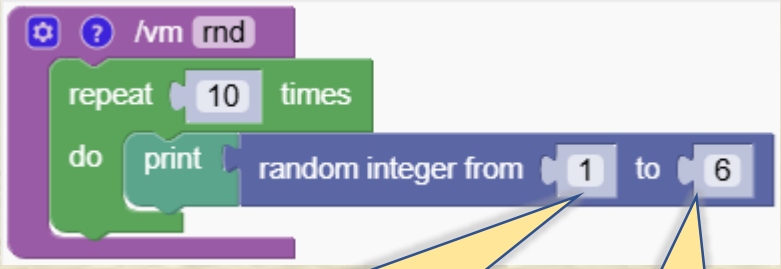
You can set the minimum and maximum value of the possible numbers



Lowest value 1

Highest value 100

23
44
2
67
66
98
7
15
23
90



Lowest value 1

Highest value 6

4
1
6
4
3
2
3
6
5
1

Artistic towers

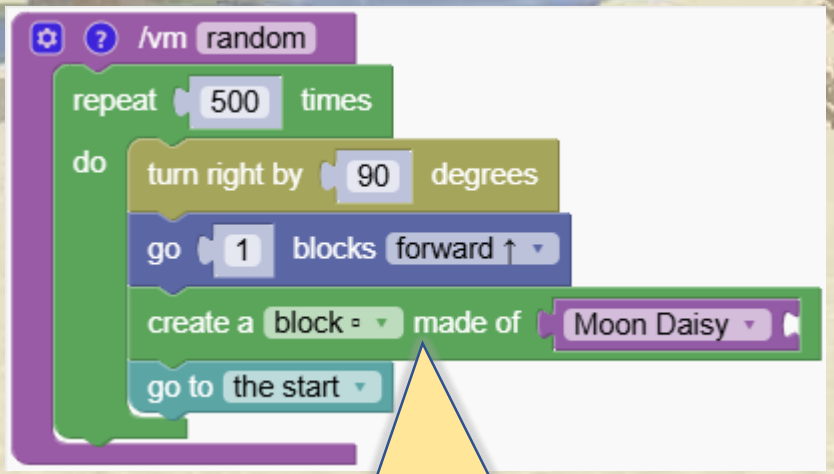
This code generates artistic towers.

Make your own art by changing the values and using circles or polygons. Have fun!

```
/vm random
repeat 20 times
do
    create a full square □ of width random integer from 2 to 8 made of Block of Copper
    go 1 blocks up ↑
```

Spreading Flowers

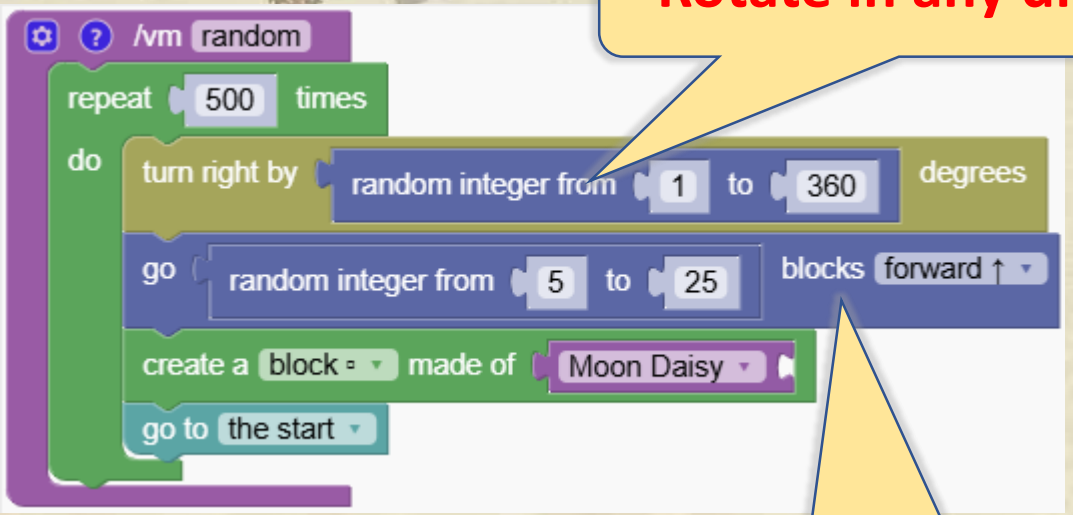
Can you use random number to spread the flower around?



This program doesn't work!
The flowers are all at the same place

Spreading Flowers

We use random numbers to rotate the robot and move it away.

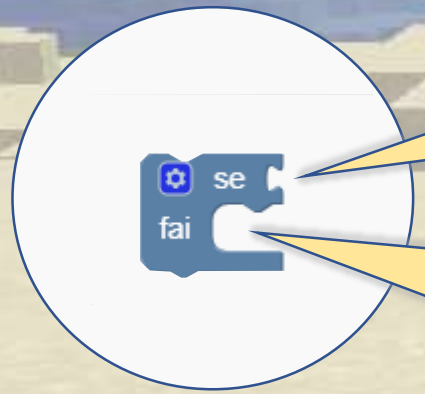


Rotate in any direction

Move forward

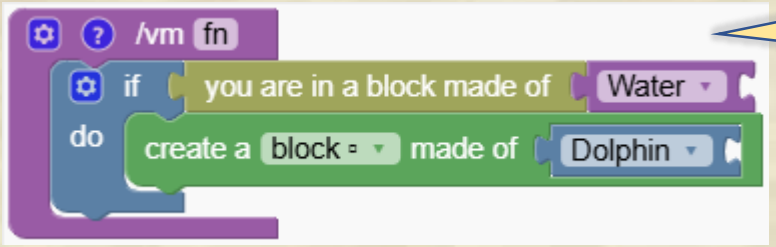
The Logic Blocks

Learn about the if, else, and elsif blocks, which are fundamental for making decisions in code.



Put here the condition

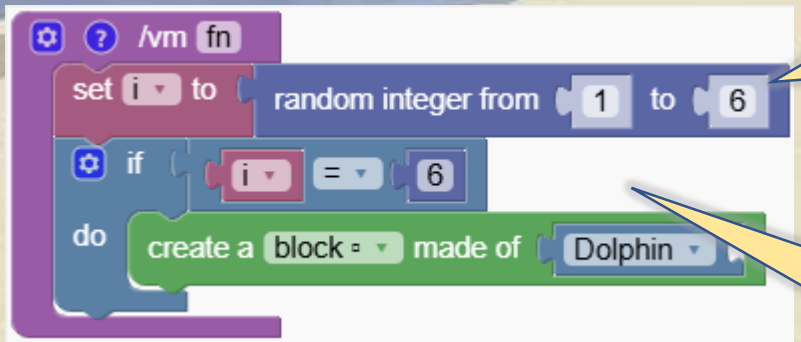
Put here what you want to do if the condition is true



Example:
If the robot is in a block made of water then spawn a dolphin

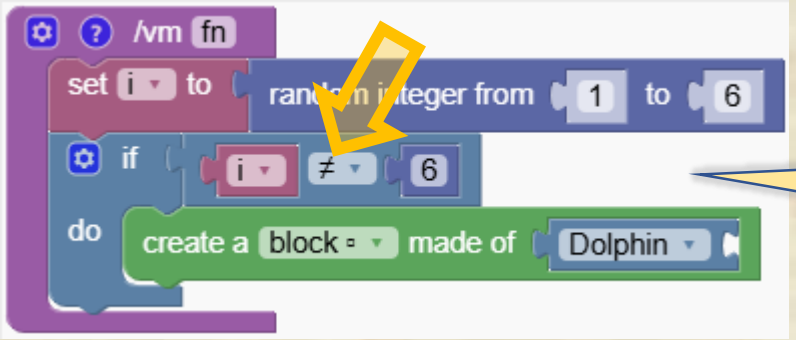
The Logic Blocks

The logic blocks are used very often with variable.



put in the variable ‘i’ a value between 1 and 6

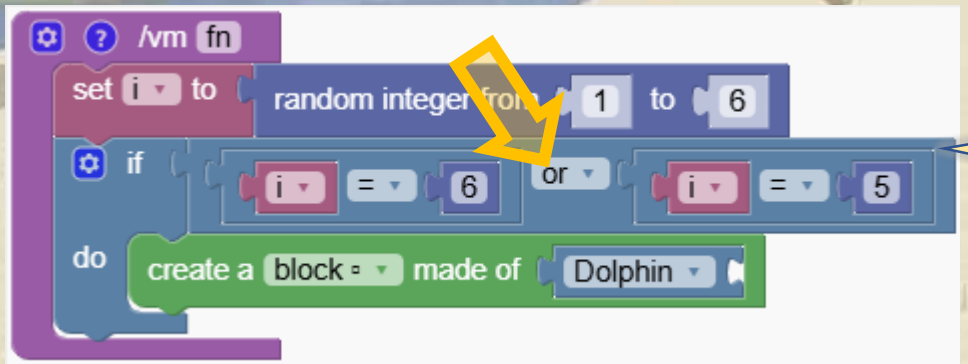
Create a dolphin only if the variable ‘i’ contains the value 6



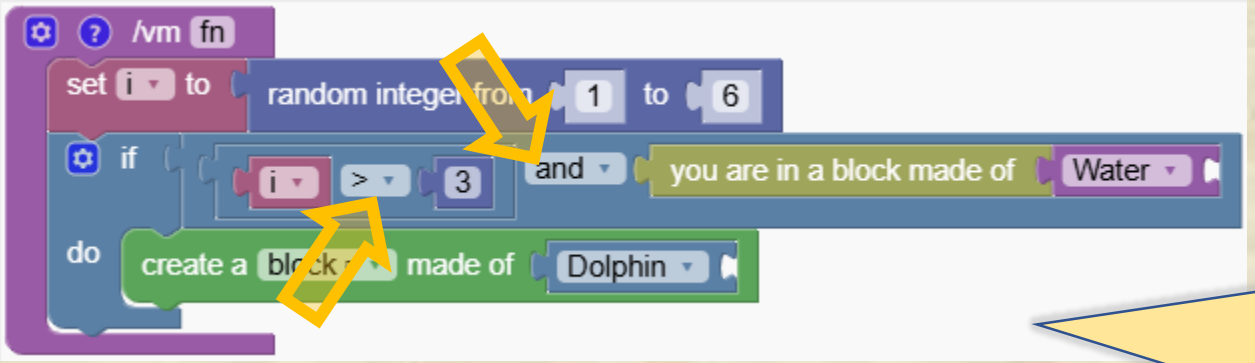
Create a dolphin only if the variable ‘i’ does NOT contain the value 6

The Logic Blocks

The conditions can be combined



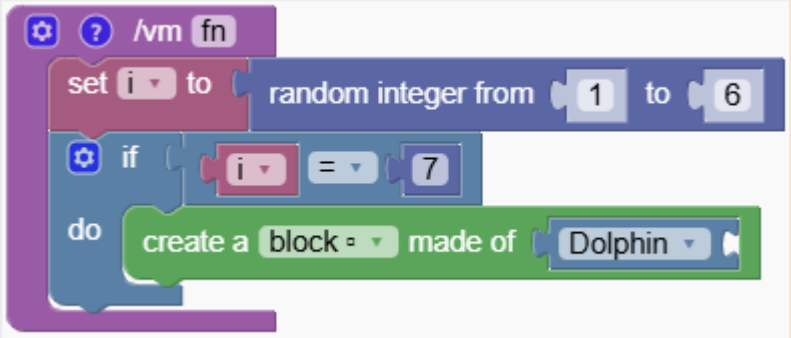
Create a dolphin only if the variable 'i' contains the value 5 OR 6



Create a dolphin only if the variable 'i' contains a value bigger than 3 and the robot is in a block made of water

Error in the Conditions

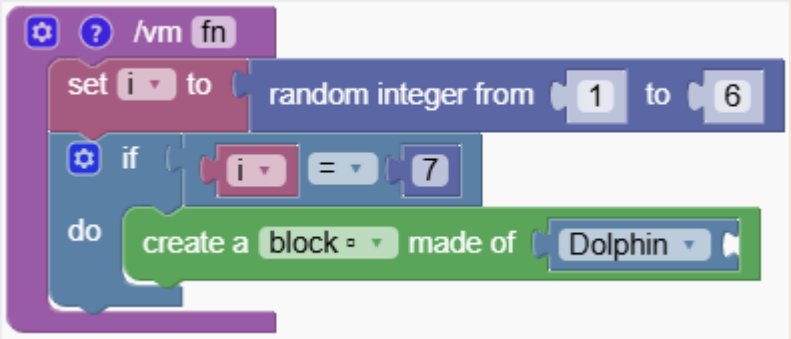
Identify and fix errors in conditions that may make no sense or result in incorrect logic.



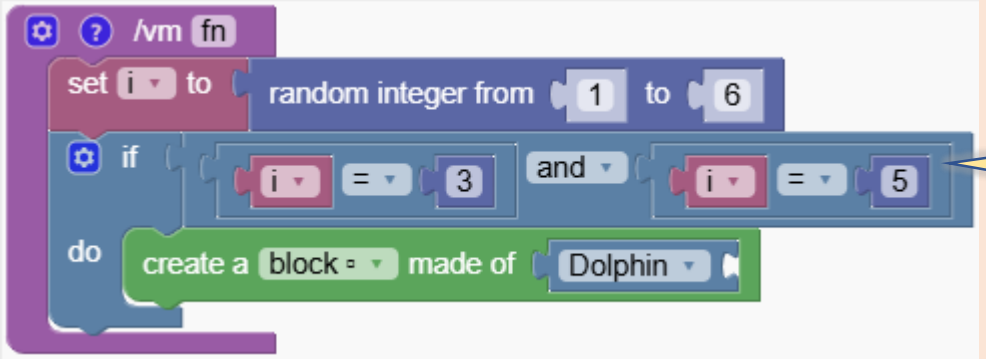
Quiz

Error in the Conditions

Identify and fix errors in conditions that may make no sense or result in incorrect logic.



The variable ‘i’ cannot contain the value 7

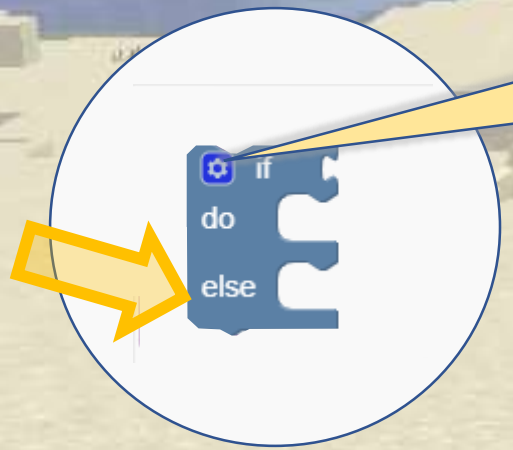


The variable ‘i’ cannot contain the value 3 and 5 at the same time

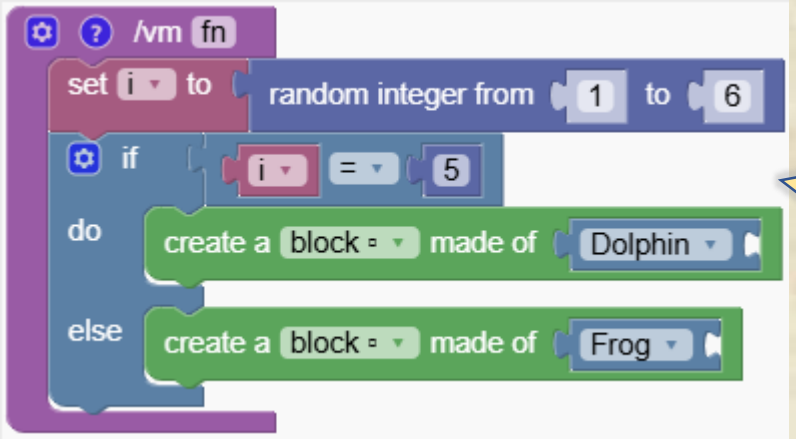
Quiz

The Logic Blocks

The ‘if else’ block allows for defining an alternative action



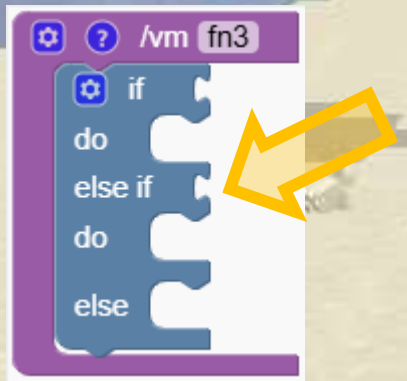
Click here to open the menu to customize the block



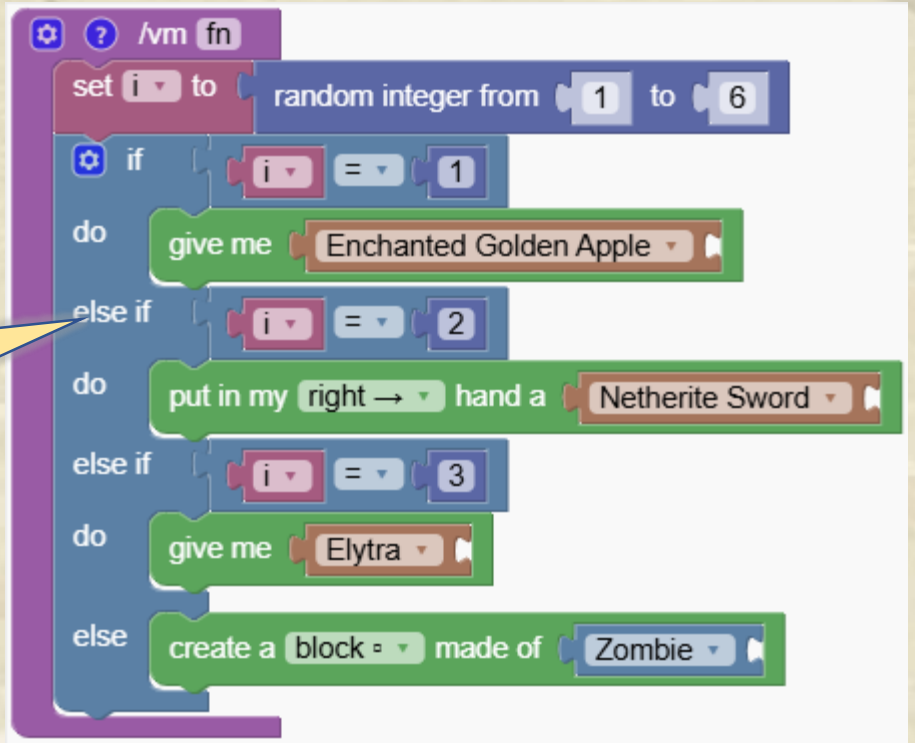
If ‘i’ contains the number 5 then spawn a dolphin, for all other values spawn a frog

The Lucky Function

You can customize the block to give more alternatives

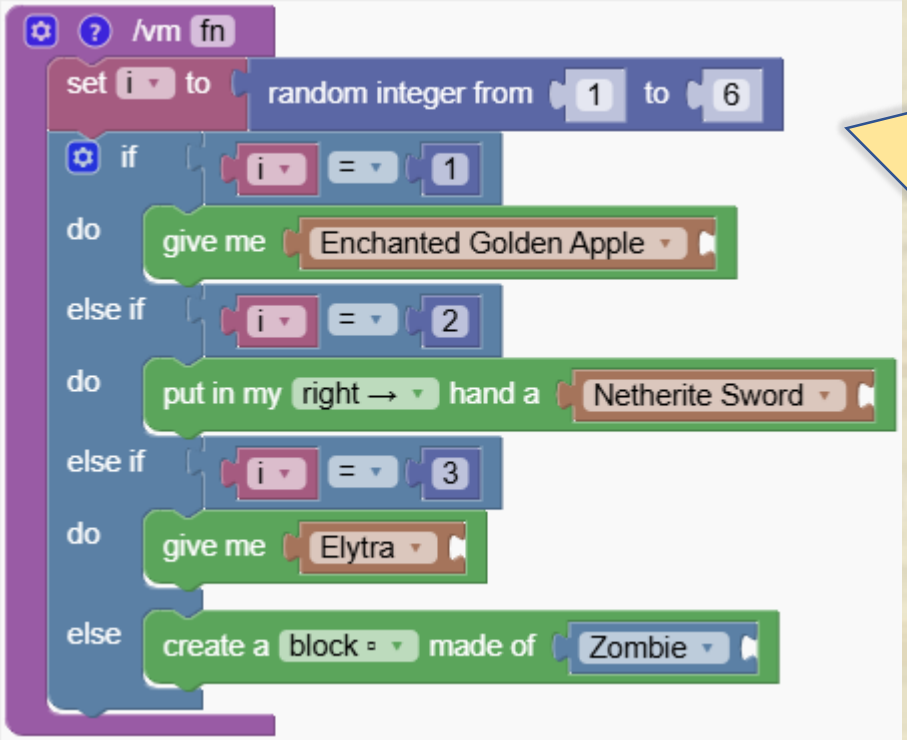


The “else if” block allows you to define more conditions



The Lucky Function

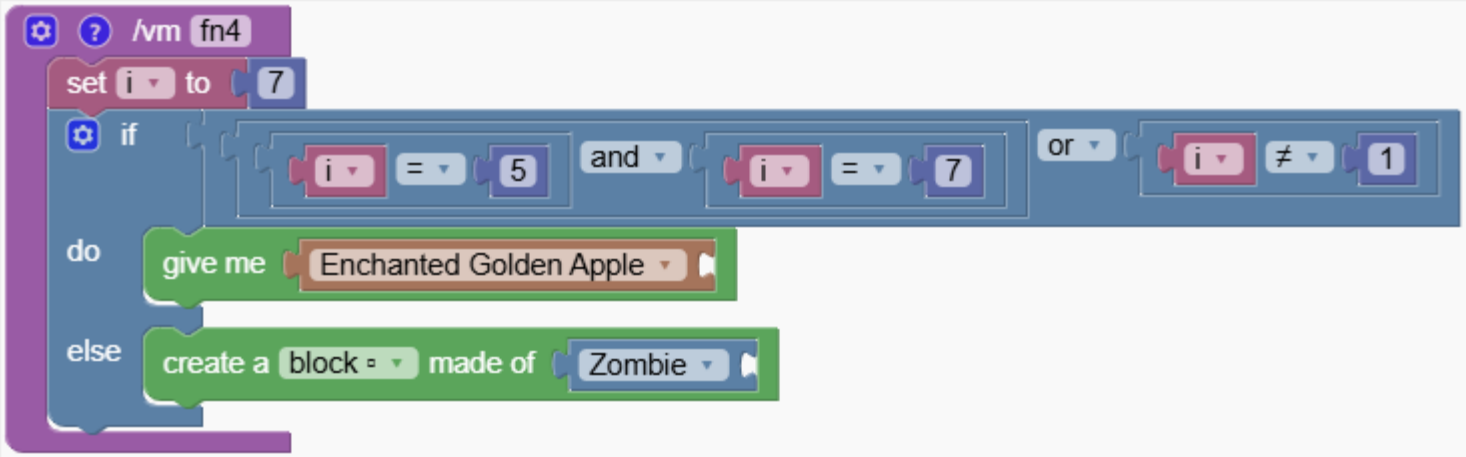
What happens if you call the function below?



Try your luck!
Running this program you could get a prize or be attacked by a zombie

What's the Result of the Program?

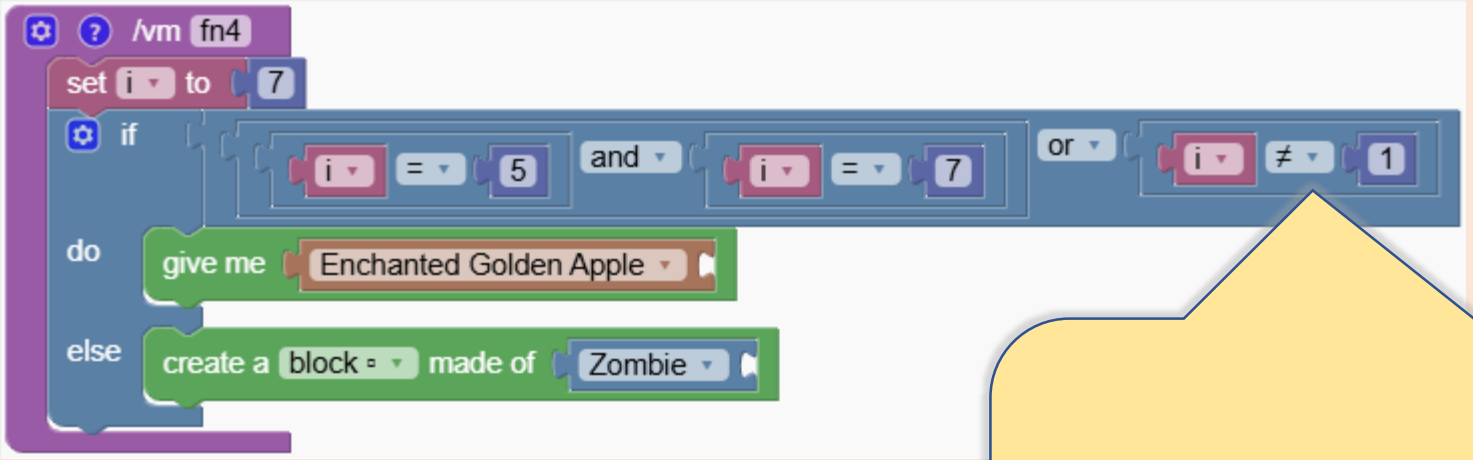
If I run this program what will happen?



Quiz

What's the Result of the Program?

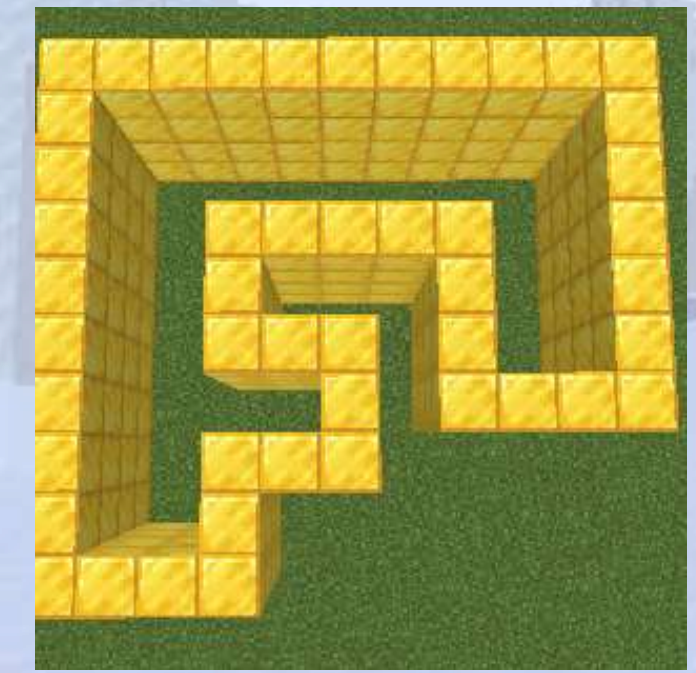
If I run this program what will happen?



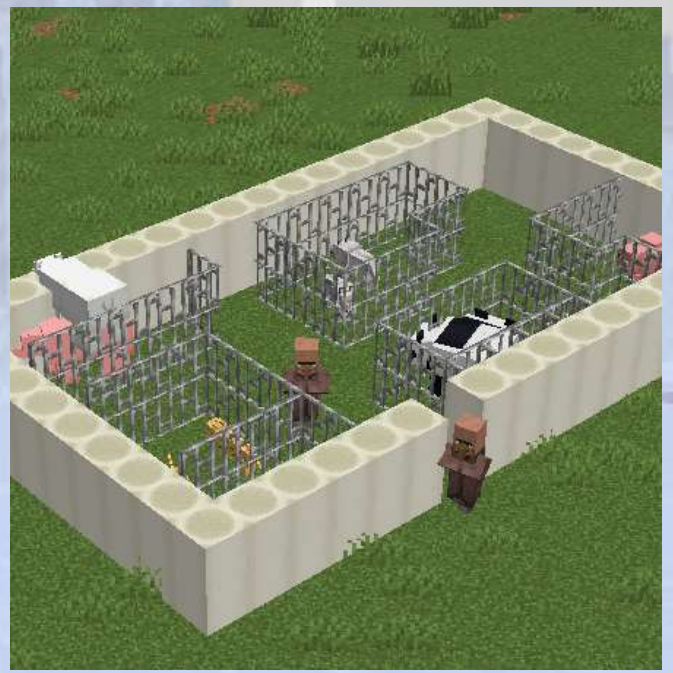
We get the apple !
The variable 'i' doesn't contain the value 1

Quiz

Complex Shapes



Create non-geometric shapes



Complex shapes

🔍 Section Overview

We create irregular structures that cannot be easily coded. With coding we are then transforming them in wonderful structures

🎯 Objectives

In this section, we will learn how to create non-geometric shapes, from drawing simple to more complex structures.

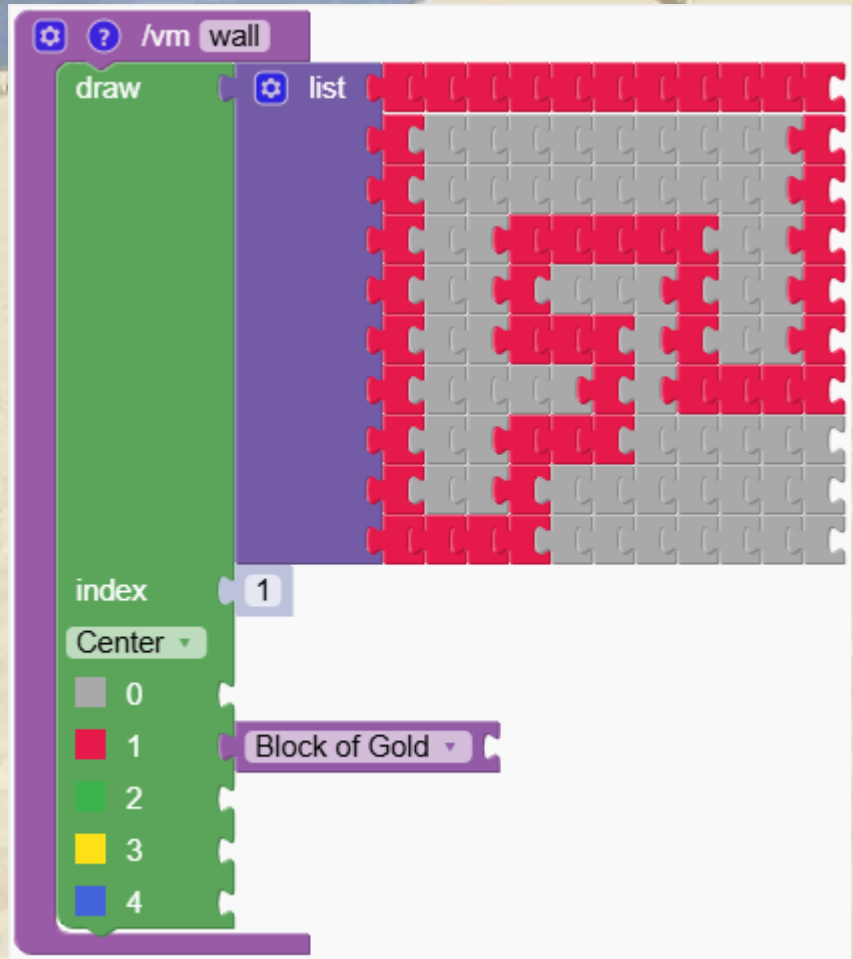
👌 Expected Outcomes

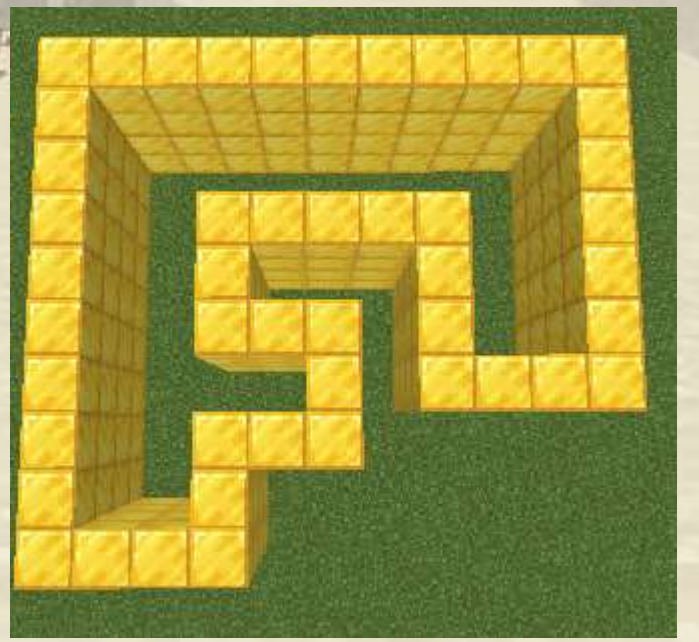
We learn how to make shapes that aren't geometric, allowing us to create more creative and freeform structures.

The drawing block

We show what the drawing block is and how it works, forming the basis for creating custom shapes.

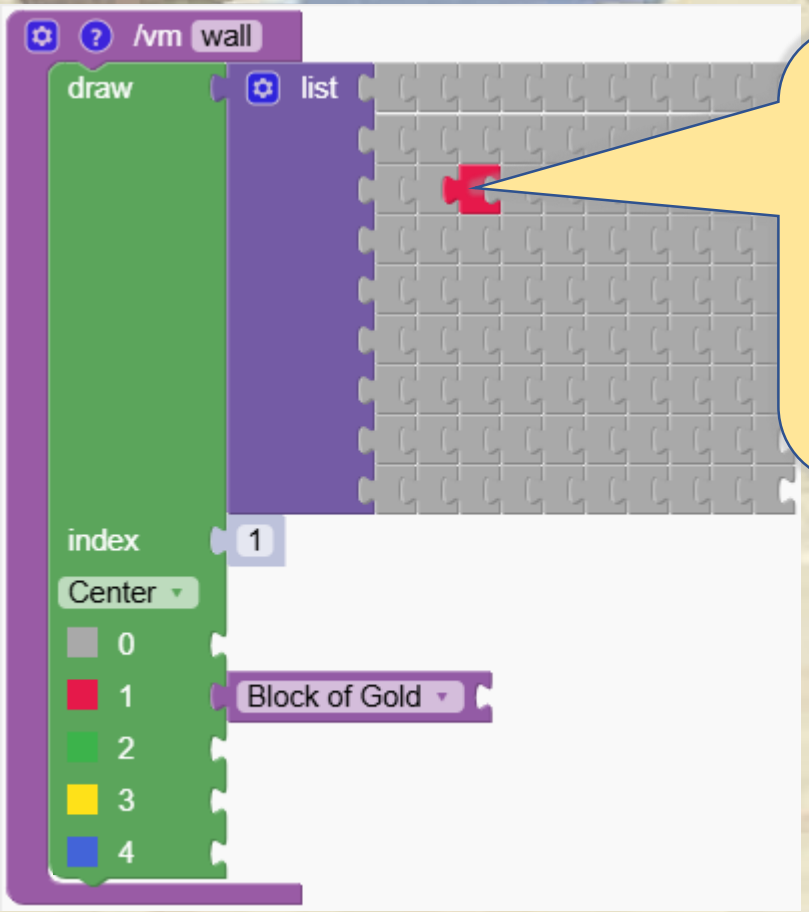
Look at the program below. We can draw exact images for our programs





The drawing block

Press a key to color the grey blocks.

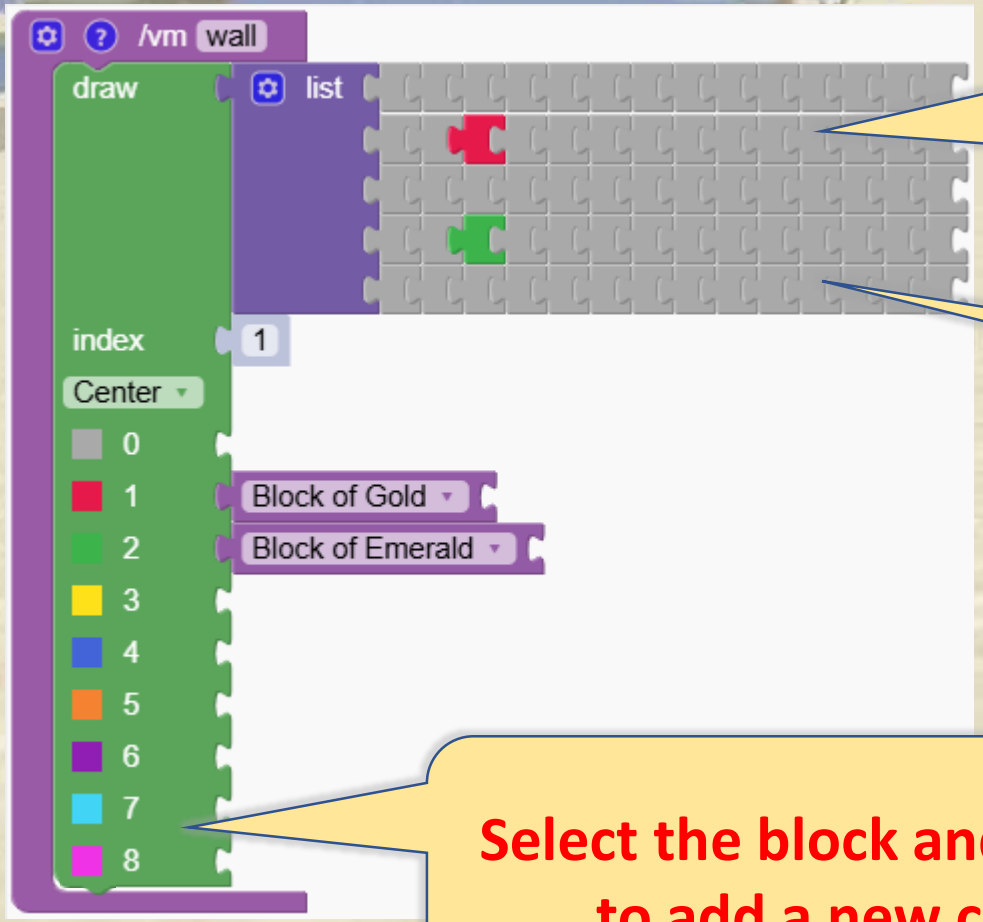


Select a block and the press ‘1’ to color it red. Below, we attached a block of gold to indicate that red means gold

The drawing block

We can add rows and columns by using keyboard keys ‘i’ and ‘l’.

We can also add more colors using keyboard key ‘i’.



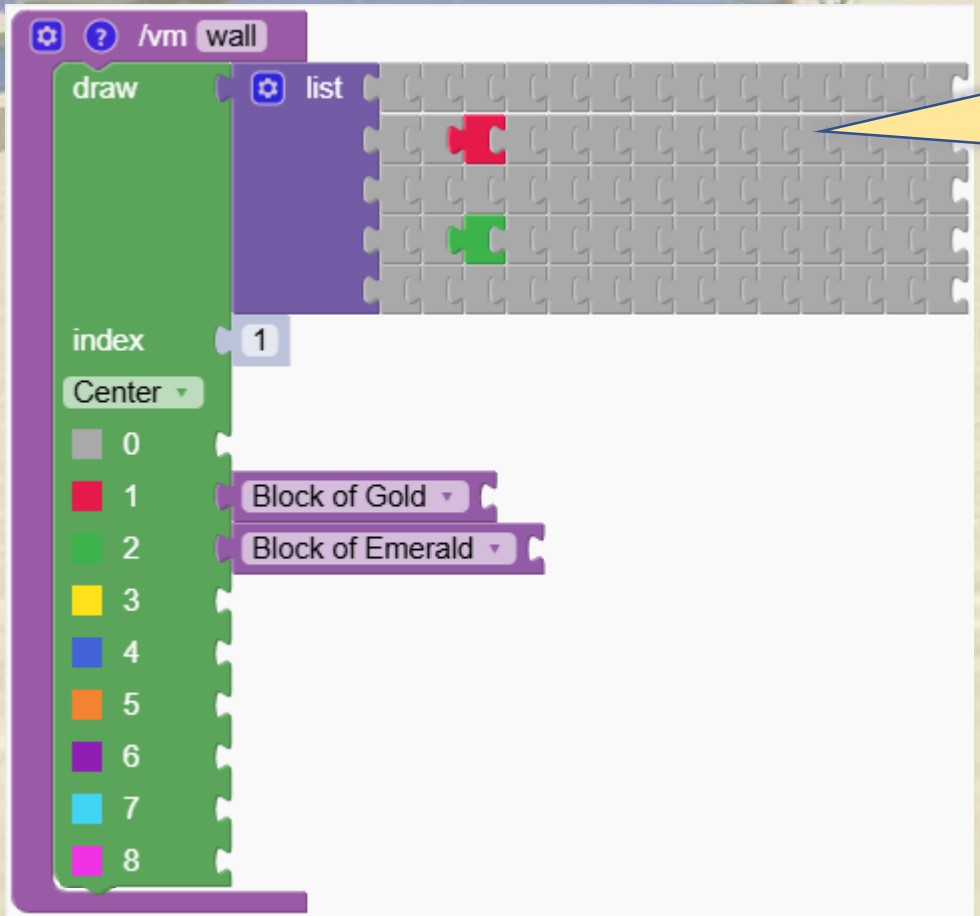
Select a block and press ‘i’ to add a column or ‘l’ to add a row

Right click to see all options

Select the block and press ‘i’ to add a new colors

The drawing block

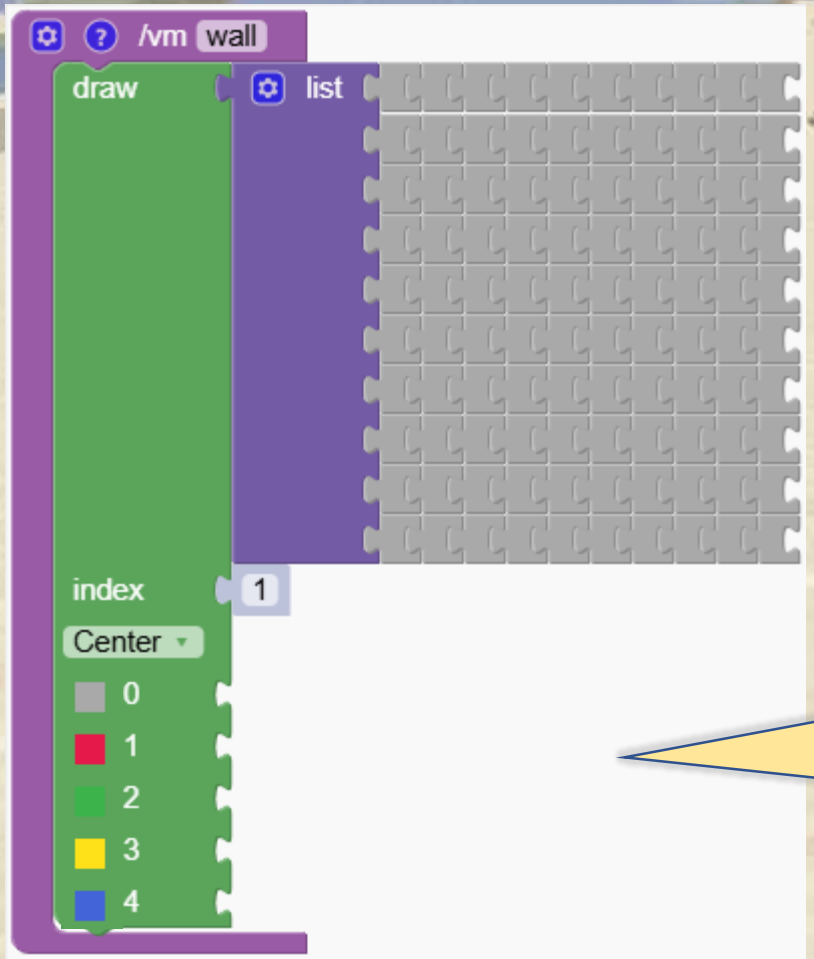
We can remove rows and columns by using keyboard keys ‘d’ and ‘D’.

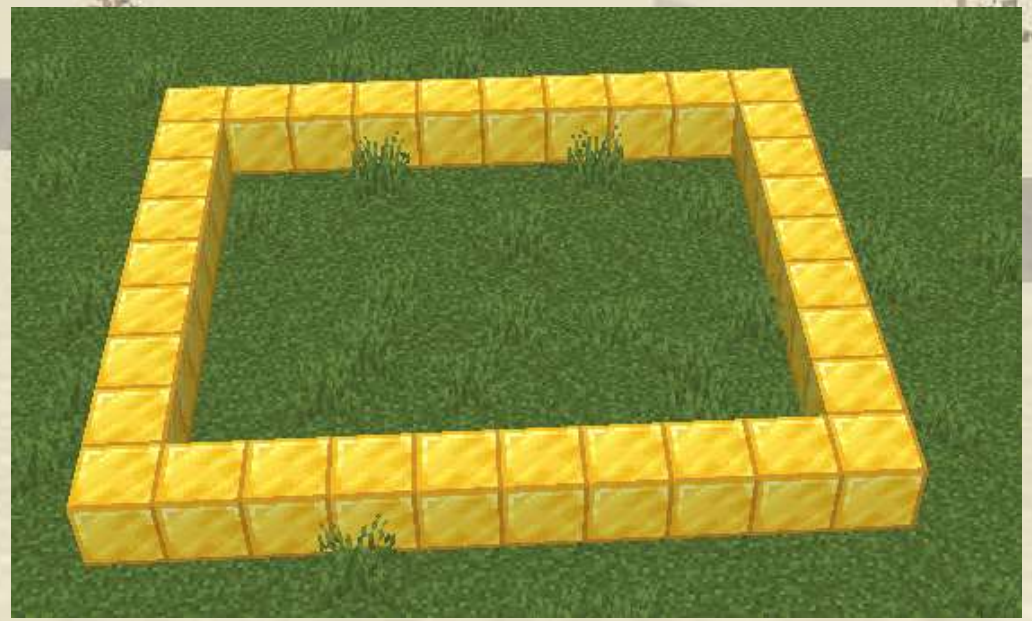


Select a block and press ‘d’ to remove a column or ‘D’ to remove a row

Draw a rectangle

As example, we are making a simple rectangle

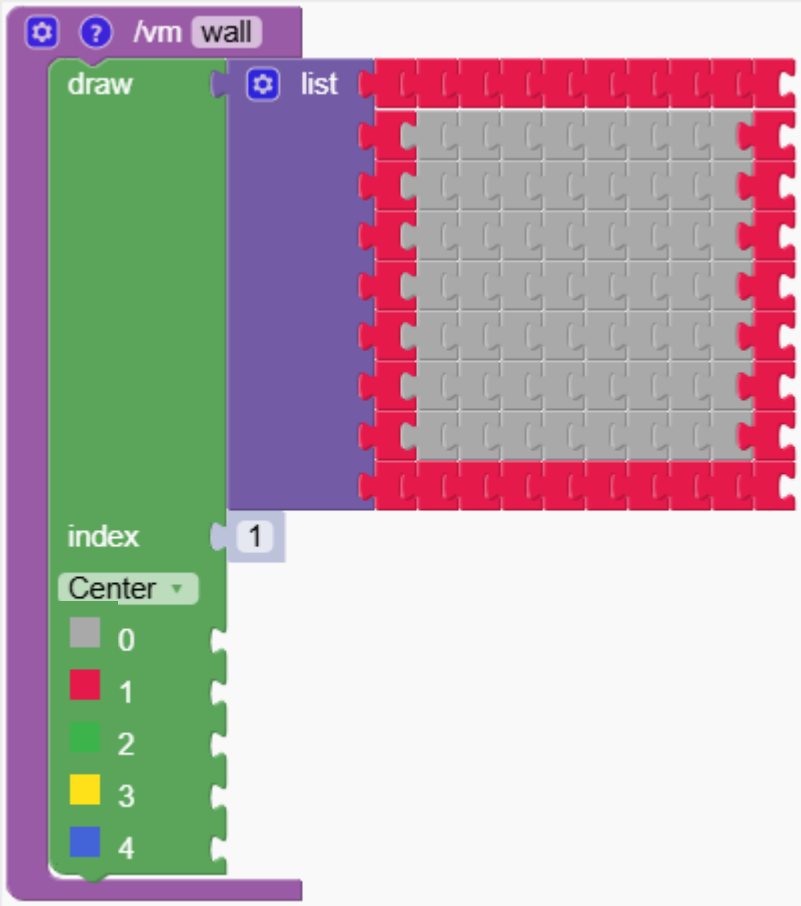


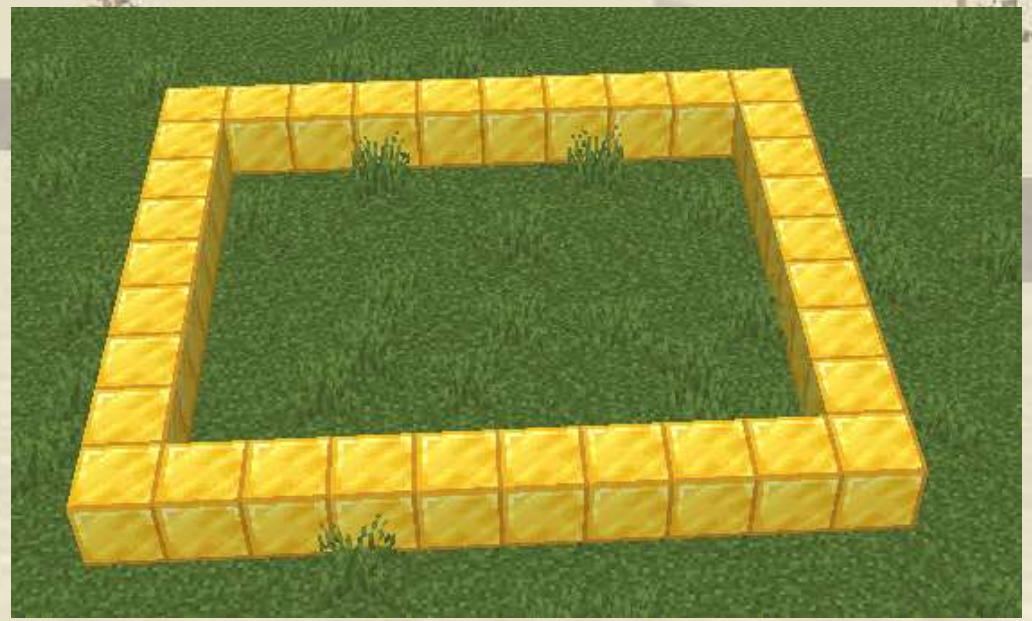


First we select a drawing block from the menu

Draw a rectangle

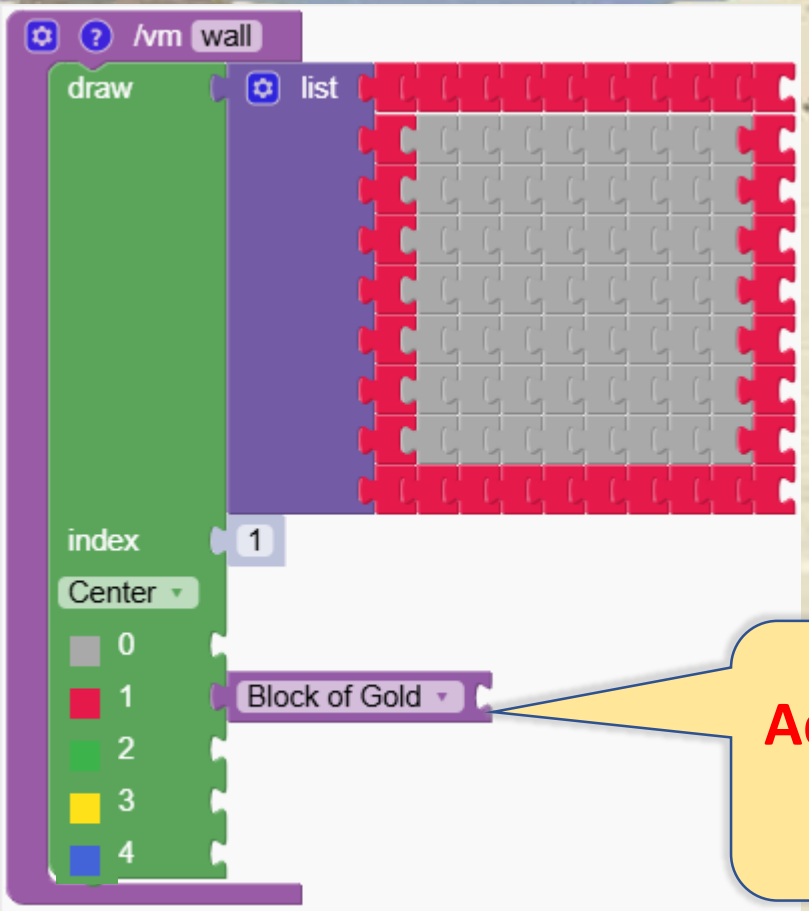
Now we paint in red by pressing the 1 key

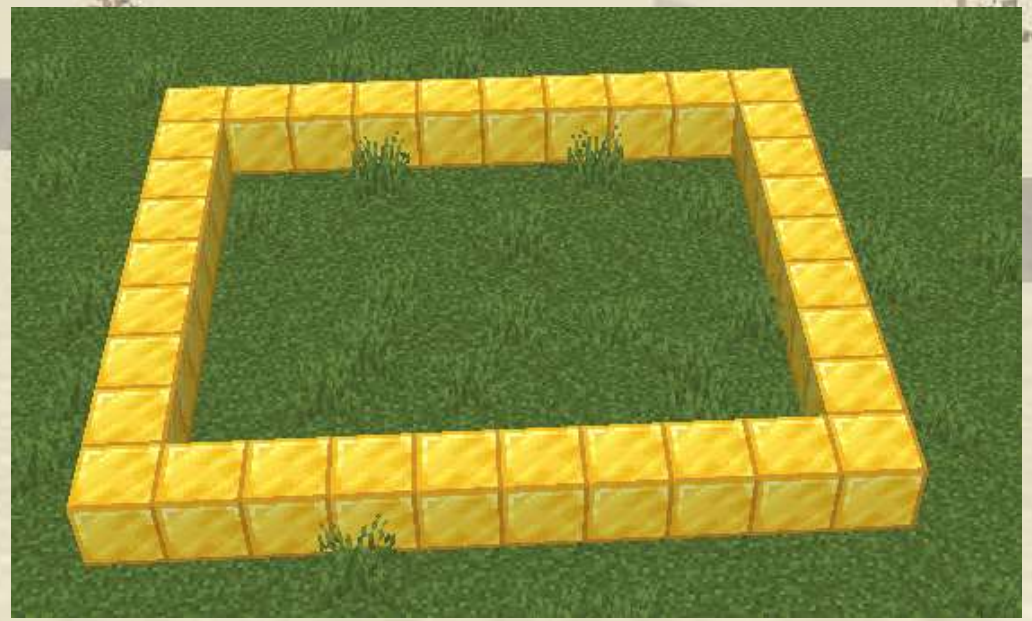




Draw a rectangle

Now we paint in red by pressing the 1 key



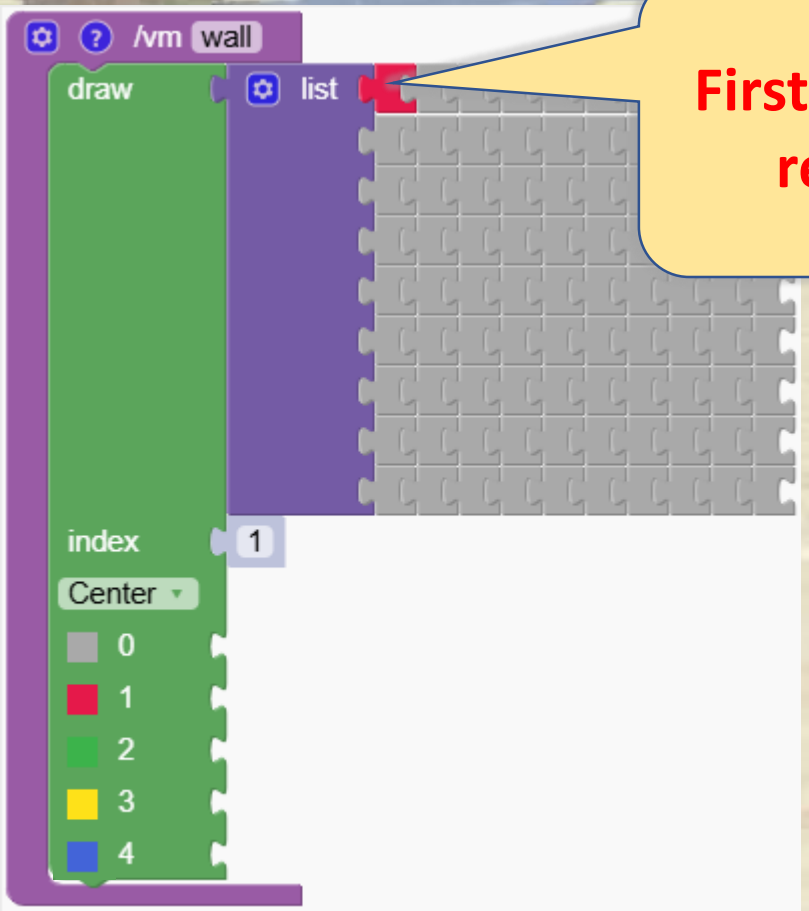


Add a block of gold. ‘1’ is now a block of gold

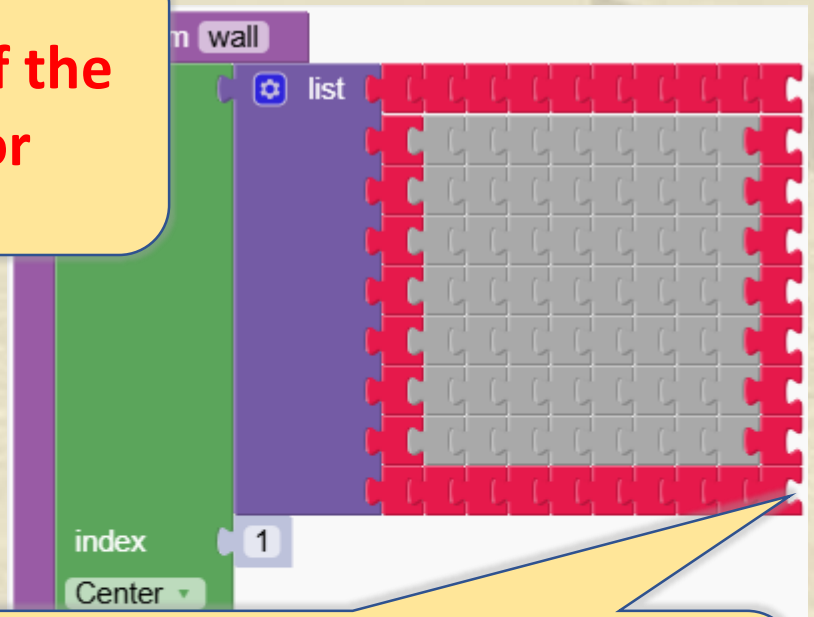
Draw a rectangle

We could have done it faster! To automatically draw a rectangle you can use the key ‘b’

(If you right-click on the grey blocks you see all the options)



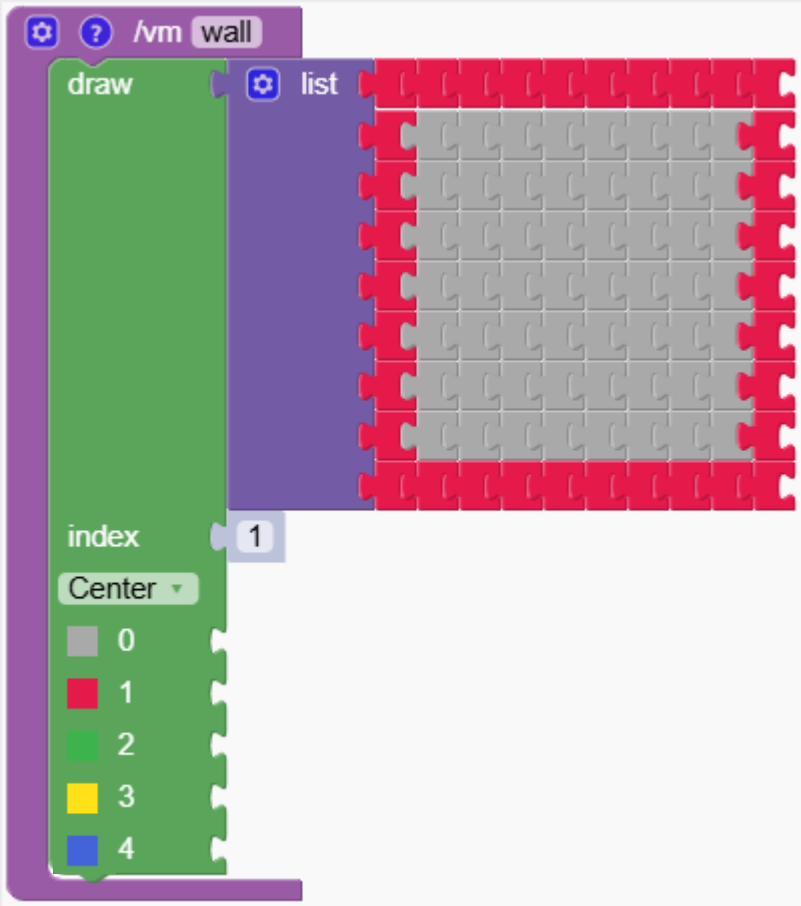
First select the top left corner of the rectangle and change its color

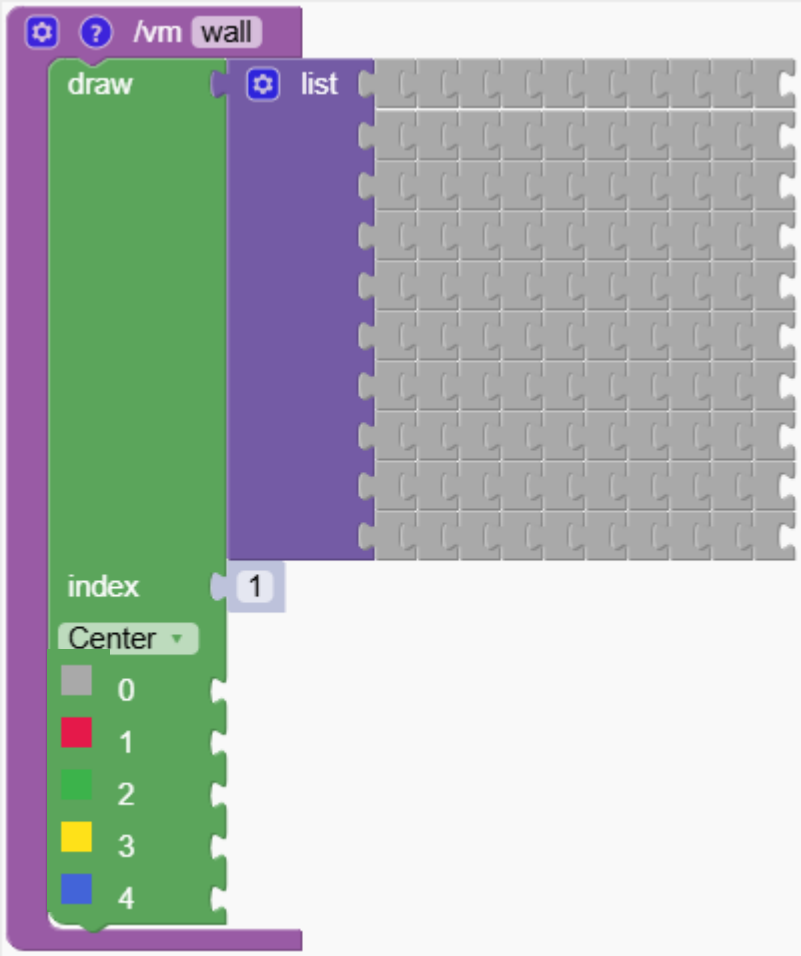


Then select the bottom right block and press ‘b’

How do I clear the blocks?

We don’t want to restart from scratch or paint all the single blocks

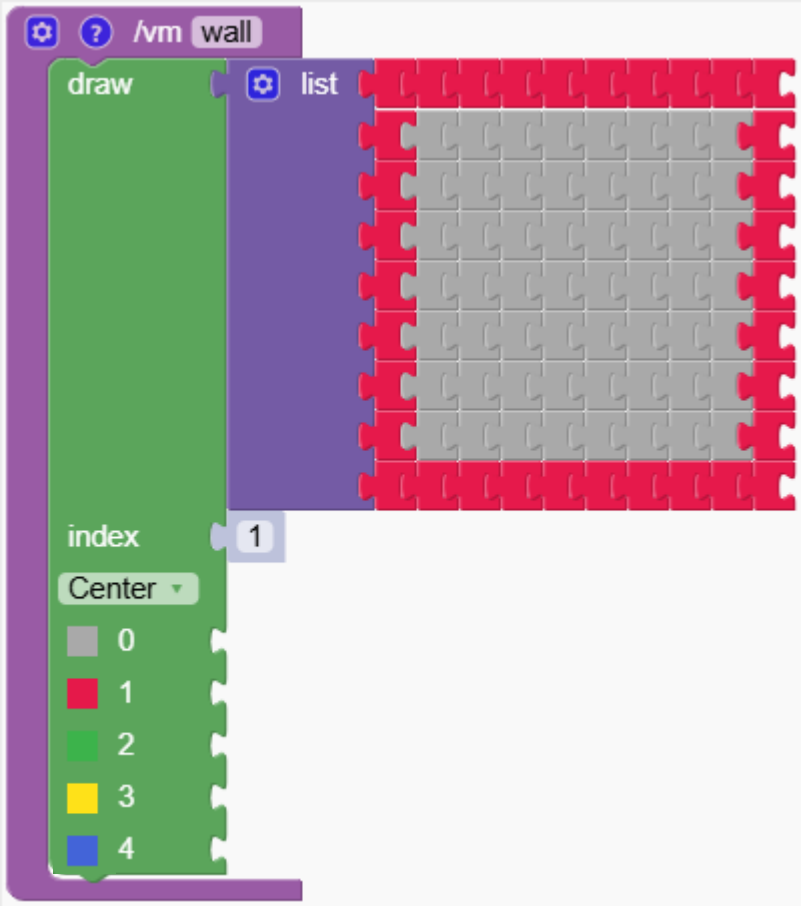


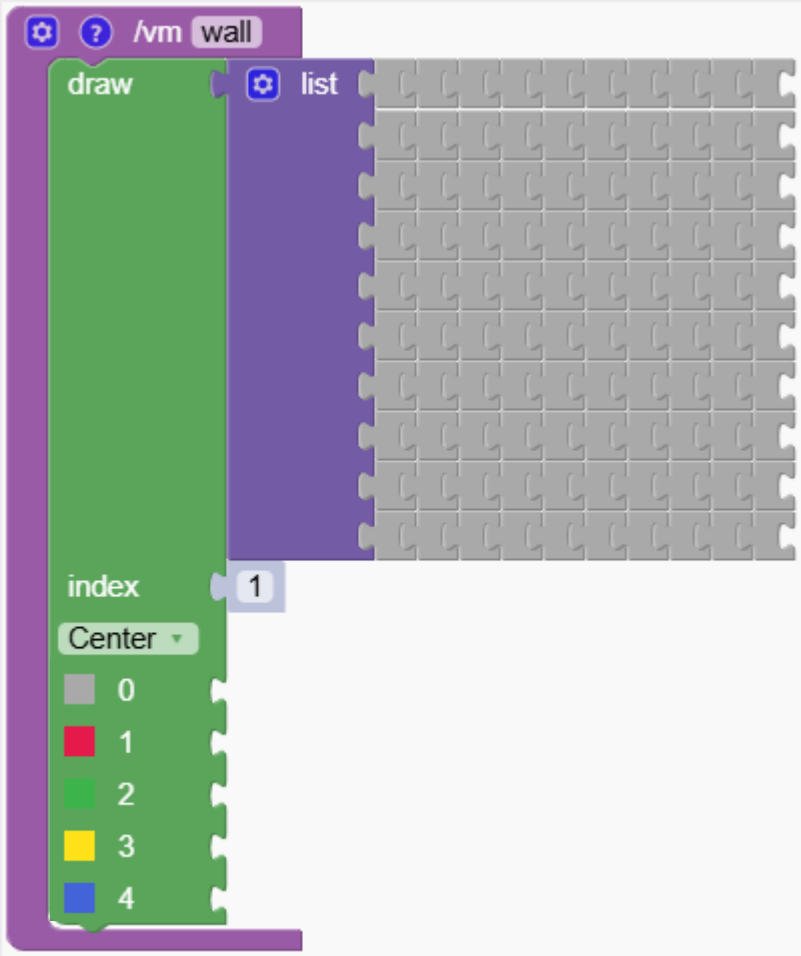


Quiz

How do I clear the blocks?

Solution: We paint a full square of grey color on the existing drawing. Use the key ‘f’ to paint a full rectangle

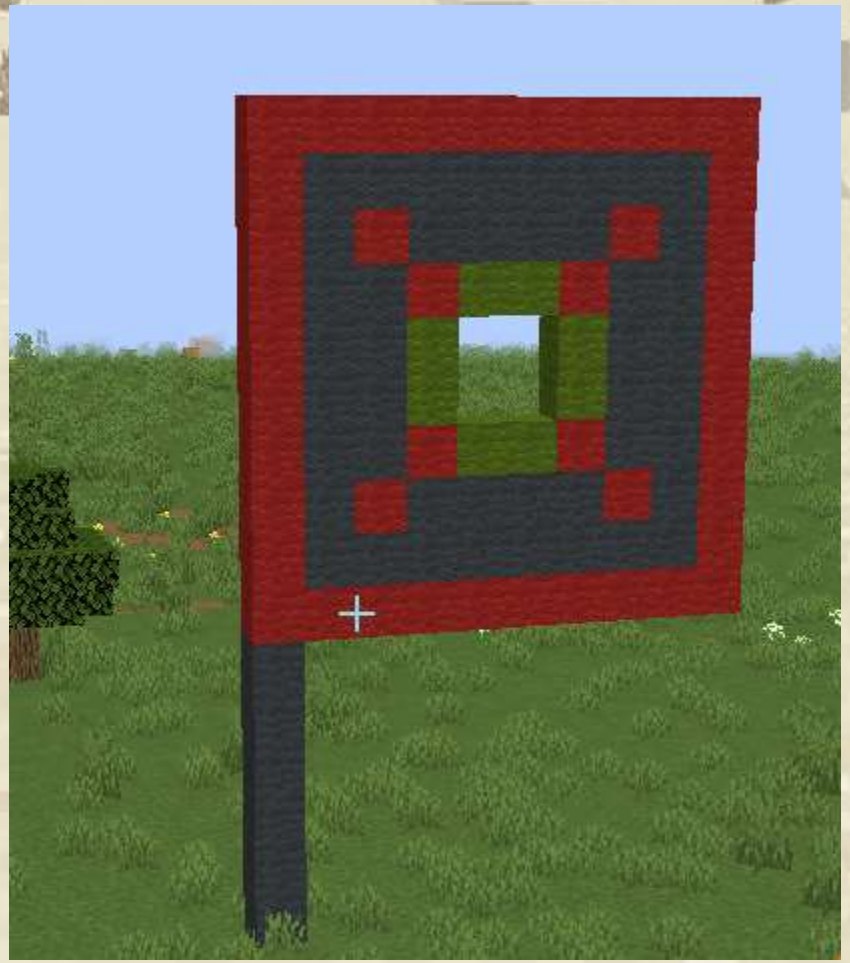




Quiz

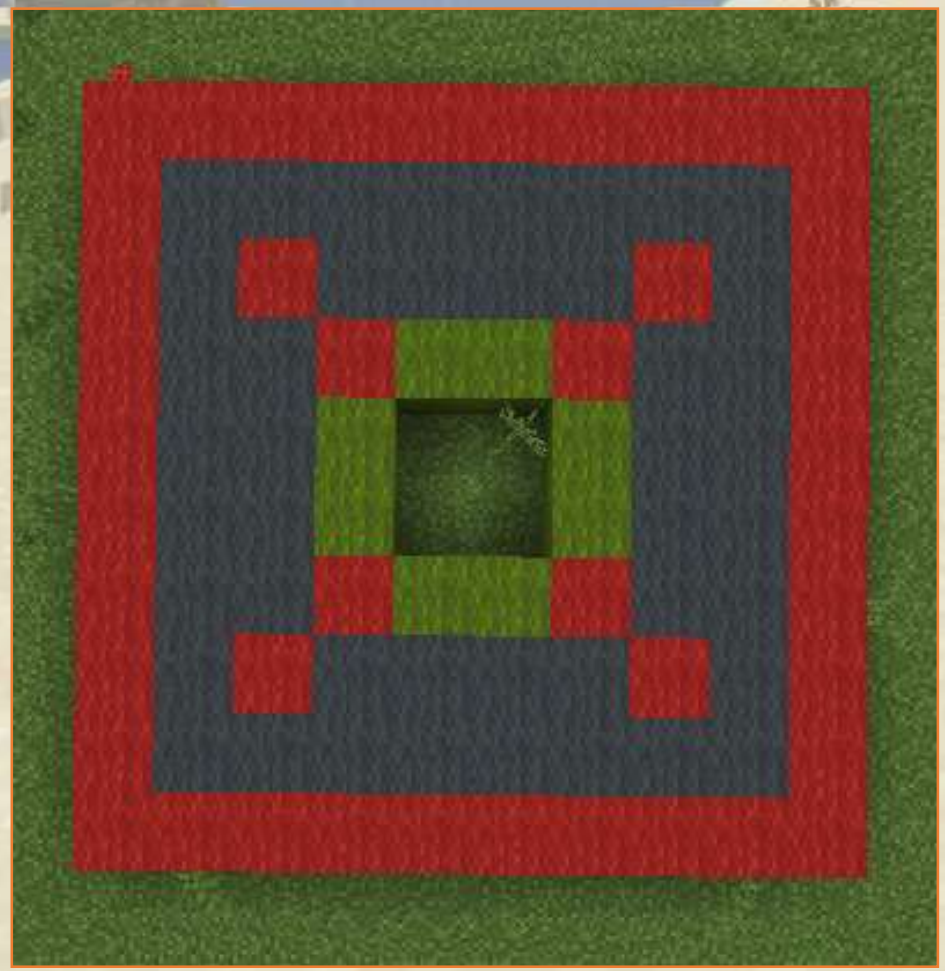
Make your own flag

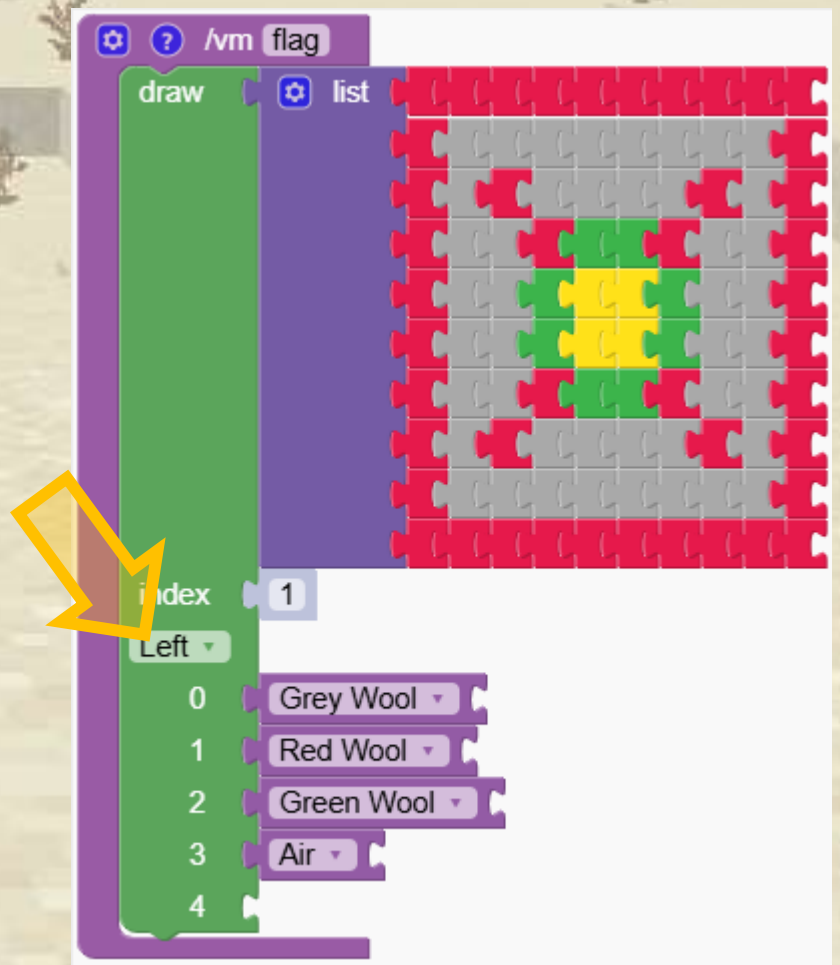
Learn how to create a custom flag, using different shapes to form the design.



Make your own flag

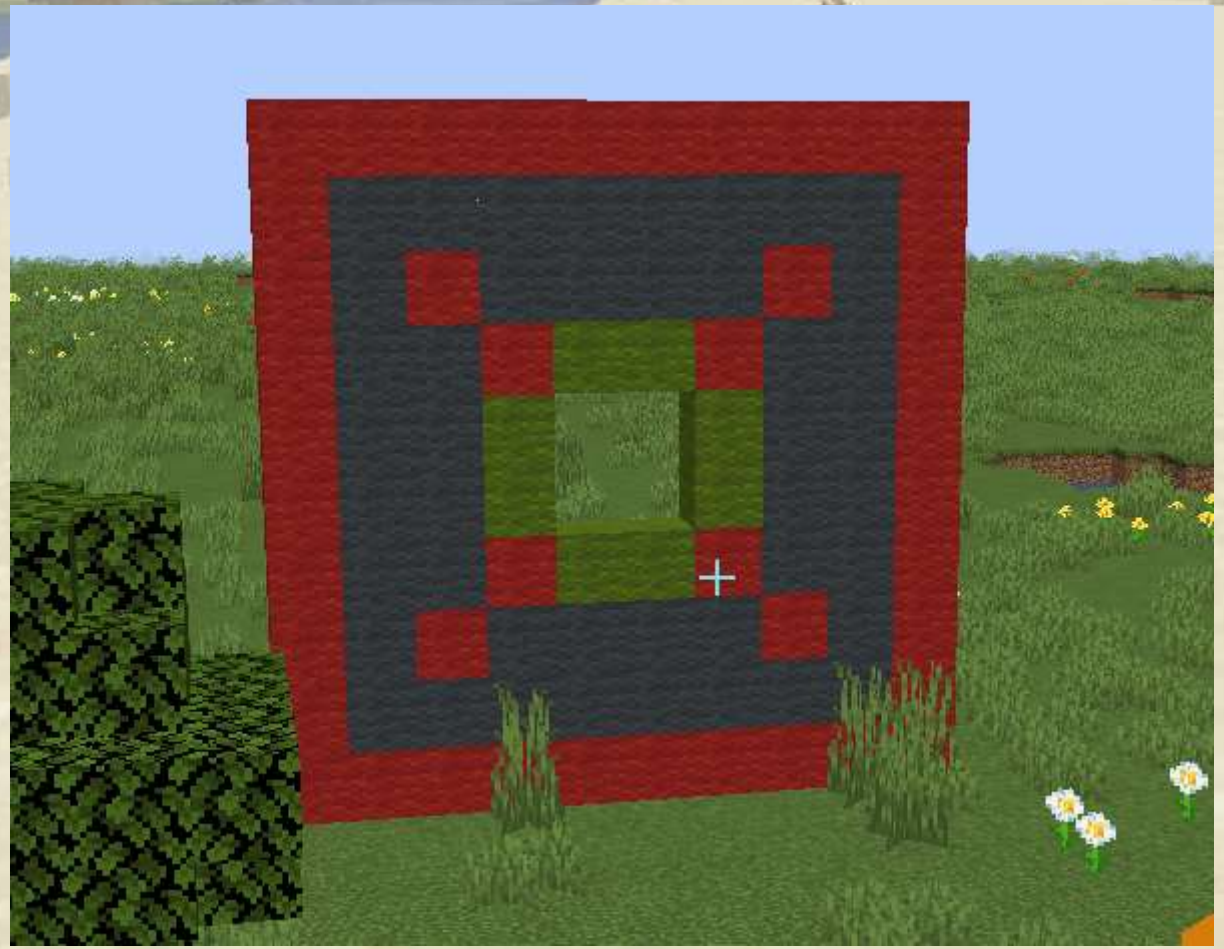
First we create our design on the ground. Notice that we set the starting point to left instead of center

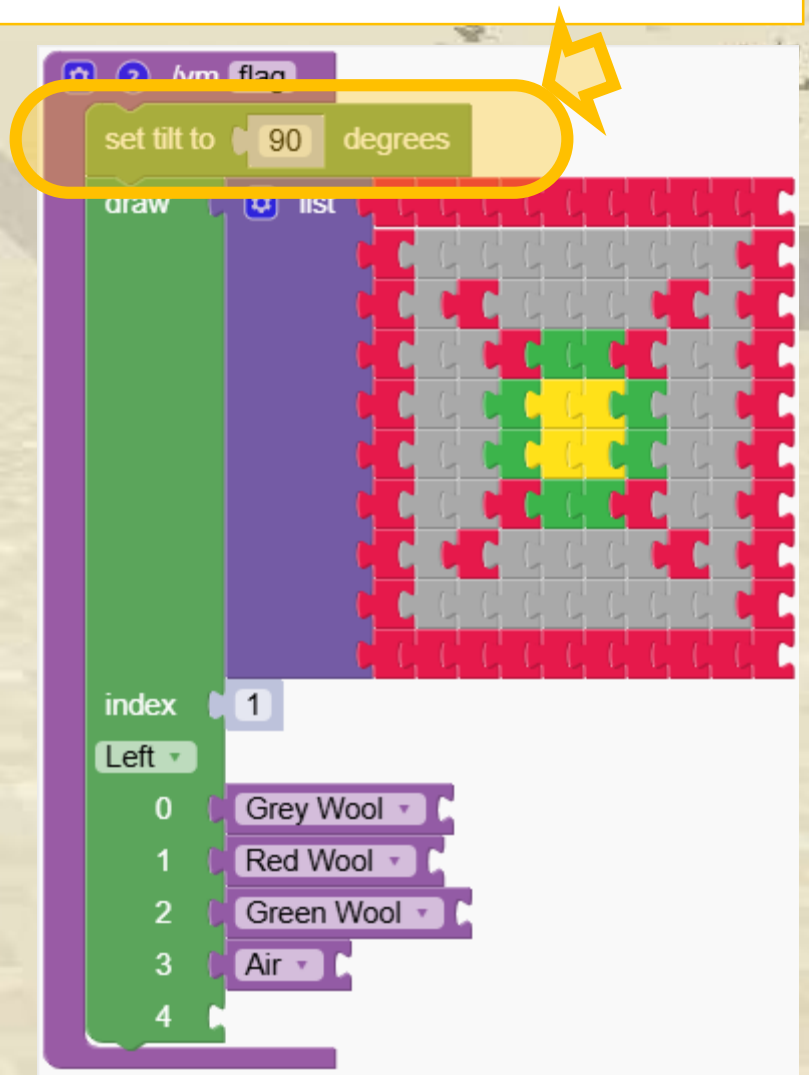




Make your own flag

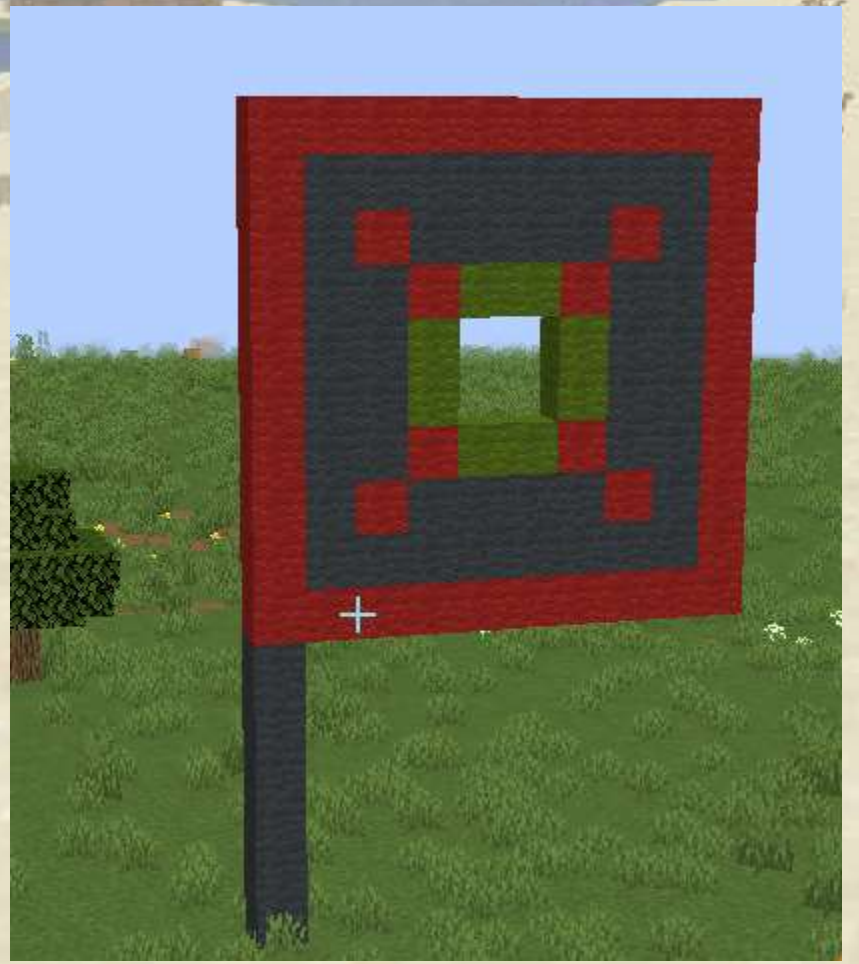
We change the tilt to make the image vertical





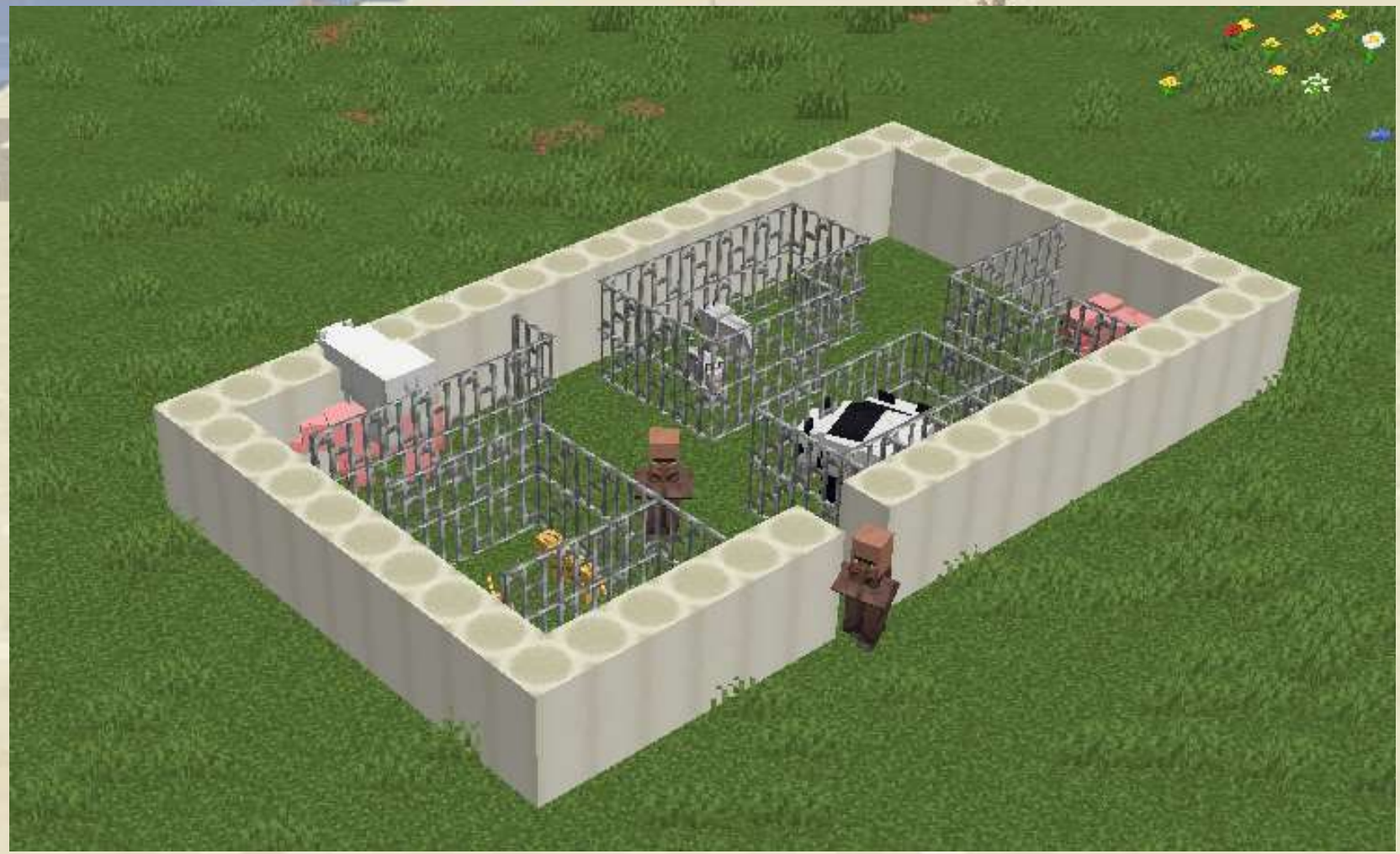
Make your own flag

We add a simple base made of 6 blocks



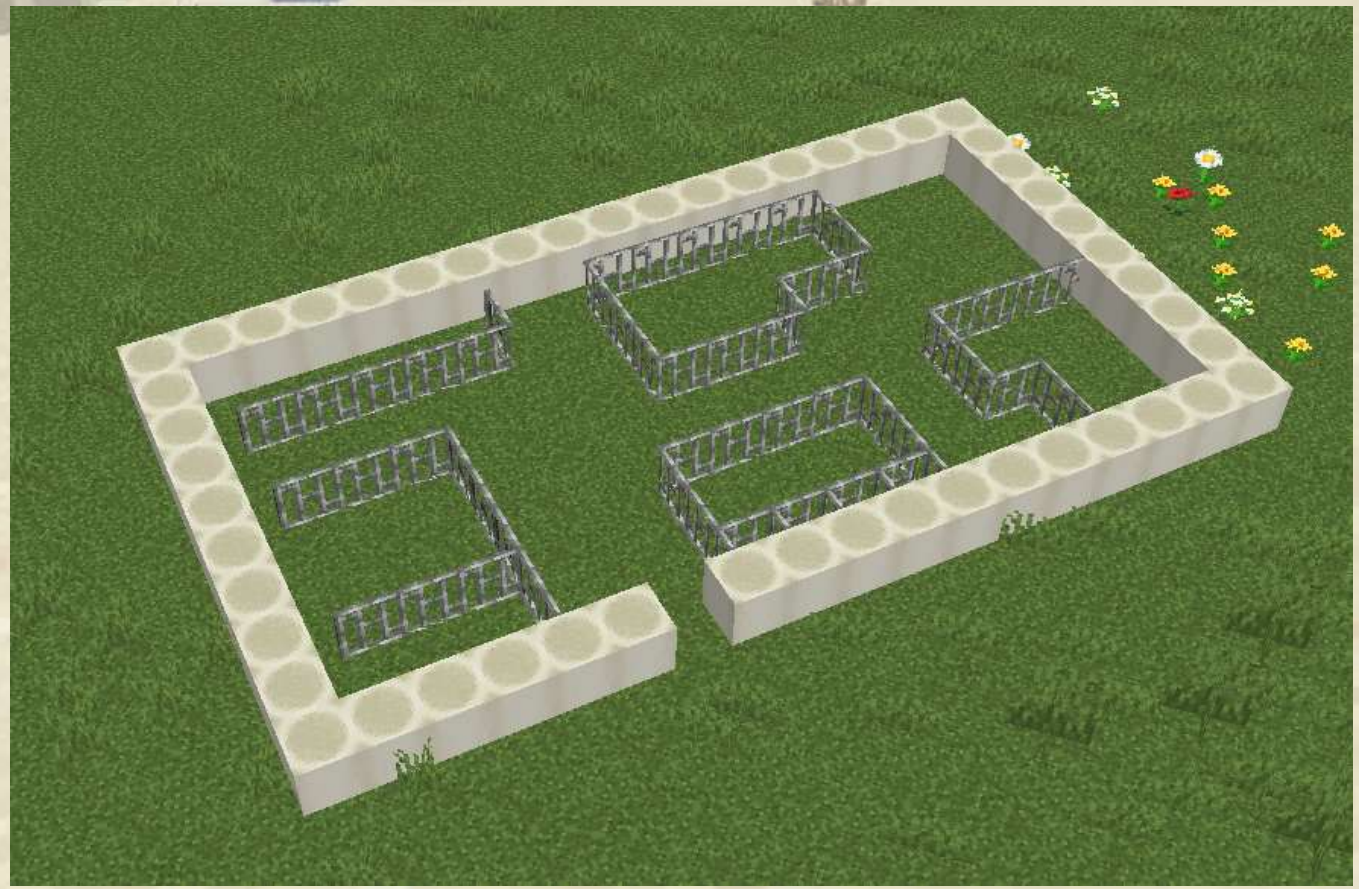
Zoo

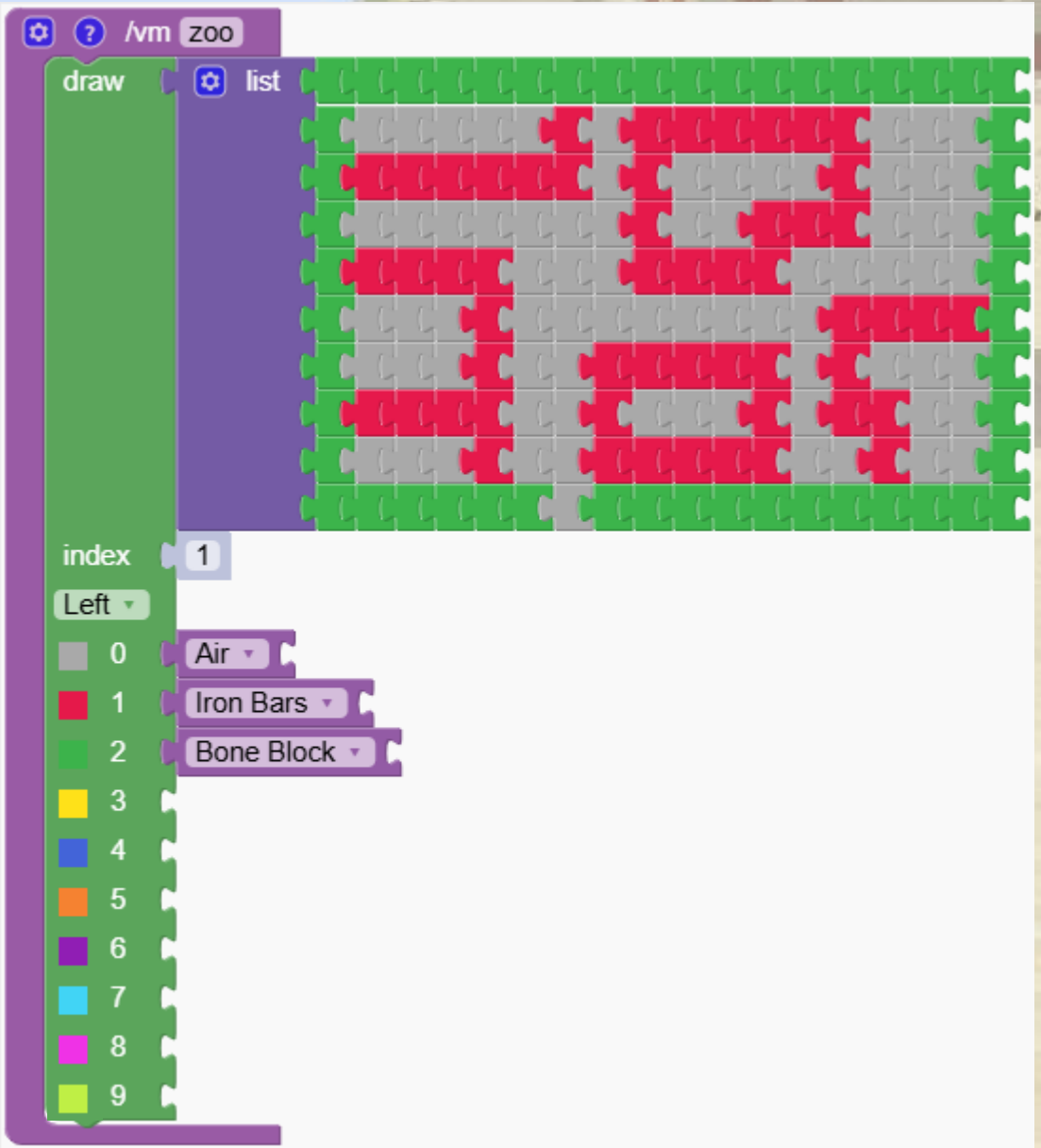
Let’s make a zoo!



Zoo

First we create the outside wall and the cages





Zoo

Then we add the animals.

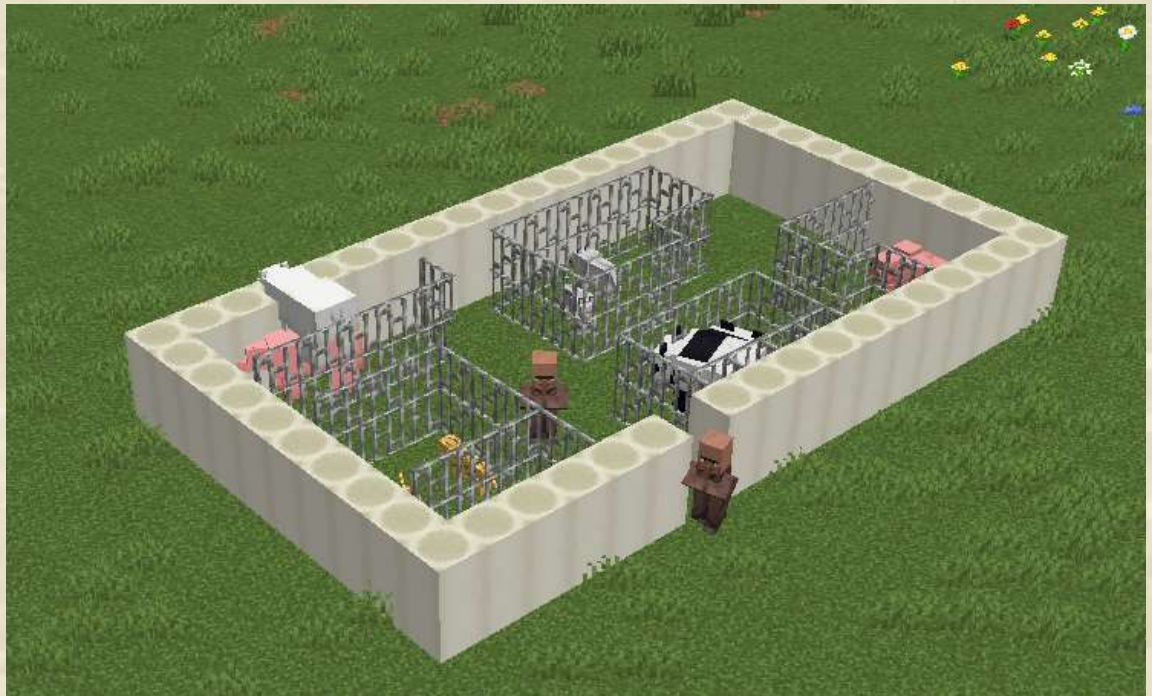
Zoo

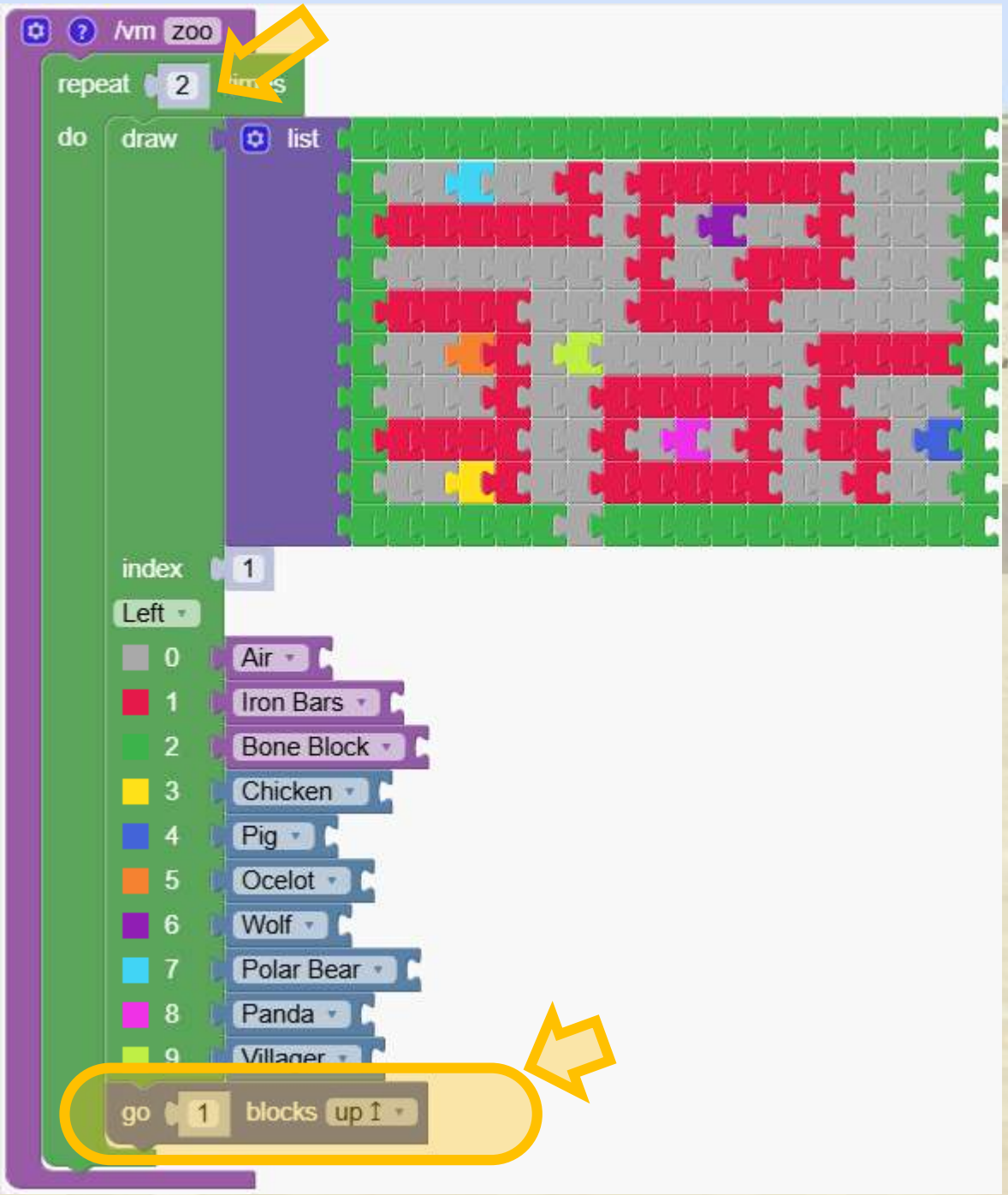
The animals are escaping!

What can we do?

Zoo

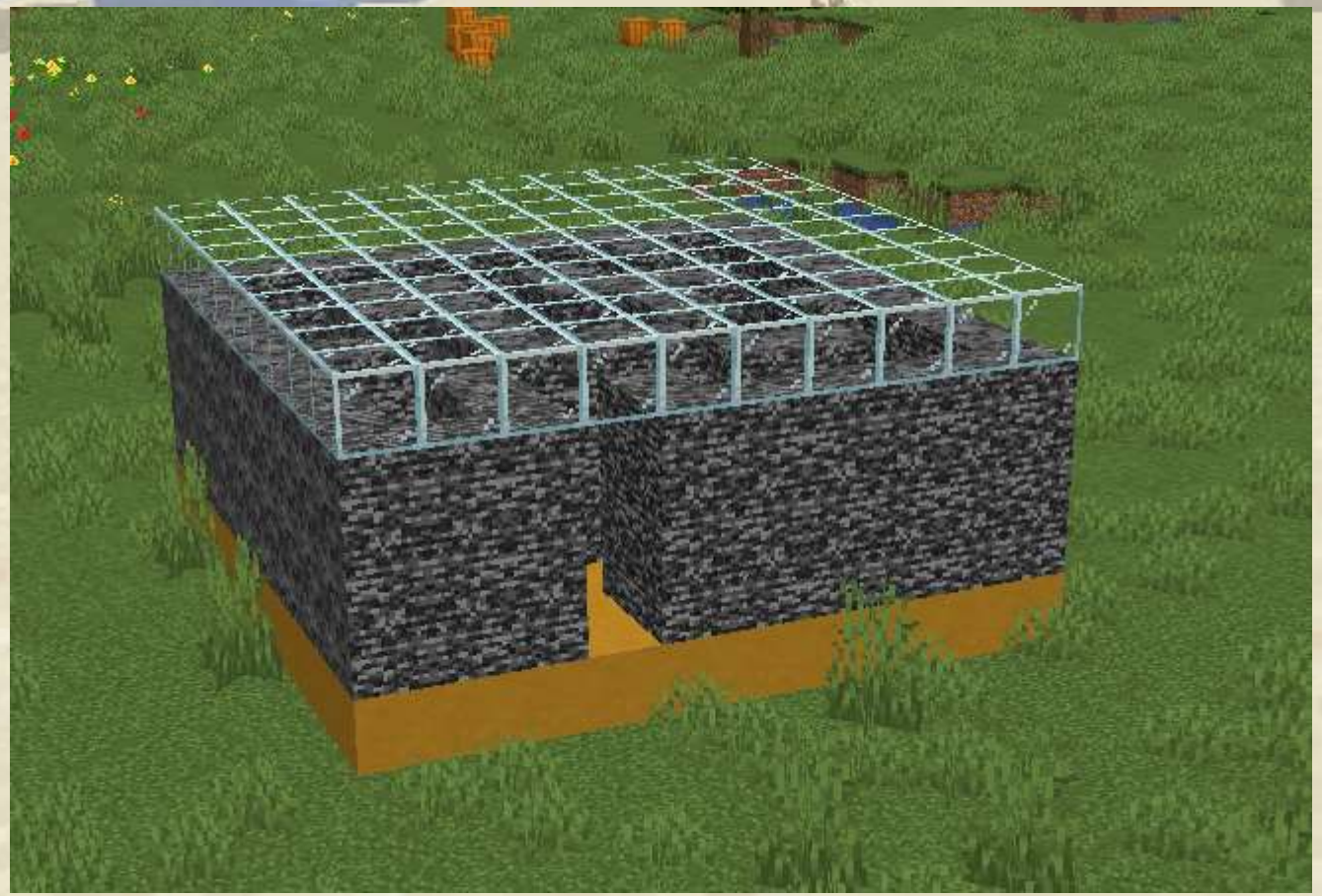
To stop the animals from escaping, we make the cages one block higher by repeating the drawing.

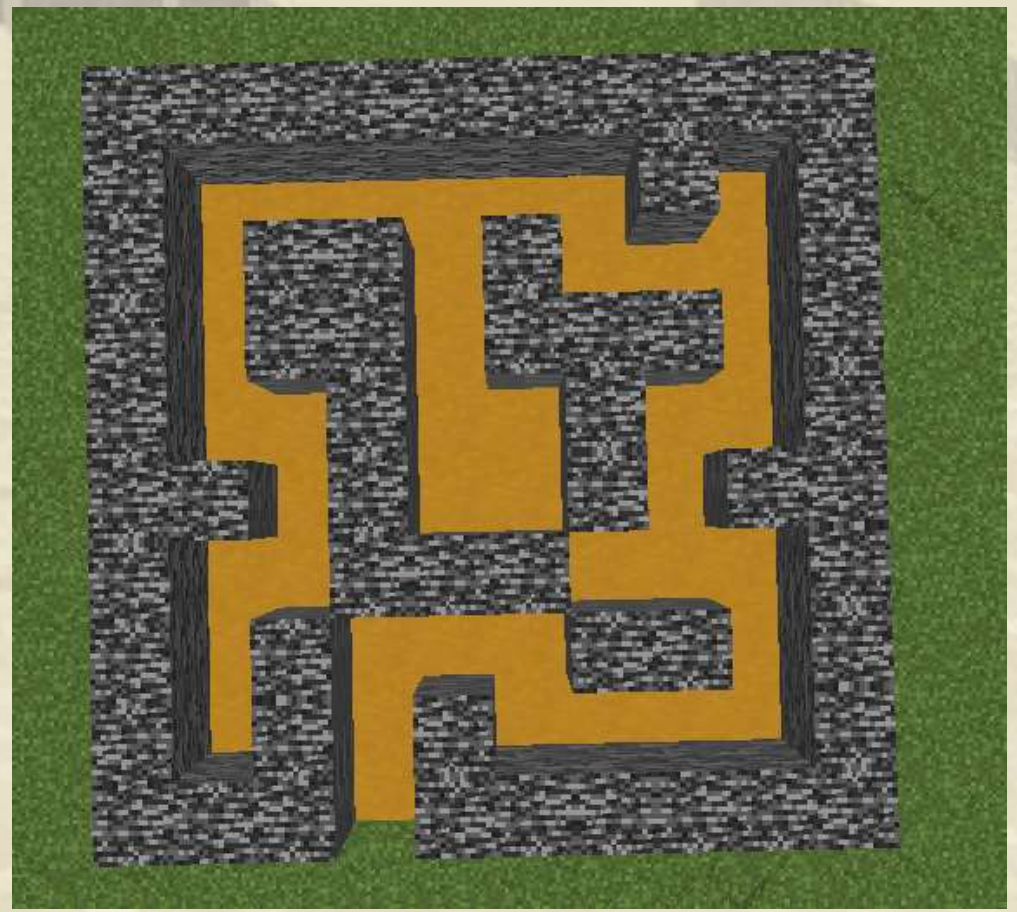




Fun ⚡ Design a maze

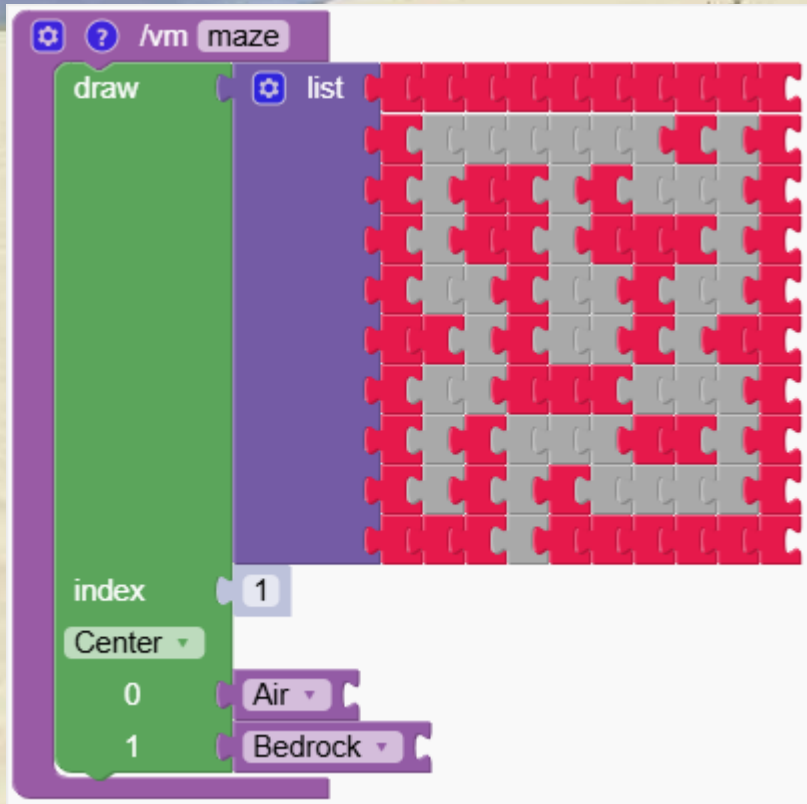
Design your maze and invite others to try and walk through it.

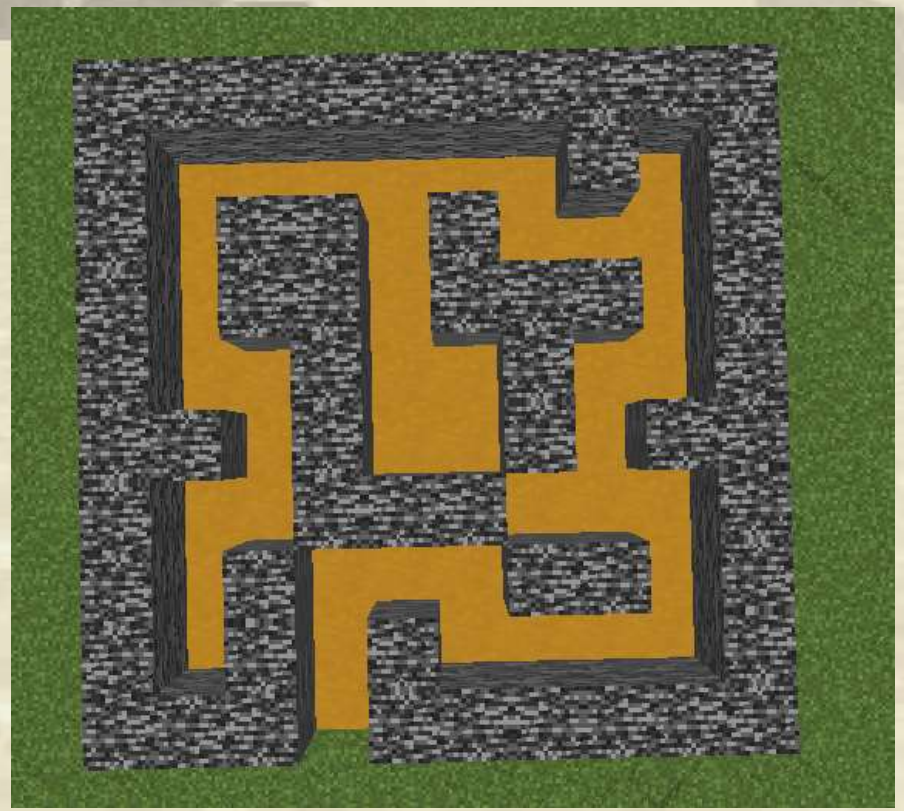




Fun ⚡ Design a maze

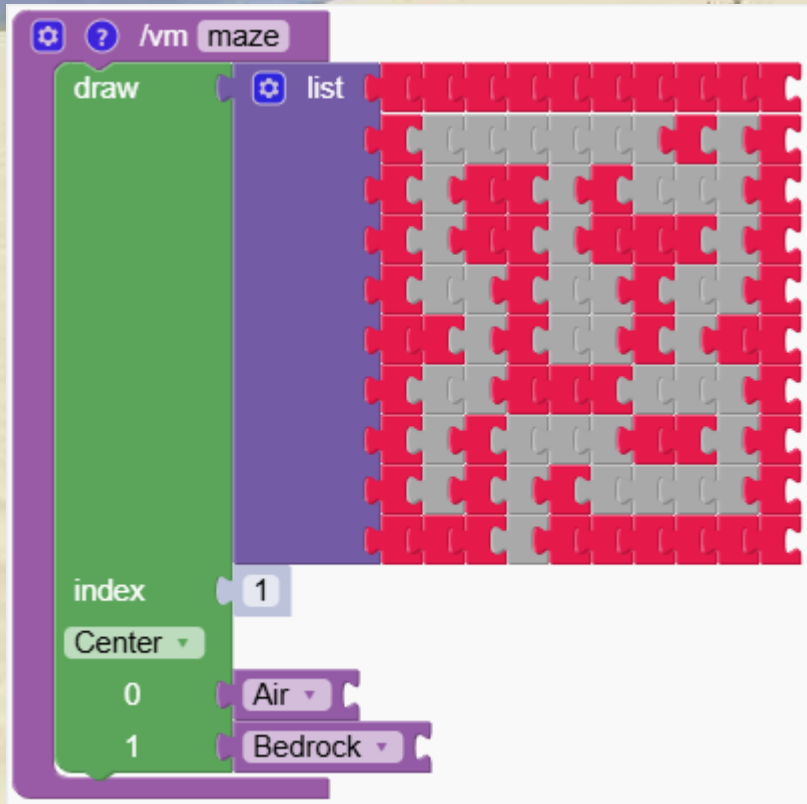
First we make the basic layout.

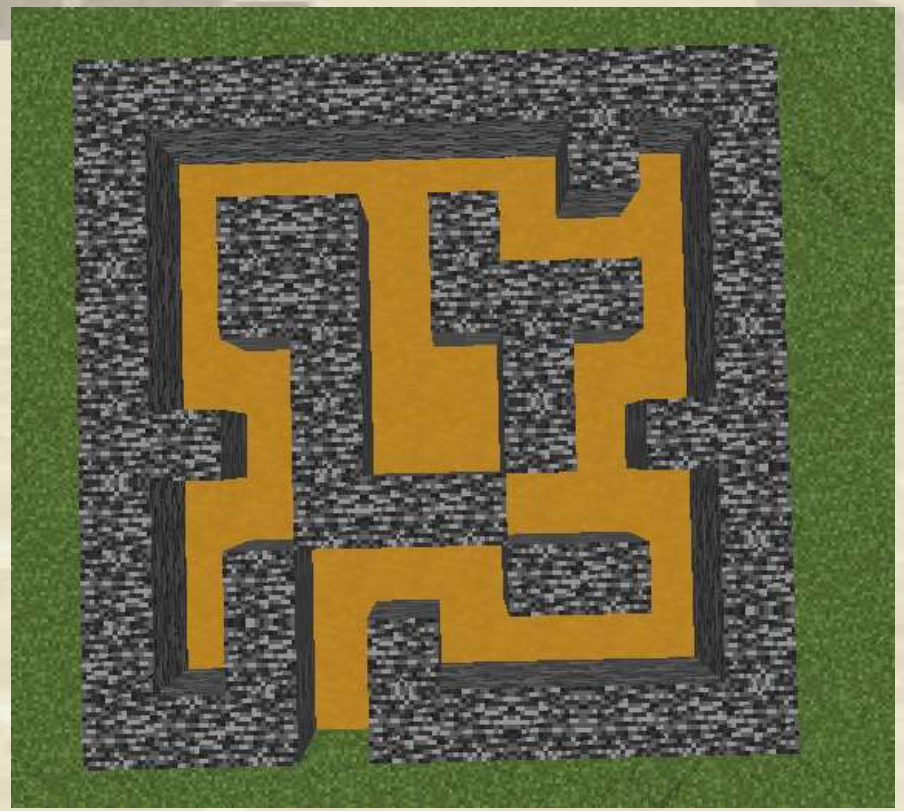




Fun ⚡ Design a maze

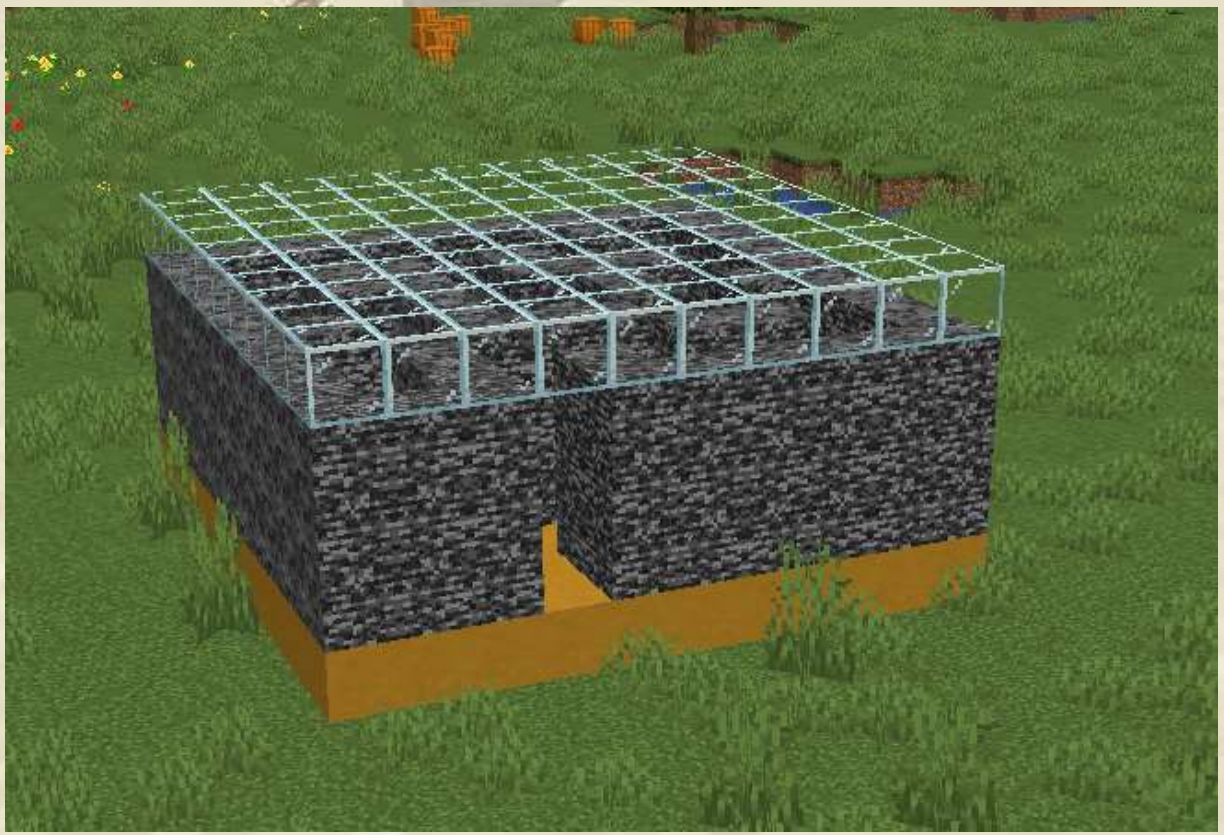
We need to raise the walls, add a floor and a roof. Can you do it?

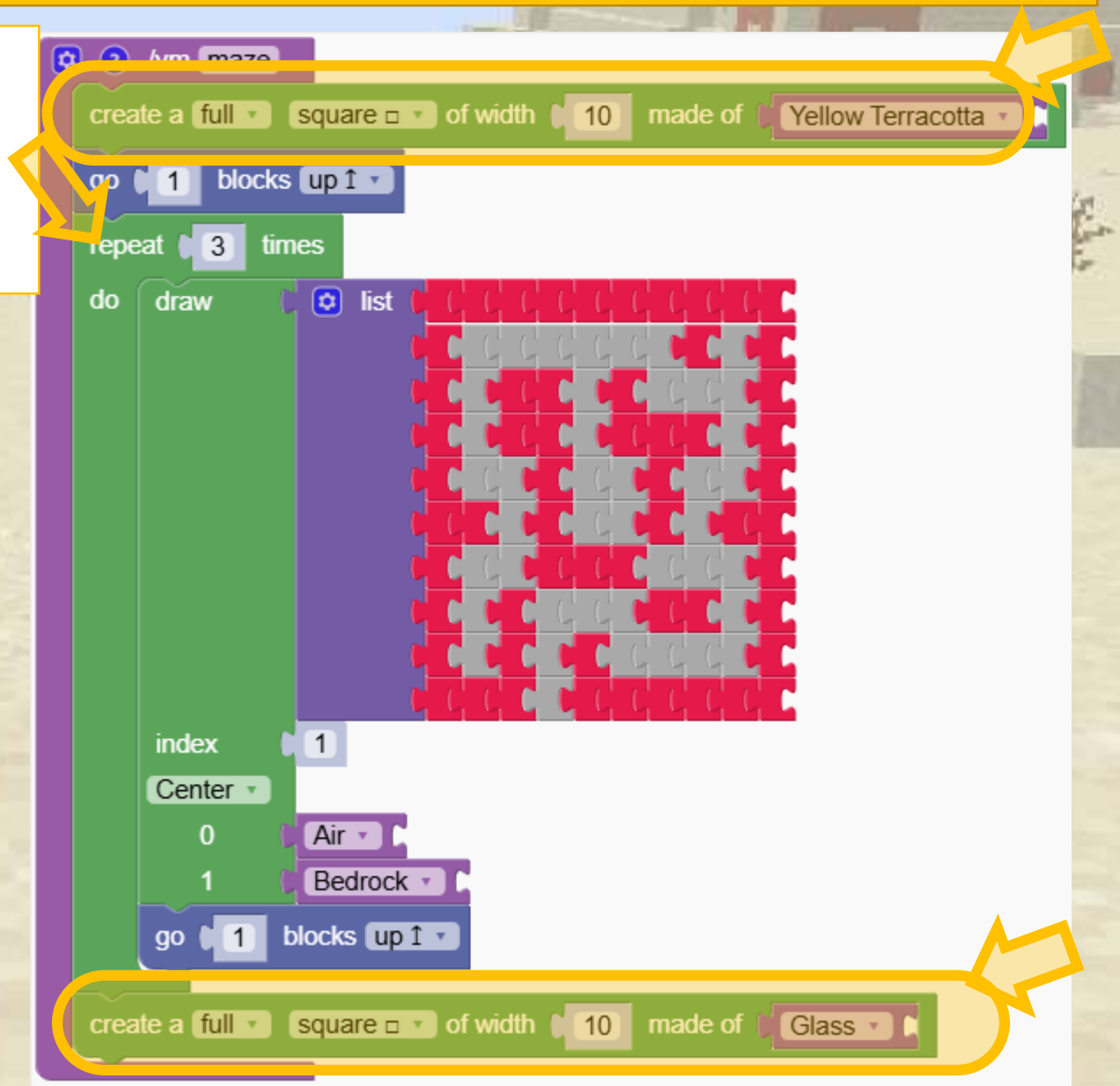




Fun ⚡ Design a maze

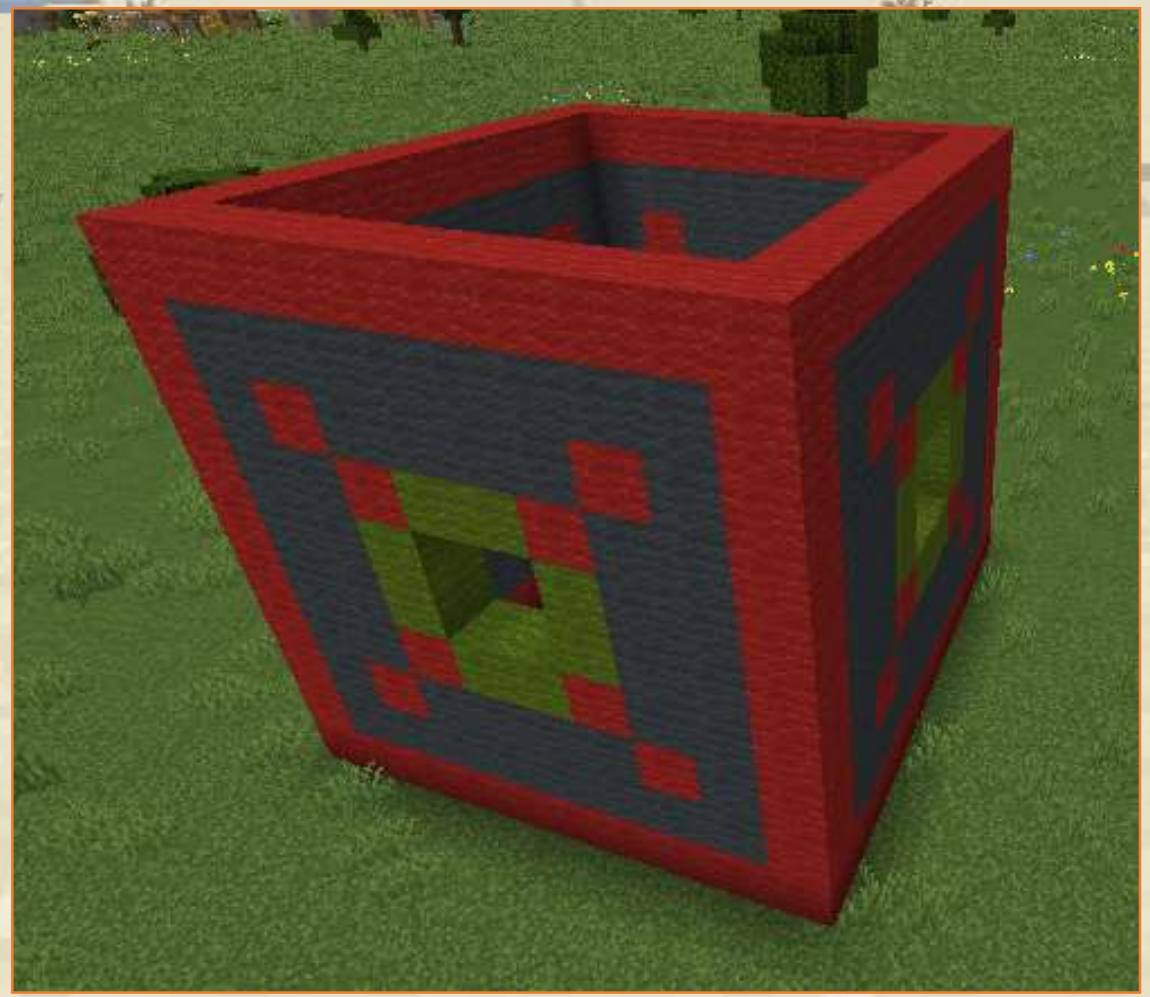
We add a floor and a roof. The walls are repeated 3 times





Make a House

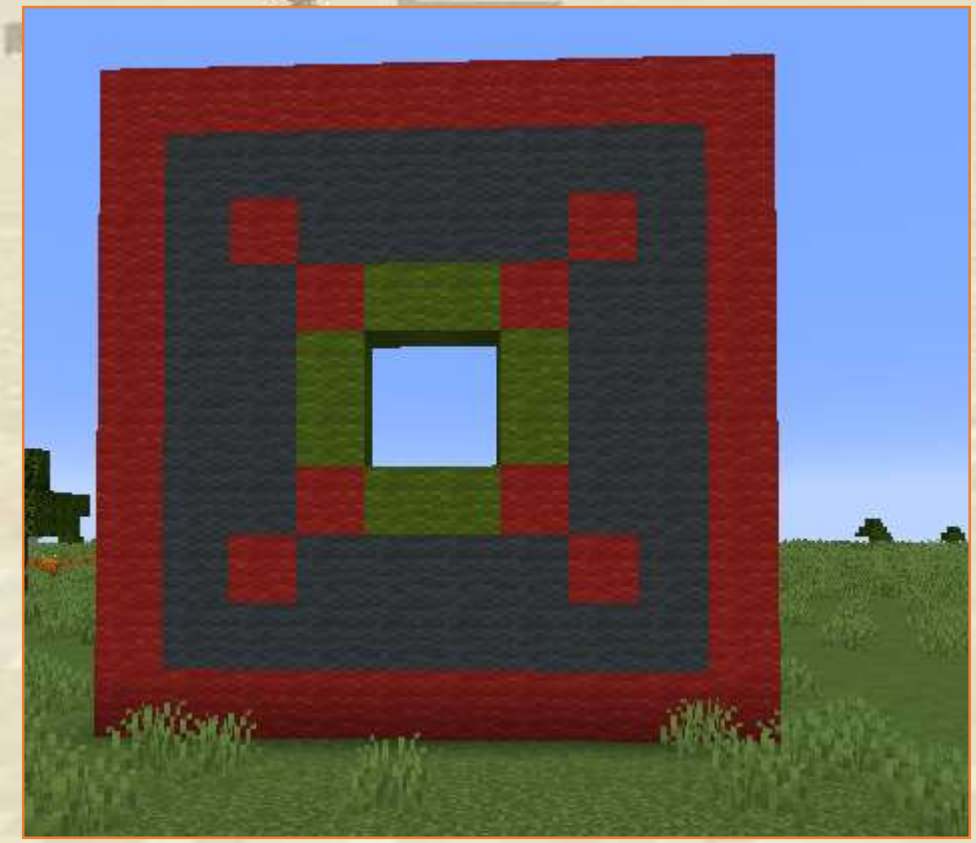
Learn how to position drawings to create a cubic house, practicing the basics of 3D shapes.

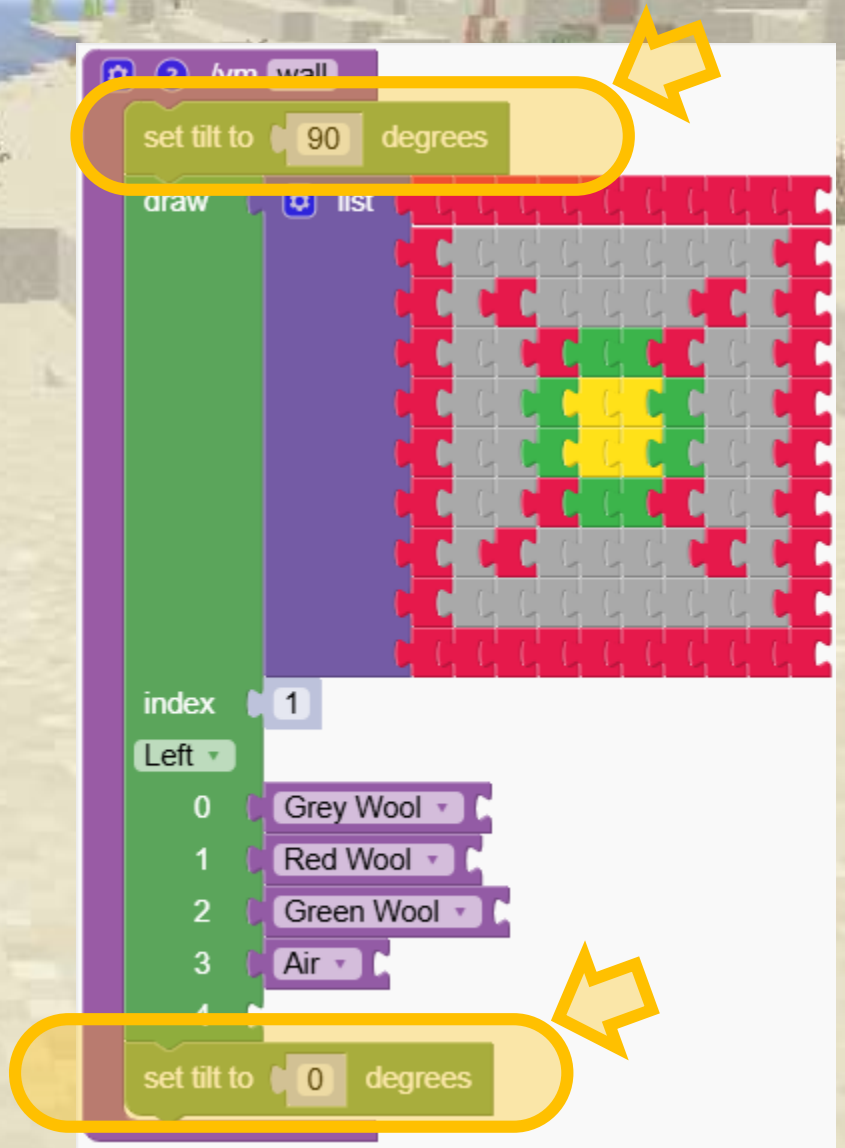


Make a House

First we create a simple wall.

Notice that we reset the tilt of the wall.



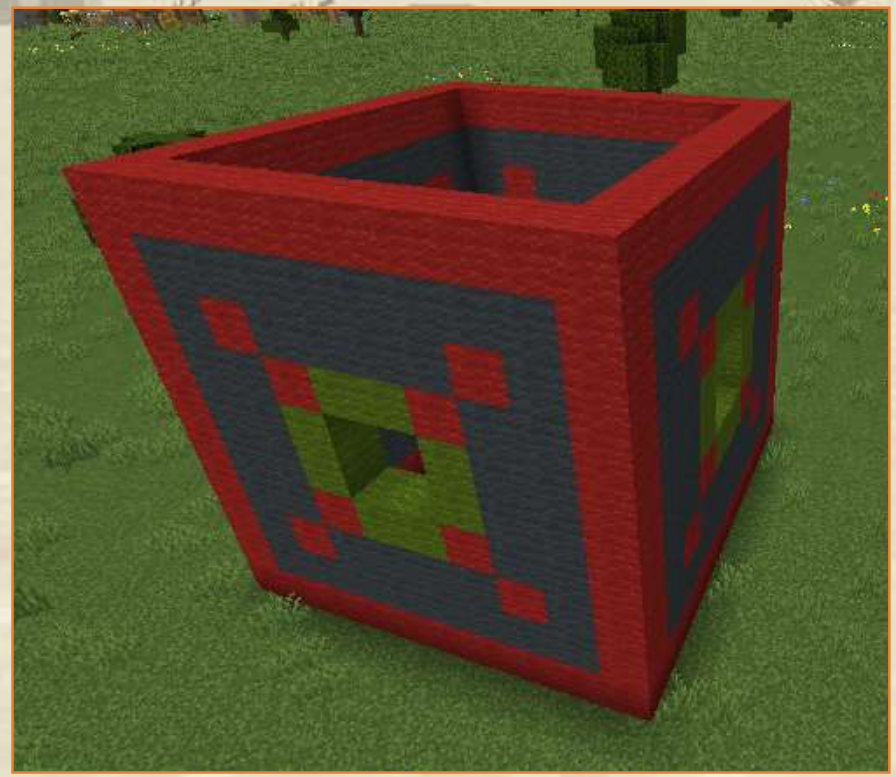


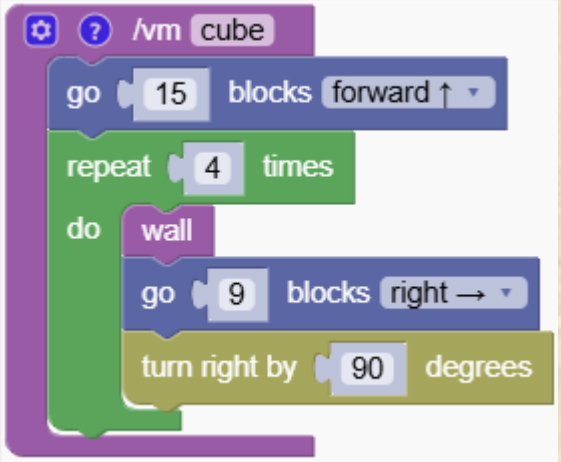
Make a House

The following program paints 4 times the wall.

(The program calls the function “wall” that we created before)

Let see how it works:

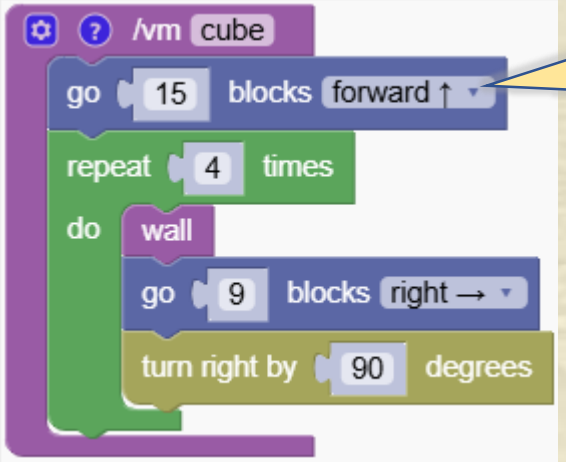




Make a House

Explanation of the code:

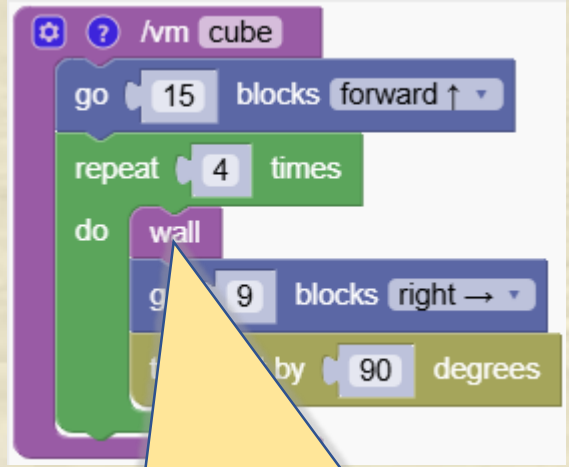
Step 1: move the house further away



Tell robot to go further away

Make a House

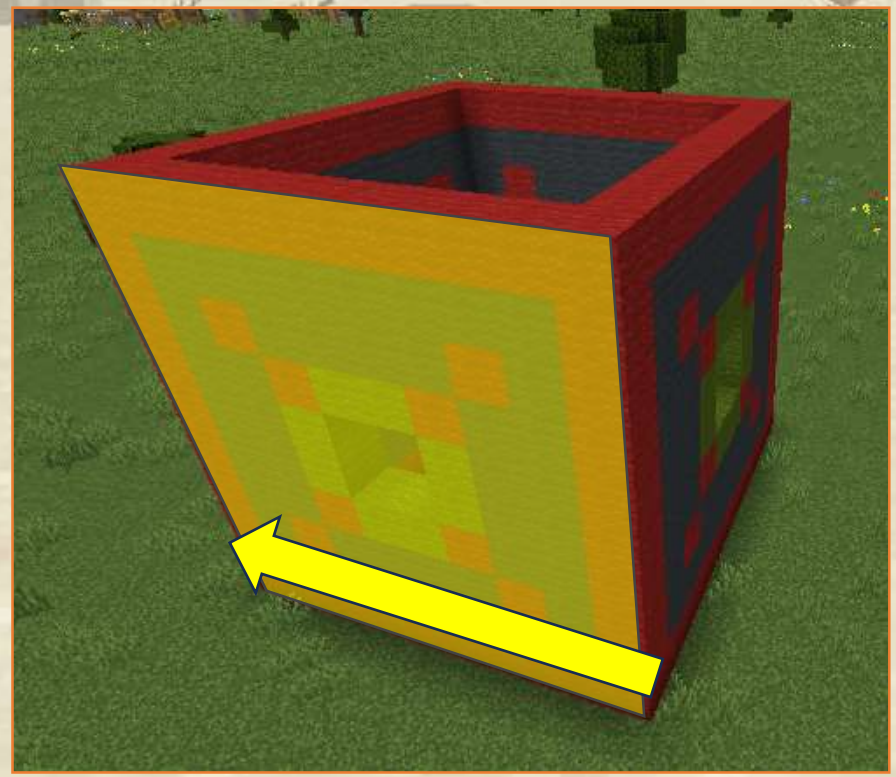
Step 2: We create the first wall

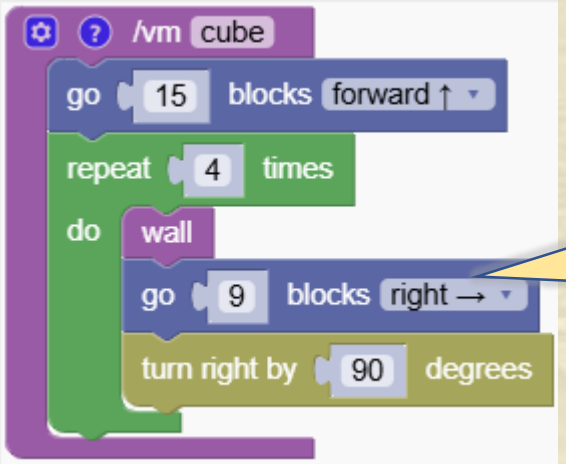


Makes the front wall

Make a House

Step 3: We tell robot to move to the right so the next wall will start at the right point

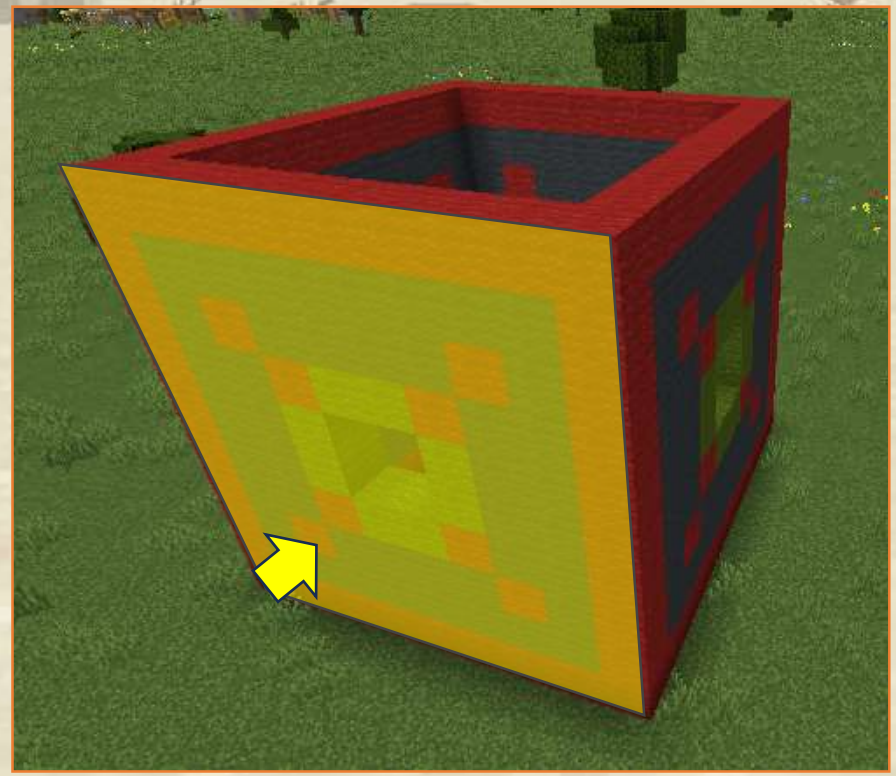


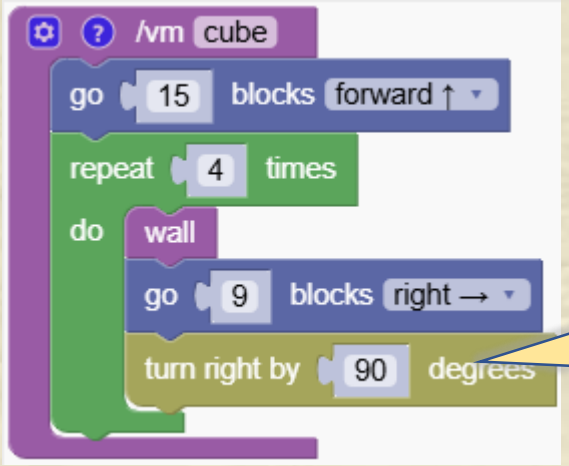


Move robot to the right

Make a House

Step 4: We turn the robot in the right direction.



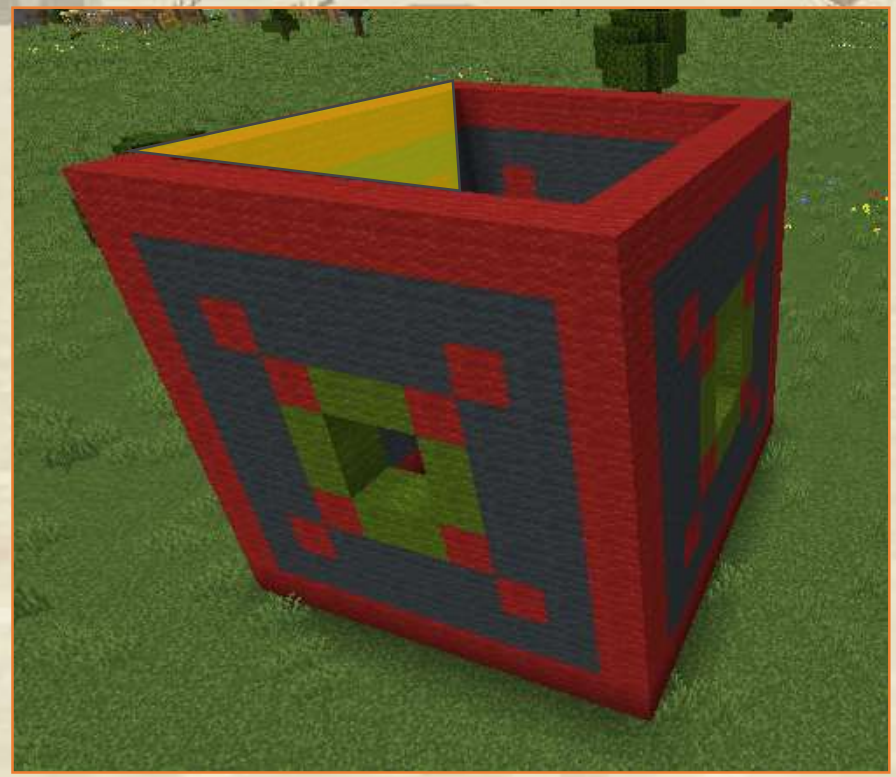


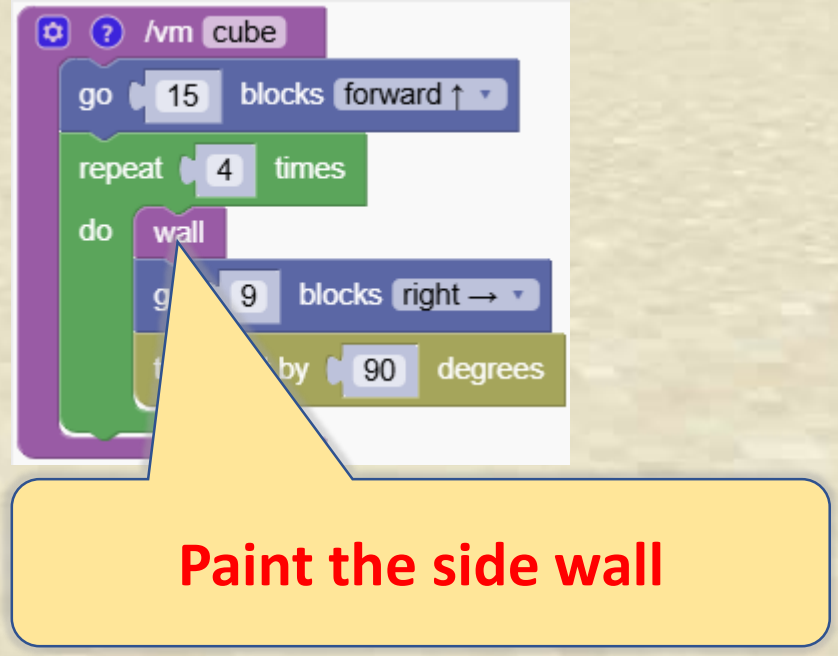
Turn robot to the right

Make a House

We paint the next wall.

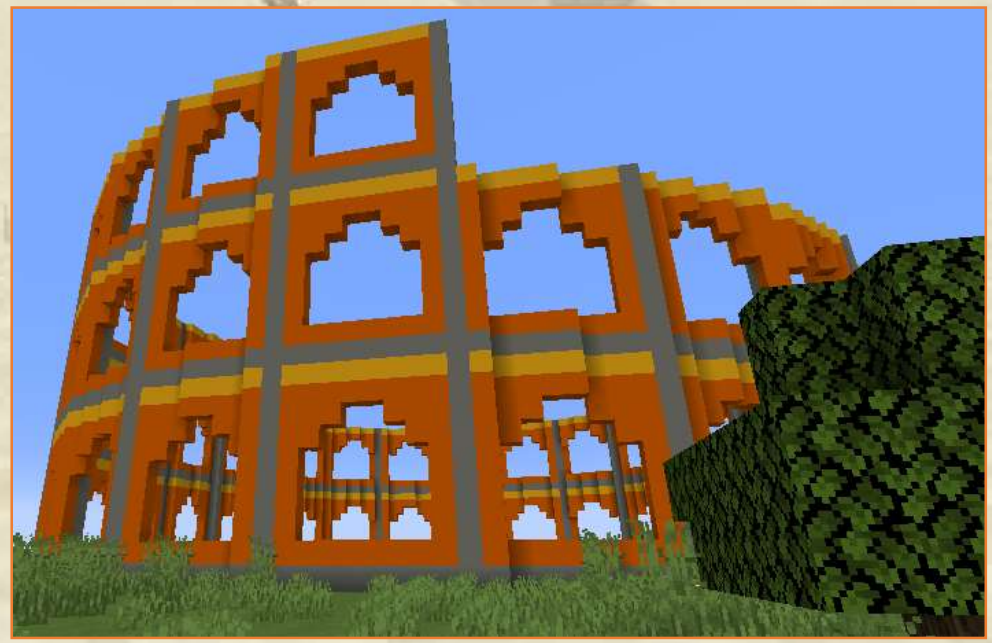
We repeat this process 4 times





The Colosseum

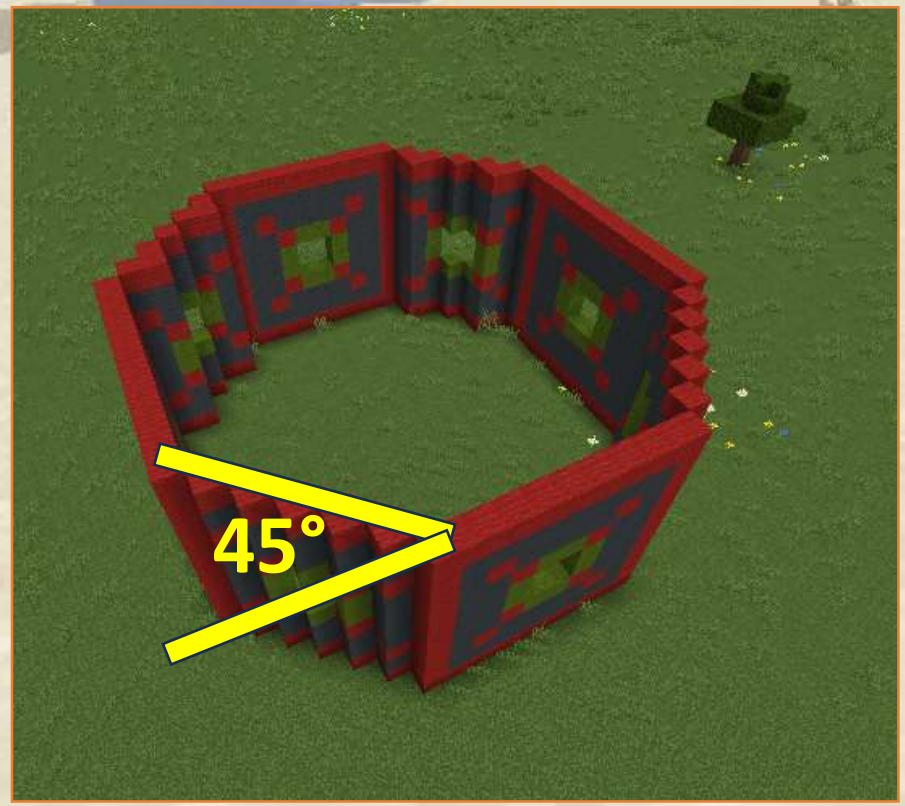
With the help of some math, we can transform the house into a colosseum structure

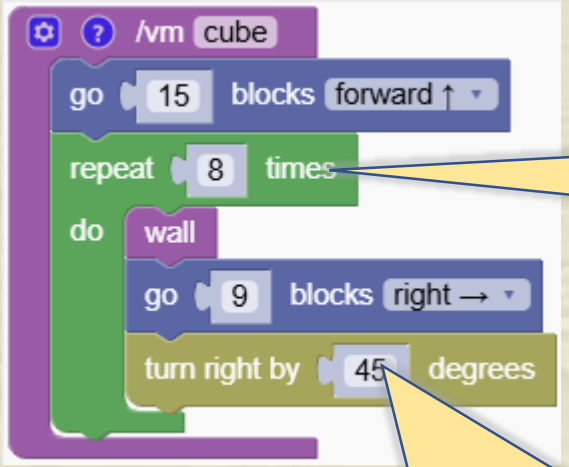


The Colosseum

We extend the house program to make it into a colosseum.

We tell robot to turn only 45 degrees so that the wall can be repeated 8 times. (8 x 45 = 360)



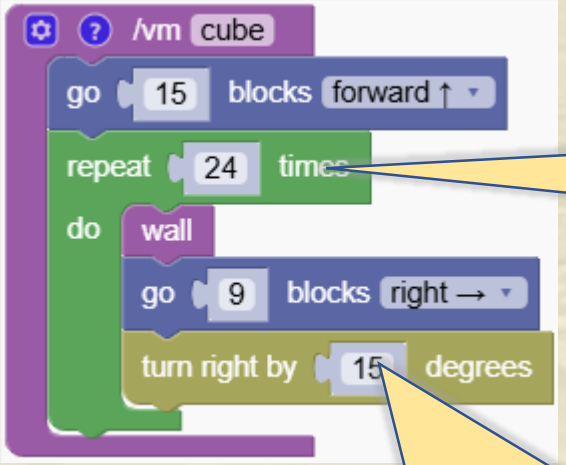


Repeat 8 times

Turn 45 degrees

The Colosseum

Now we make 3 times more walls. Just adjust the rotation to 15 degrees (24 x 15 = 360)

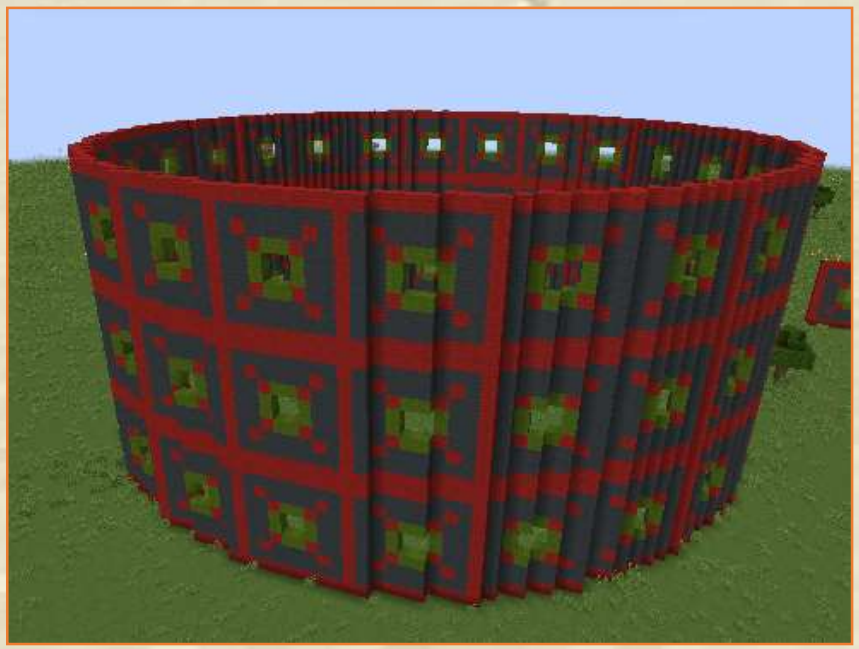


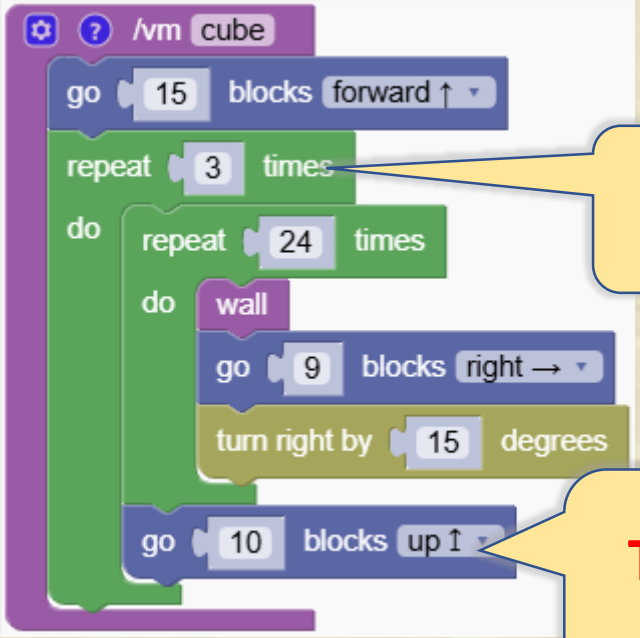
Repeat 24 times

Turn 15 degrees

The Colosseum

Let's repeat it 3 times





3 layers

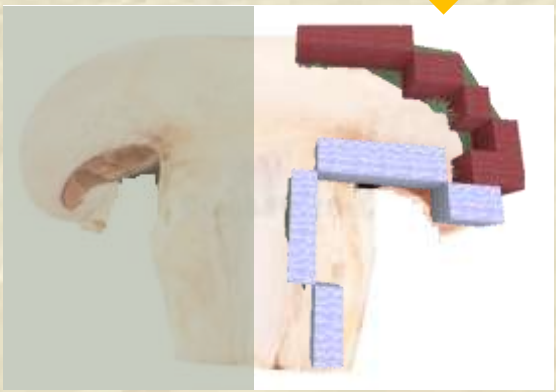
The next layer is 10 blocks above the previous one

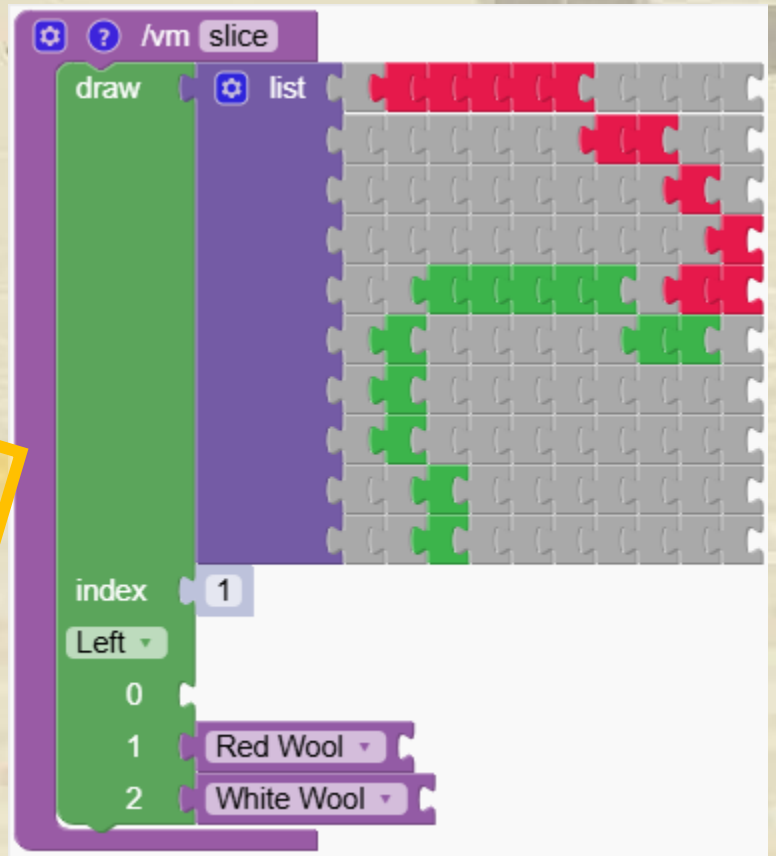
The Mushroom House

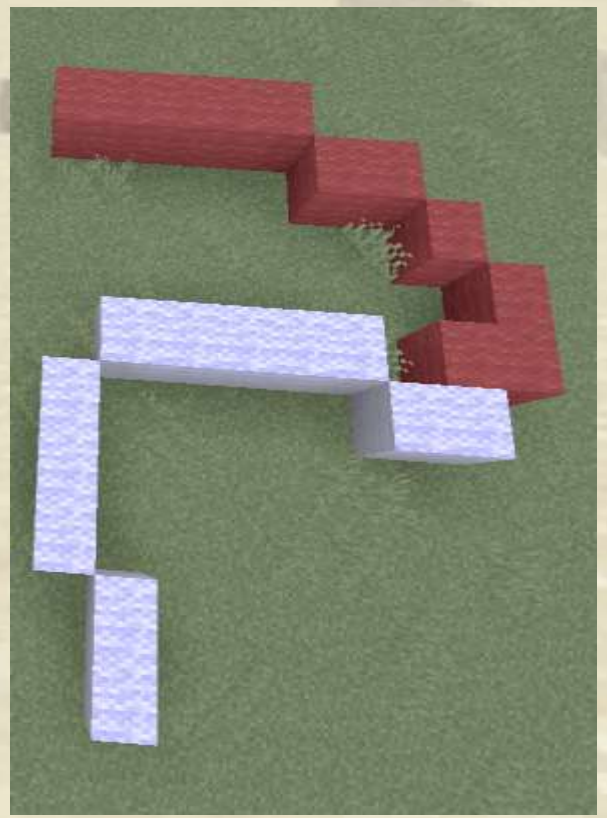
Rotate drawings to create unique and fantastical house designs, like a mushroom house.

The Mushroom House

We first create half a slice of our mushroom house

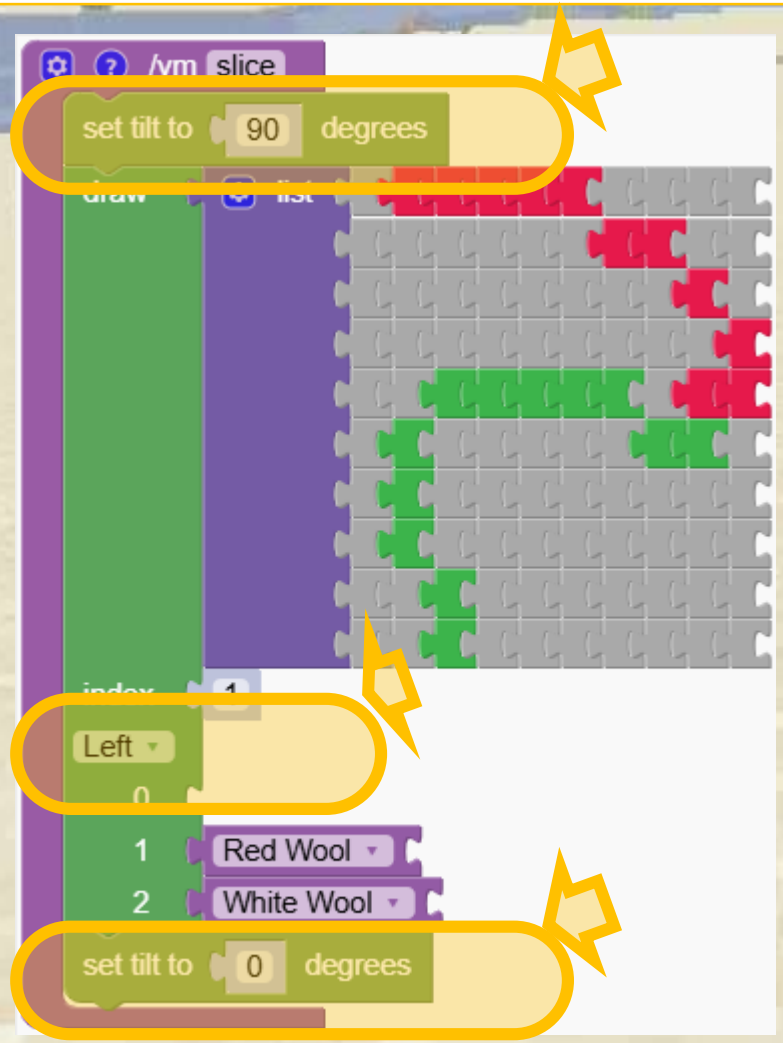


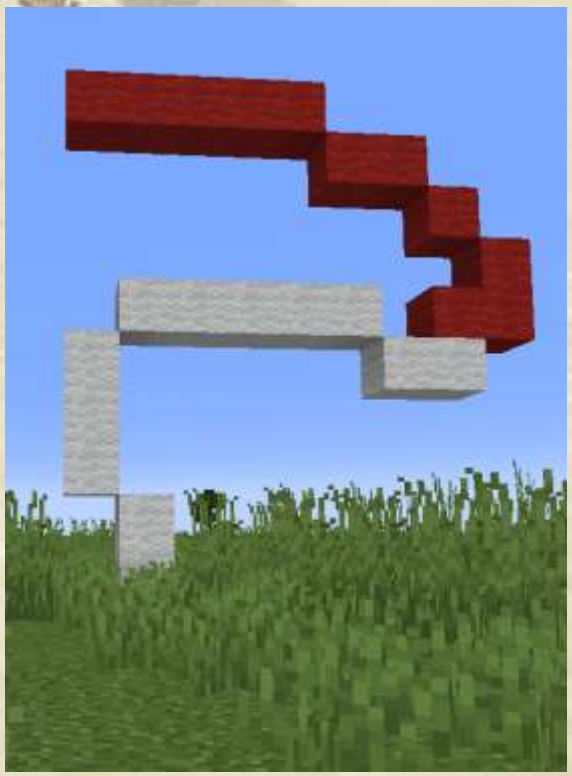




The Mushroom House

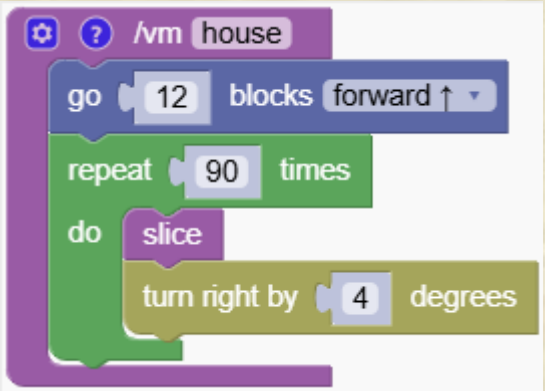
The slice should be vertical and be drawn from the left bottom corner





The Mushroom House

The program below repeats 90 times by rotating the slice



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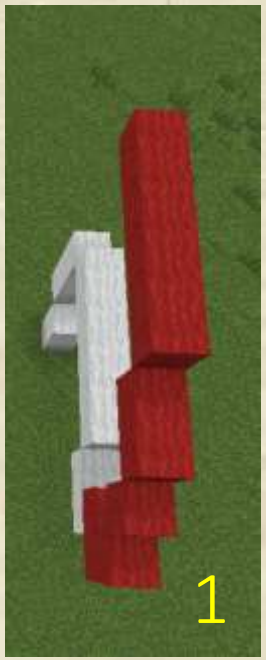
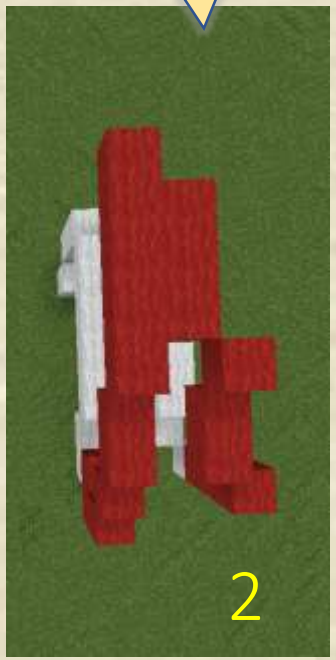
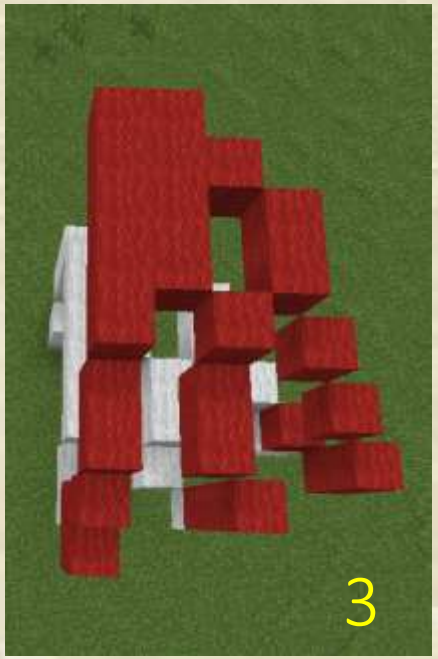
Copied 6 times







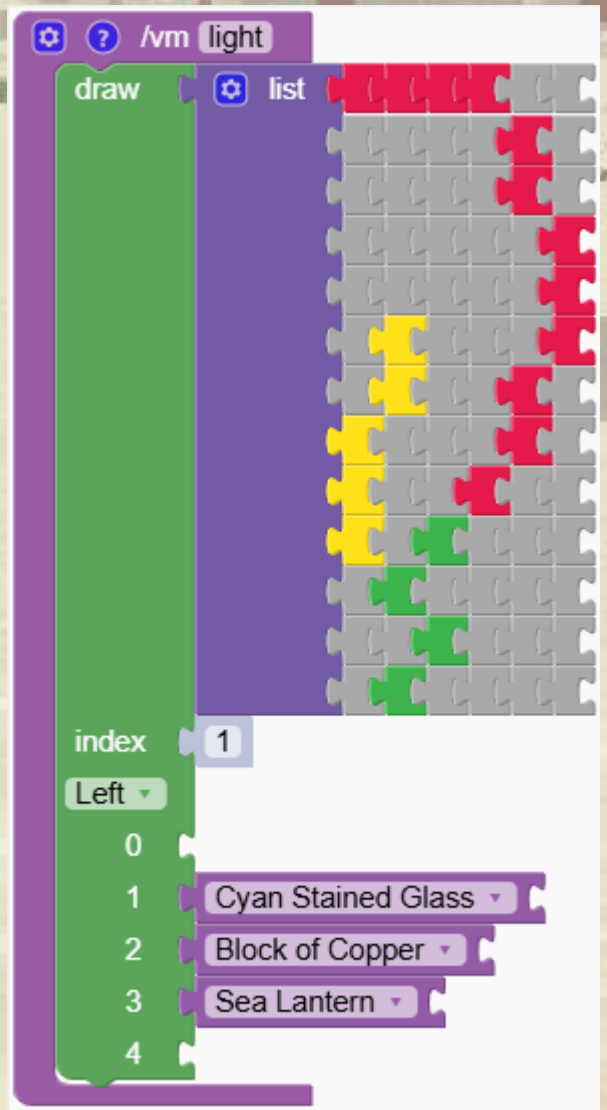
The Lightbulb

Let’s make a Lightbulb

The Lightbulb

This drawing creates a slice of the lightbulb.

Can you make it into a full lightbulb?



The Lightbulb

While rotating, we repeat the drawing 90 times.