



# SPACE INVADERS

## Introduction

Computers may at first seem smart but really they're just very good at doing as they're told by following the instructions given to them. Instructions are given to a computer in the form of a programme which is really just a step-by-step list of instructions for the computer to follow and this is what we'll be learning in this exercise.

We'll be learning how to build our very own Space Invaders game in Scratch. If you don't already know Scratch, it's a visual programming language that makes coding simple and will allow us to make fun and creative programmes to play with.

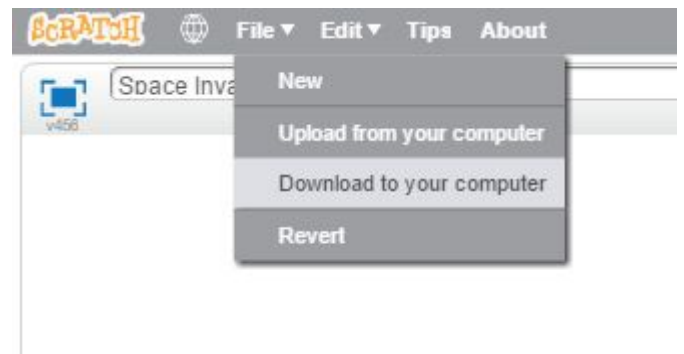
For us to start building our game however we must start to think as a computer does. All tasks and instructions need to be broken down into small chunks so they are easily followed not just by ourselves but by the computer too. This guide breaks down our Space Invaders game into easy to follow sections.

Let's get started by first loading Scratch. You can either install Scratch on your computer or load it via your web browser by navigating to <https://scratch.mit.edu/>

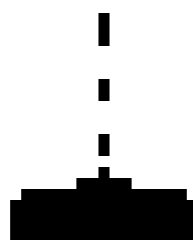
## Top Tip

Don't forget to save your work regularly. It's good practice to get in the habit of saving any progress you've made. So when you're feeling great after solving a coding problem, save it, save it, save it!

The save options may differ slightly between Scratch versions but head on up to the File option in the top left and you'll find it.



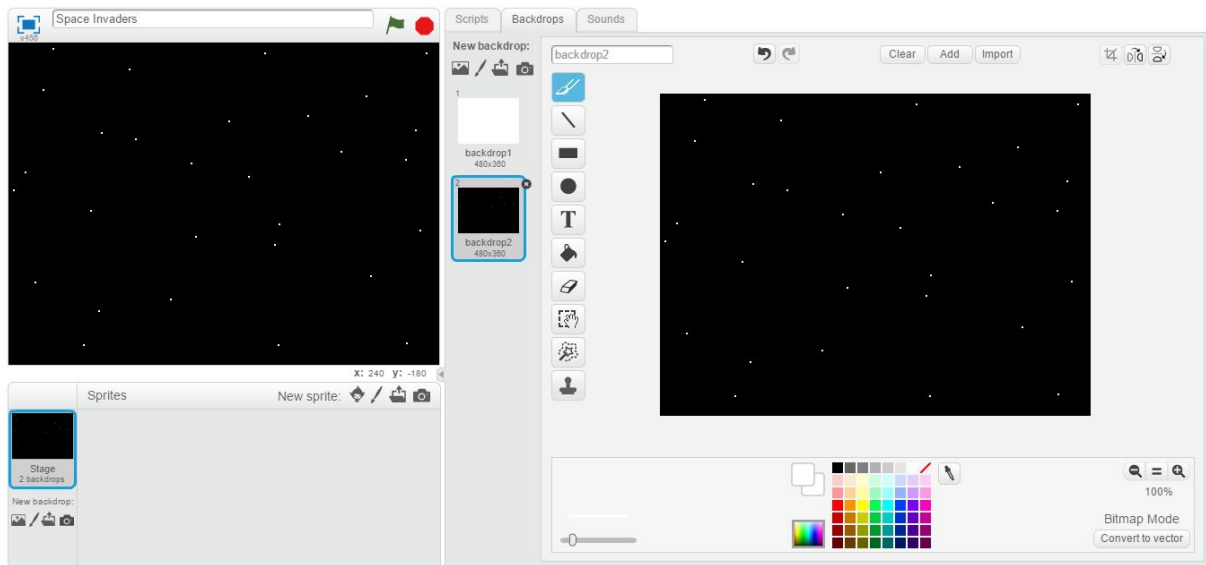
**Let's start saving the world from an alien invasion.**



## Step 1: Prepare background

Let's start at the very beginning and start with the background. This is where all the gameplay will happen so we need to make sure it's something nice and simple to prevent the player from being distracted.

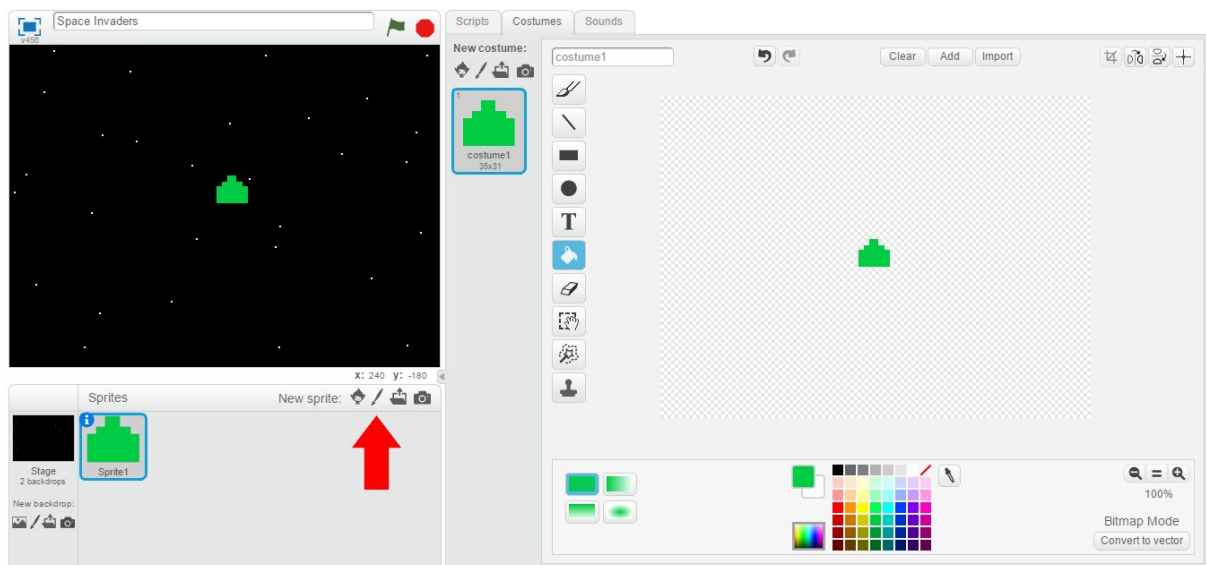
As we are defending Earth from an alien invasion in space, let's create a starry backdrop. Start with a black background and add a few white stars.



## Step 2: Making the cannon

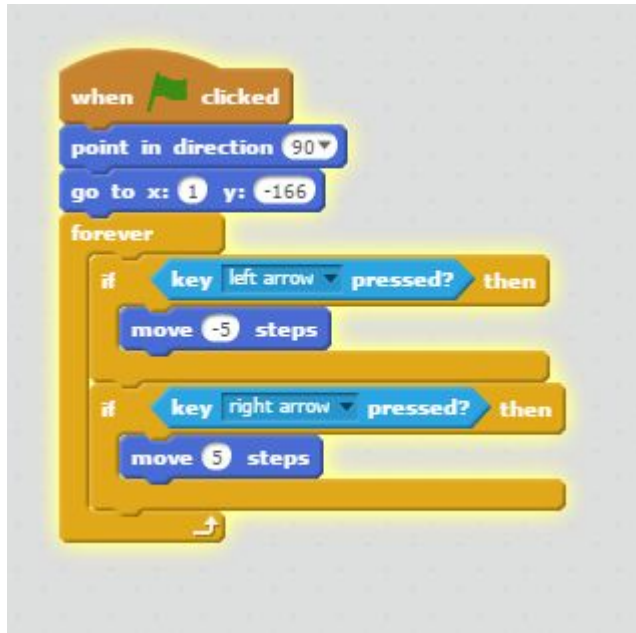
Those familiar with the classic Space Invaders game will know that the player controls a cannon at the bottom of the screen, shooting up at the advancing aliens, earning points and saving the day.

To start building our cannon we first need to click on the Paint New Sprite icon, highlighted in the image below. It's this option that allows us to design all the elements of our game, including the cannon that we'll draw now. It doesn't matter if you draw it too big or too small, we can always come back and correct it later on.



We have something on the screen, we now need to build our set of instructions for the cannon so we can control it from within the game. Click on the Scripts tab and let's start building our blocks.

## The Blocks



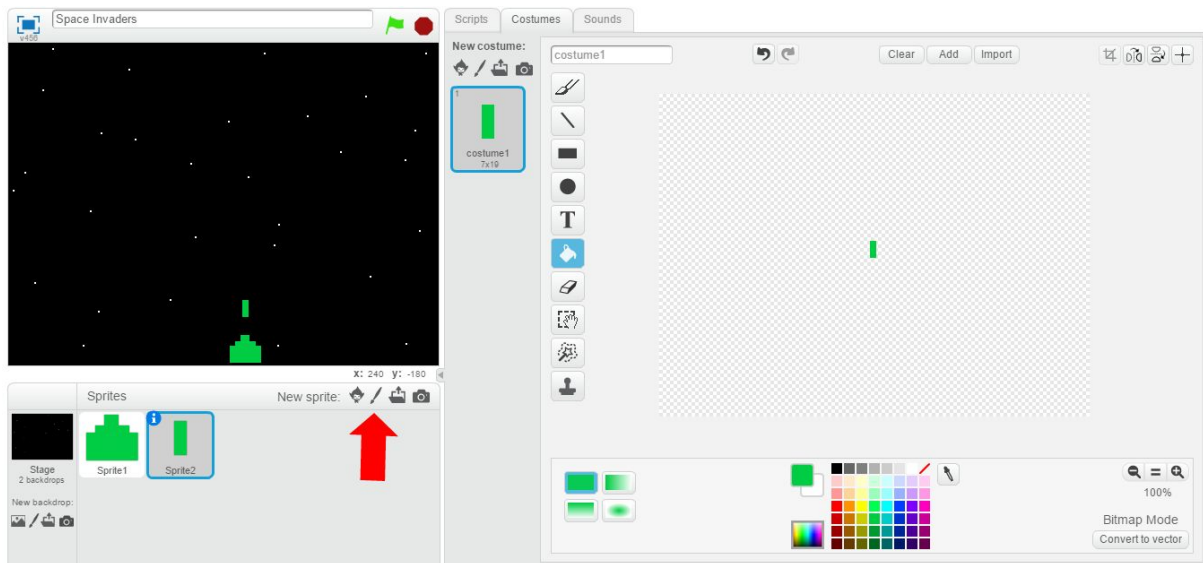
Construct the blocks as shown in the image. Once completed, hit the green flag button and give it a test using the left and right arrow keys.

Questions:

- Where does the cannon position itself when we first start the game? How can we change this?
- How do we give it another starting position?
- How do we alter the cannon's speed?

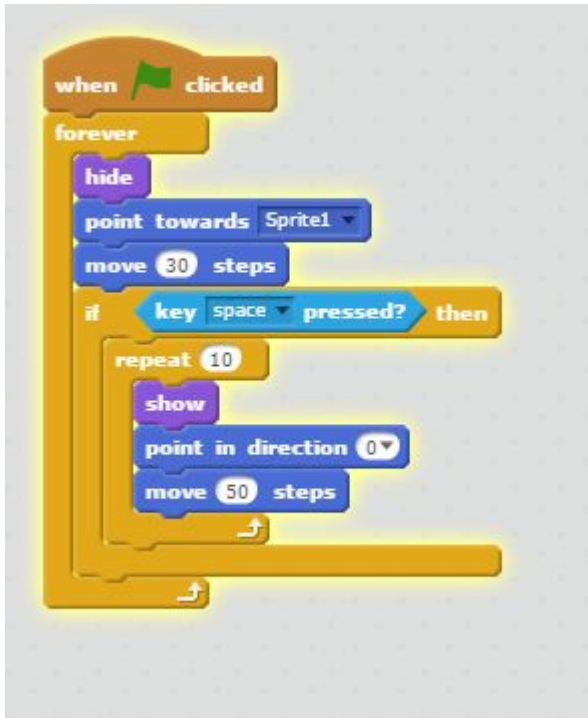
## Step 3: The Laser

What's a shoot 'em up game with nothing to shoot? Let's set up our laser that we'll shoot from the cannon at the aliens. Just like before we need to select the Paint New Sprite icon and draw our simple laser beam as shown below.



Although our laser beam is a really tiny sprite, we still need to build blocks for it to tell the computer what to do with it. In this case we will fire the laser from the cannon by hitting the space bar.

## The Blocks



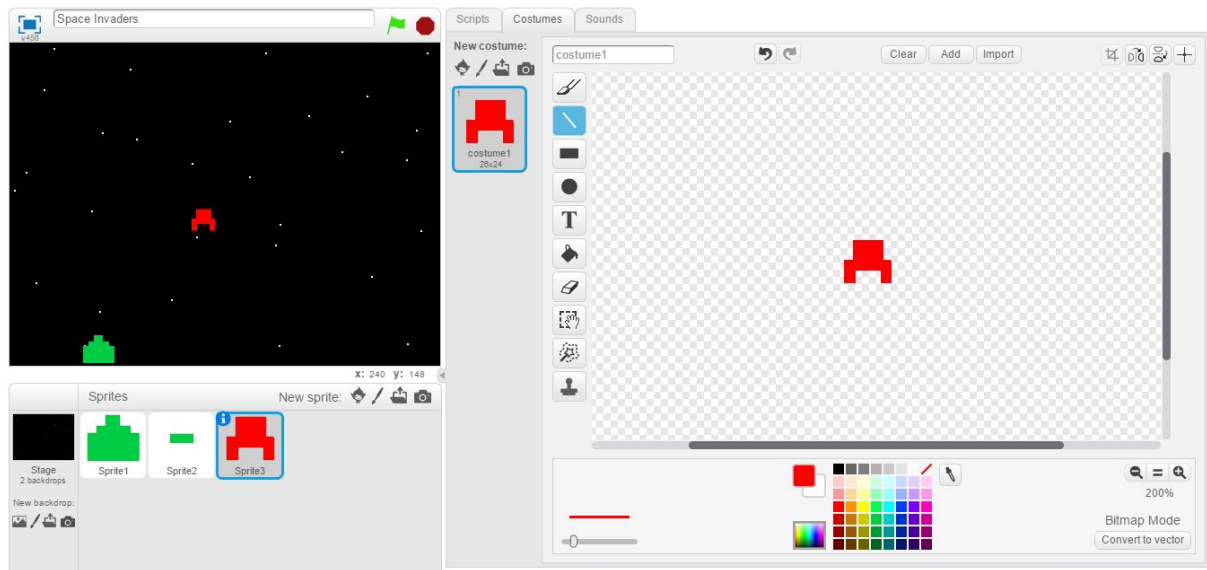
Construct the blocks as shown in the image. Once completed, hit the green flag button and give it a test by first hitting the space bar to fire the laser. Now practice moving the cannon from side to side using the arrow keys and firing the laser.

Questions:

- Why do we hide the laser from view and get it to follow the cannon?
- When the laser is activated by pressing the space bar, does it move fast enough? How can we alter its speed?

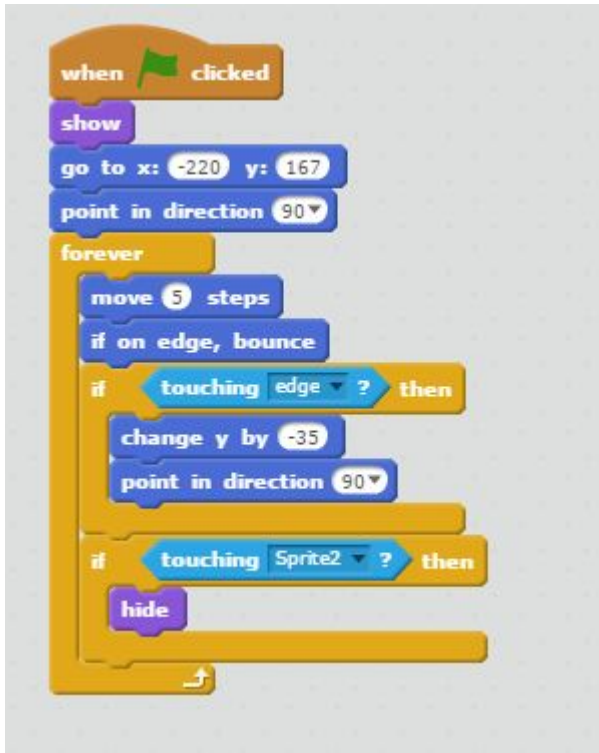
## Step 4: The Aliens

We now have something to shoot but nothing to shoot at. Space Invaders is all about attacking aliens so let's draw our first one using the Paint New Sprite icon.



Once again, with any sprite we draw, we need to programme it with a set of instructions. Here we are getting our alien to advance across the screen, only to move down the screen and advance across the screen in the other direction once it reaches the edge of the screen.

## The Blocks



Construct the blocks as shown in the image. Once completed, hit the green flag button and give it a test. The alien should move across the screen, advancing further down the screen when it reaches the edge of the screen.

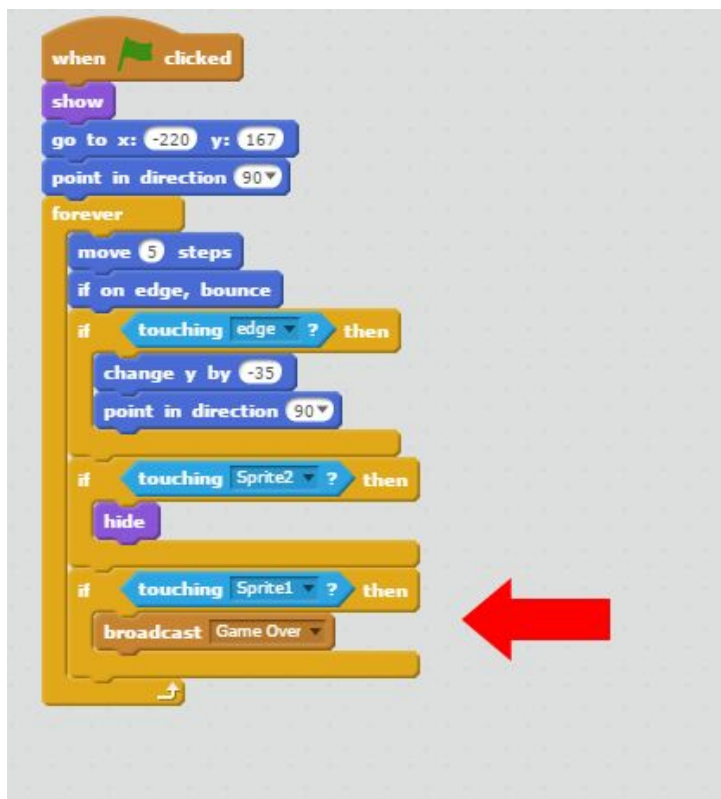
Questions:

- What happens when the alien reaches the edge of the screen?
- How can we quicken the alien's advances?
- Why do we hide the alien when it touches Sprite2 (the laser)?
- How do we change the way the alien looks?

## Step 5: Game Over

Like with any game, we can't win every time so we need to think about what happens when it's game over. For our game, everything finishes when an alien reaches the bottom of the screen and collides into our cannon.

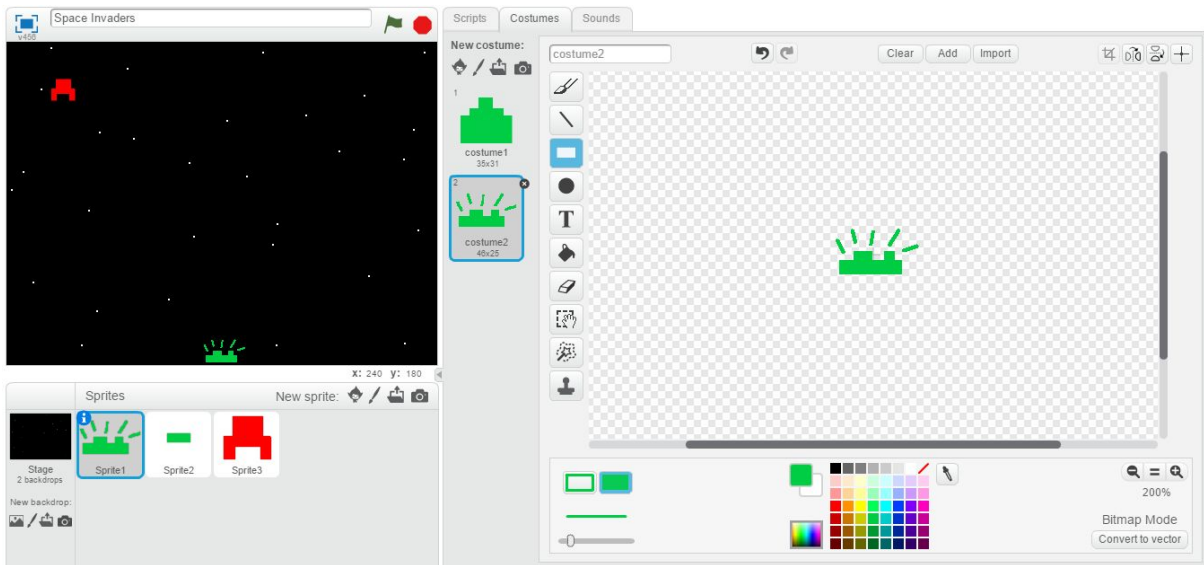
## The Blocks



To programme the game over part of our Space Invaders, we don't need to build new blocks, instead we just need to add to the blocks we built earlier on in the Alien section.

This time we are adding the following, highlighted in the image on the left. This will tell the computer it's game over when the alien comes into contact with Sprite1 (the cannon).

When an alien does collide with our cannon, it would be nice to have the cannon explode to confirm that it's game over for the player. We do this by navigating to the cannon sprite and add another costume for a destroyed cannon as shown below.



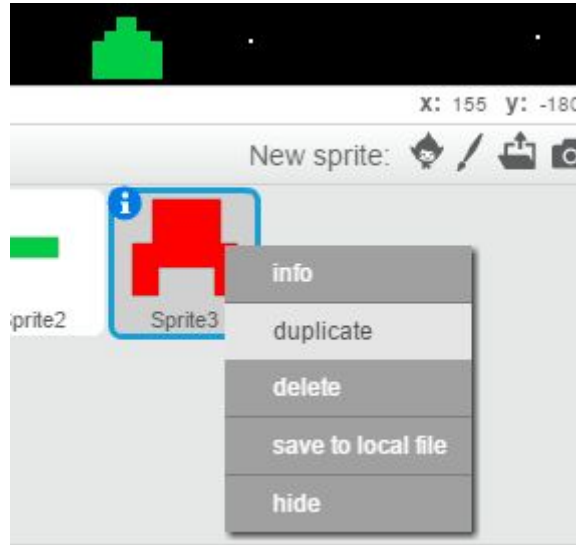
Now let's tell the computer what to do with our blown up cannon. Like everything else, this is done in the blocks.

The Blocks	
<pre>when clicked switch costume to costume1 point in direction 90 go to x: 1 y: -166 forever   if key left arrow pressed? then     move -5 steps   if key right arrow pressed? then     move 5 steps  when I receive Game Over switch costume to costume2 say Game Over stop all</pre>	<p>We also need to add more blocks to the Cannon blocks too. When the computer knows that it's game over, we need to change to look of our cannon to something that has unfortunately been blown up by the aliens.</p> <p>Questions:</p> <ul style="list-style-type: none"><li>• How do we reset the cannon's appearance at the start of each game?</li></ul>

## Step 6: Adding More Aliens

To save us time and effort building each additional alien from the very beginning we can copy the first one we made, copy it over and over until we have a large alien army.

To duplicate the first alien we made, right click on the alien sprite and select the Duplicate option from the menu.



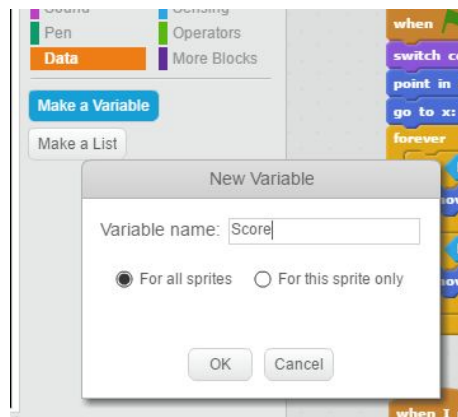
Not only does the sprite get copied but all its blocks do too. For each alien that we copy we will need to add in new starting coordinate else all the aliens will start on top of each other. We do this by changing the starting coordinates in the following block:



## Step 7: Scoring

Let's make things interesting and start keeping score of how many aliens we shoot. We do this by using a variable. Imagine a variable as a piece of paper. Every time we shoot an alien we write the score on the paper, recording it until we need to increase it.

To add a new variable, head on over to the Data section, make a new variable called 'Score' and set it for all sprites.



We now need to instruct the computer to increase our score every time we shoot an alien and we do this in the blocks of every alien sprite we're created.

### The Blocks



Add the blocks as shown in the image to the existing set of Alien blocks. Once completed, hit the green flag button and give it a test by shooting some of the advancing aliens.

Questions:

- Is awarding one point enough? How could we award different points for shooting different aliens?

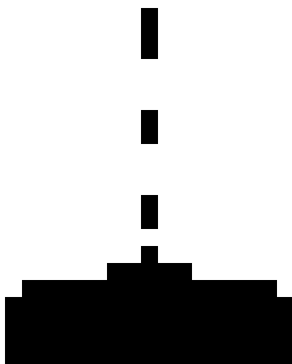


```

when clicked
  set Score to 0
  switch costume to costume1
  point in direction 90
  go to x: 1 y: -166
  forever
    if key left arrow pressed? then
      move -5 steps
    if key right arrow pressed? then
      move 5 steps
  when I receive Game Over
    switch costume to costume2
    say Game Over
    stop all
  
```

Don't forget to reset the score to zero every time we start a new game. We do this by adding the following to our Cannon blocks.

**Well done!** You have successfully coded a Space Invaders game that not only allows you defend Earth against an alien attack but you now have the building blocks to go forward and build your own games and ideas as well as improving on what we've made to make it your own.



Improving our

# SPACE INVADERS

Game

Here are some ideas to think about when improving our game:

- Sound effects.
- What happens when all aliens have been destroyed?
- Making some aliens more difficult to shoot than others.
- Special bonuses to earn more points.
- Aliens firing back.
- Creating cannon shelters.
- Making the game two player.
- High score leaderboard.