



# Andhra Pradesh State Skill Development Corporation



# Scratch Programming

## Introduction of Scratch

## Introduction to Scratch:

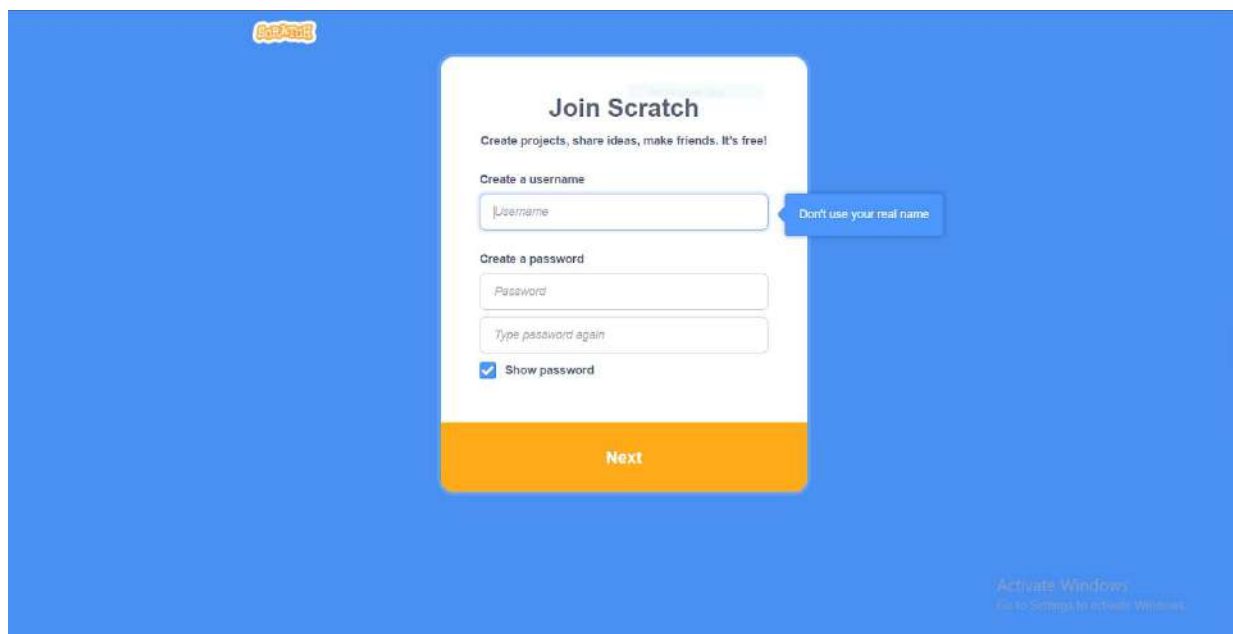
Scratch is a visual programming language that allows students to create their own interactive stories, games and animations. As students design Scratch projects, they learn to think creatively, reason systematically, and work collaboratively. Scratch was created by the Lifelong Kindergarten group at MIT Media lab.

## Getting Started With Scratch


Scratch was first developed in 2003 at the Massachusetts Institute of Technology. It started out as downloadable software but is now an online tool.

To get started, just visit the [Scratch Website](https://scratch.mit.edu) and sign up for an account with your email address.

click **Join Scratch**.

The image shows the Scratch website's sign-up page. At the top left is the Scratch logo. The main heading is "Join Scratch" in bold. Below it is the tagline "Create projects, share ideas, make friends. It's free!". The form has two sections: "Create a username" with a text input field labeled "Username" and a blue tooltip that says "Don't use your real name"; and "Create a password" with two text input fields labeled "Password" and "Type password again". There is a checkbox labeled "Show password" which is checked. At the bottom of the form is a large orange button labeled "Next". In the bottom right corner of the page, there is a small watermark that says "Activate Windows Go to settings to activate Windows."

**Step-1:** Create a username and password for yourself, and then click the **Next** button to move to the next screen:




What country do you live in?

Select country ▼

Next

**Step-2:**After Selecting Country Click on **Next** Button



When were you born?

November ▼ 1995 ▼

We will keep this information private. ?

Next

**Step-3:** Here you're asked to provide some informant about yourself After Entering details click on **Next** Button and move on.

# What's your gender?

Scratch welcomes people of all genders.

☐ Female

☒ Male

☐ Non-binary


☐ Another gender:

☐ Prefer not to say

We will keep this information private. [?](#)

**Next**

**Step-4:**Enter Gender Here and Click on Next.



**What's your email?**

We will keep this information private. [?](#)

By creating an account, you acknowledge the [Privacy Policy](#) and you accept and agree to the [Terms of Use](#).

**Create Your Account**

The form is set against a blue background. The top section features a colorful illustration of a rainbow, a white envelope, and a landscape with green hills, trees, and mountains under a blue sky with clouds and stars. The main content area is white, and the bottom section is a large orange button.

**Step-5:**Provide your email address and you'll receive an email confirmation



# Confirm your Scratch account

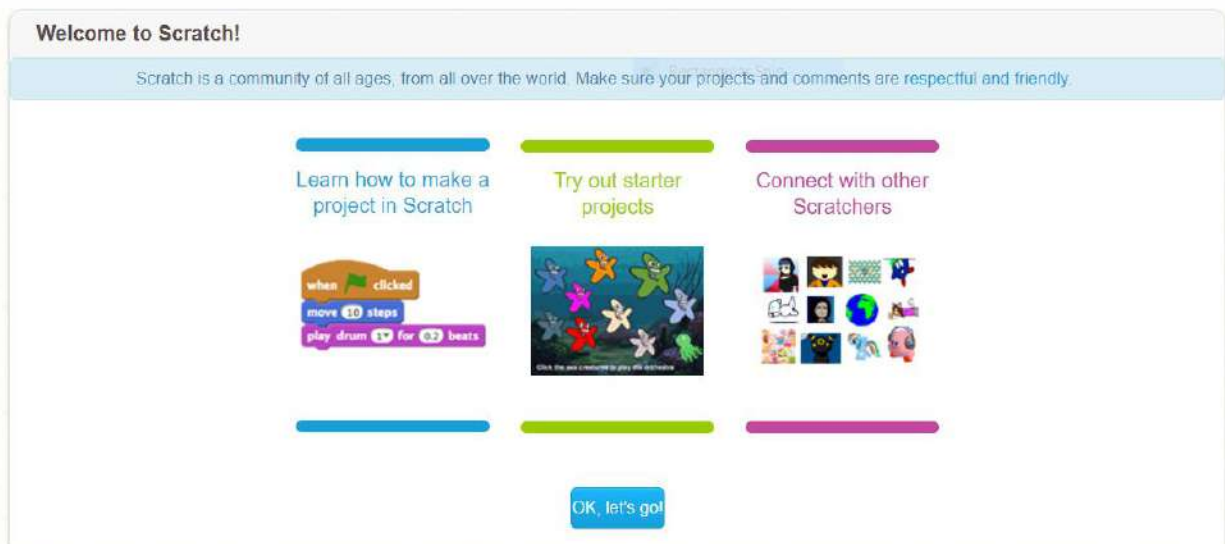
You just signed up for a new Scratch account with the username:



To finish creating your account, click on the link below:

**Confirm my account**

**Step-6:** You have to click the link in your email or click on **confirm my account** to complete the registration process.



You will get Welcome to scratch.

## **Use of Scratch:**

Scratch is a website you can use to create your own interactive stories, games, and animations! With Scratch you can:

- Write simple computer programs
- Create computer stories, games, and animations
- Share stories, games, and animations with others

## **Introduction to Computer and programming:**

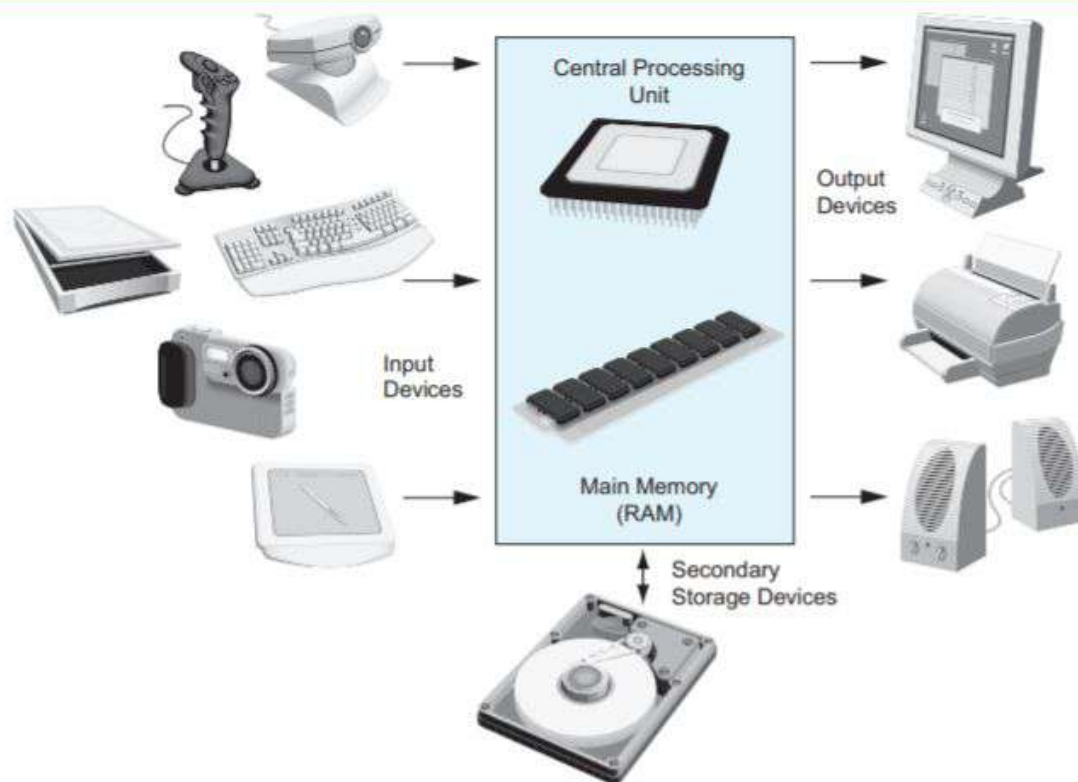
- Computer programming is the process of designing and writing computer programs.
- computers for tasks such as writing papers, searching for articles, sending email, and participating in online classes. At work, people use computers to analyze data, make presentations, conduct business transactions, communicate with customers and coworkers, control machines in manufacturing facilities, and do many other things. At home, people use computers for tasks such as paying bills, shopping online, communicating with friends and family, and playing computer games
- The uses of computers are almost limitless in our everyday lives.
- Computers can do such a wide variety of things because they can be programmed. This means that computers are not designed to do just one job, but to do any job that their programs tell them to do. A program is a set of instructions that a computer follows to perform a task.
- Programs are commonly referred to as software. Software is essential to a computer because it controls everything the computer does. All of the software that we use to make our computers useful is created by individuals working as programmers or software developers. A programmer, or software developer, is a person with the training and skills necessary to design, create, and test computer programs. Computer programming is an exciting and rewarding career. Today, you will find programmers' work used in business, medicine, government, law enforcement, agriculture, academics, entertainment, and many other fields



## Hardware and Software

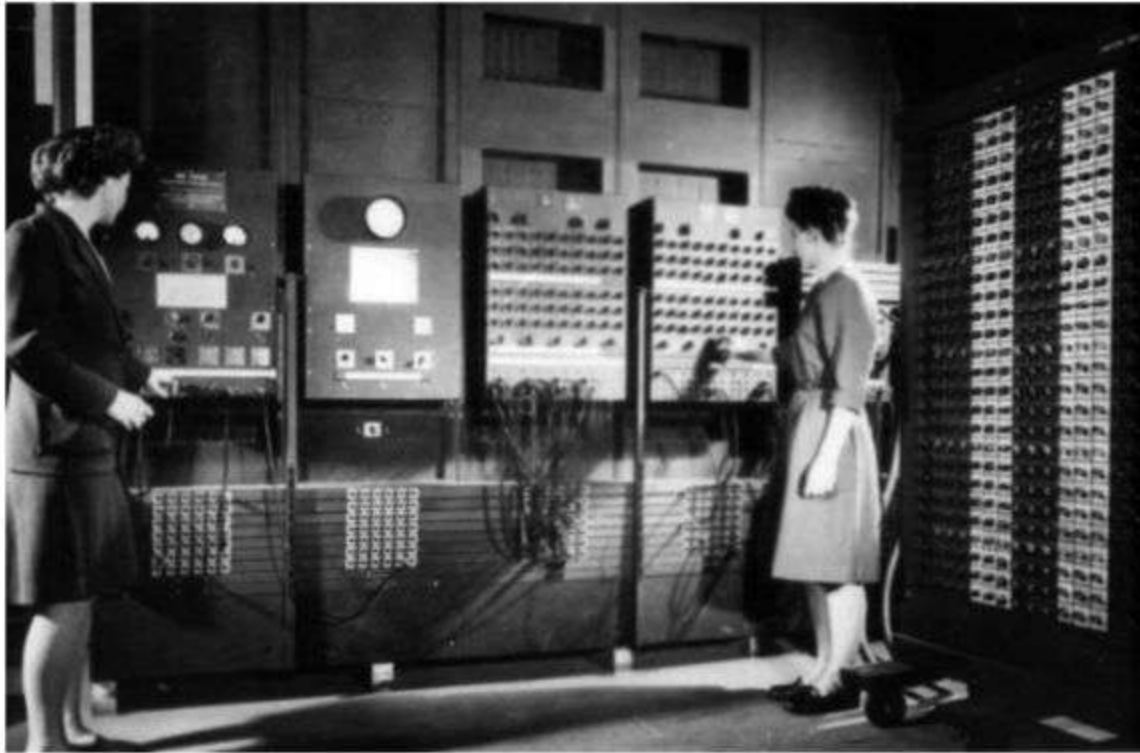
- The physical devices that a computer is made of are referred to as the computer's hardware. The programs that run on a computer are referred to as software.
  - If you have ever shopped for a computer, you've probably seen sales literature listing components such as microprocessors, memory, disk drives, video displays, graphics cards, and so on.
  - A typical computer system consists of the following major components:
- The central processing unit (CPU)
  - Main memory
  - Secondary storage devices
  - Input devices

- Output devices



## The CPU:

- When a computer is performing the tasks that a program tells it to do, we say that the computer is running or executing the program. The central processing unit, or CPU, is the part of a computer that actually runs programs. The CPU is the most important component in a computer because without it, the computer could not run software. In the earliest computers, CPUs were huge devices made of electrical and mechanical components such as vacuum tubes and switches
- The two women in the photo are working with the historic ENIAC computer. The ENIAC, which is considered by many to be the world's first programmable electronic computer, was built in 1945 to calculate artillery ballistic tables for the U.S. Army. This machine, which was primarily one big CPU, was 8 feet tall, 100 feet long, and weighed 30 tons.



The ENIAC computer (courtesy of U.S. Army Historic Computer Images)

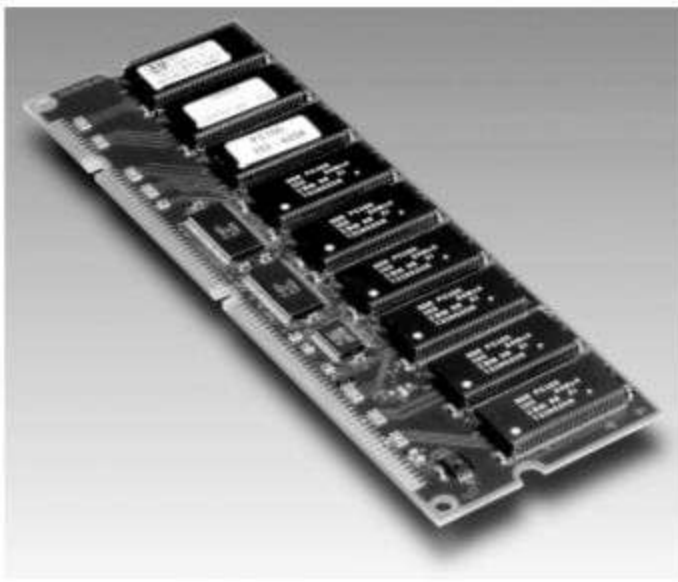
Today, CPUs are small chips known as microprocessors.



A lab technician holds a modern microprocessor.

## **Main Memory**

- You can think of main memory as the computer's work area. This is where the computer stores a program while the program is running, as well as the data that the program is working with. For example, suppose you are using a word processing program to write an essay for one of your classes. While you do this, both the word processing program and the essay are stored in main memory.
- Main memory is commonly known as random-access memory, or RAM. It is called this because the CPU is able to quickly access data stored at any random location in RAM. RAM is usually a volatile type of memory that is used only for temporary storage while a program is running. When the computer is turned off, the contents of RAM are erased. Inside your computer, RAM is stored in chips,



### **Secondary Storage Devices:**

Secondary storage is a type of memory that can hold data for long periods of time, even when there is no power to the computer. Programs are normally stored in secondary memory and loaded into main memory as needed. Important data, such as word processing documents, payroll data, and inventory records, is saved to secondary storage as well. The most common type of secondary storage device is the disk drive. A disk drive stores data by magnetically encoding it onto a circular disk. Most computers have a disk drive mounted inside their case. External disk drives, which connect to one of the computer's communication ports, are also available. External disk drives can be used to create backup copies of important data or to move data to another computer. In addition to external disk drives, many types of devices have been created for copying data, and for moving it to other computers. For many years floppy disk drives were popular. A floppy disk drive records data onto a small floppy disk, which can be removed from the drive. Floppy disks have many disadvantages, however. They hold only a small amount of data, are slow to access data, and can be unreliable. The use of floppy disk drives has declined dramatically in recent years, in favor of superior devices such as USB drives. USB drives are

small devices that plug into the computer's USB (universal serial bus) port, appear to the system as a disk drive. These drives do not actually contain a disk, however. They store data in a special type of memory known as flash memory. USB drives, which are also known as memory sticks and flash drives, are inexpensive, reliable, and small enough to be carried in your pocket. Optical devices such as the CD (compact disc) and the DVD (digital versatile disc) are also popular for data storage. Data is not recorded magnetically on an optical disc, but is encoded as a series of pits on the disc surface. CD and DVD drives use a laser to detect the pits and thus read the encoded data. Optical discs hold large amounts of data, and because recordable CD and DVD drives are now commonplace, they are good mediums for creating backup copies of data.

### **Input Devices:**

Input is any data the computer collects from people and from other devices. The component that collects the data and sends it to the computer is called an input device. Common input devices are the keyboard, mouse, scanner, microphone, and digital camera. Disk drives and optical drives can also be considered input devices because programs and data are retrieved from them and loaded into the computer's memory.

### **Output Devices:**

Output is any data the computer produces for people or for other devices. It might be a sales report, a list of names, or a graphic image. The data is sent to an output device, which formats and presents it. Common output devices are video displays and printers. Disk drives and CD recorders can also be considered output devices because the system sends data to them in order to be saved.

### **Software :**

If a computer is to function, software is not optional. Everything that a computer does, from the time you turn the power switch on until you shut the system down,

is under the control of software. There are two general categories of software: system software and application software. Most computer programs clearly fit into one of these two categories. Let's take a closer look at each.

### **System Software :**

The programs that control and manage the basic operations of a computer are generally referred to as system software. System software typically includes the following types of programs:

#### **Operating Systems:**

An operating system is the most fundamental set of programs on a computer. The operating system controls the internal operations of the computer's hardware, manages all of the devices connected to the computer, allows data to be saved to and retrieved from storage devices, and allows other programs to run on the computer.

#### **Utility Programs**

A utility program performs a specialized task that enhances the computer's operation or safeguards data. Examples of utility programs are virus scanners, file compression programs, and data backup programs.

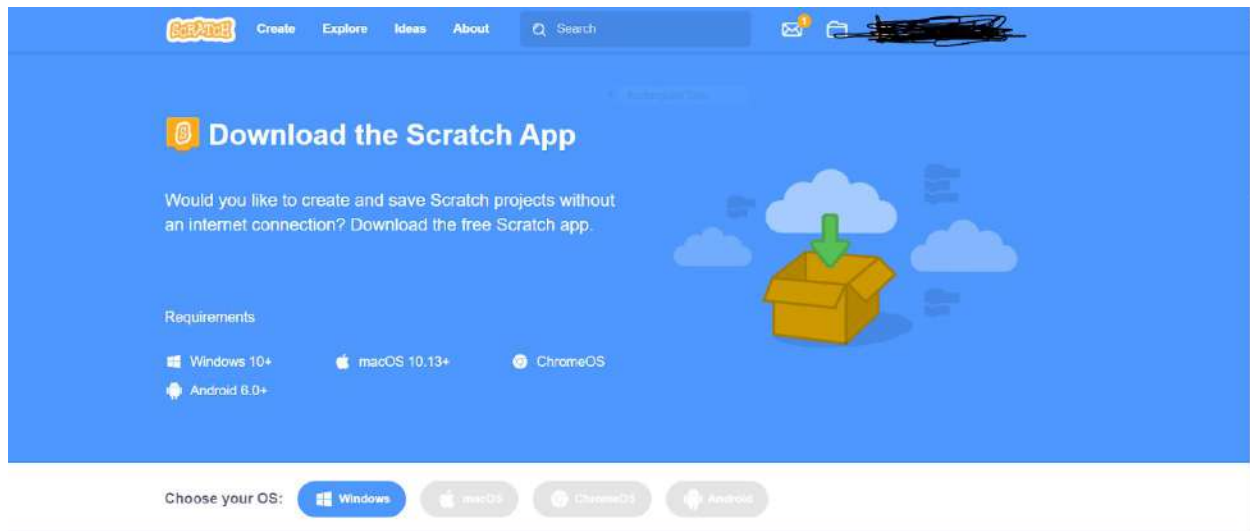
#### **Software Development Tools**

Software development tools are the programs that programmers use to create, modify, and test software. Assemblers, compilers, and interpreters are examples of programs that fall into this category. Application Software Programs that make a computer useful for everyday tasks are known as application software. These are the programs that people normally spend most of their time running on their computers. Microsoft Word, a word processing program, and Adobe Photoshop, an image editing program. Some other examples of application software are spreadsheet programs, email programs, web browsers, and game programs.

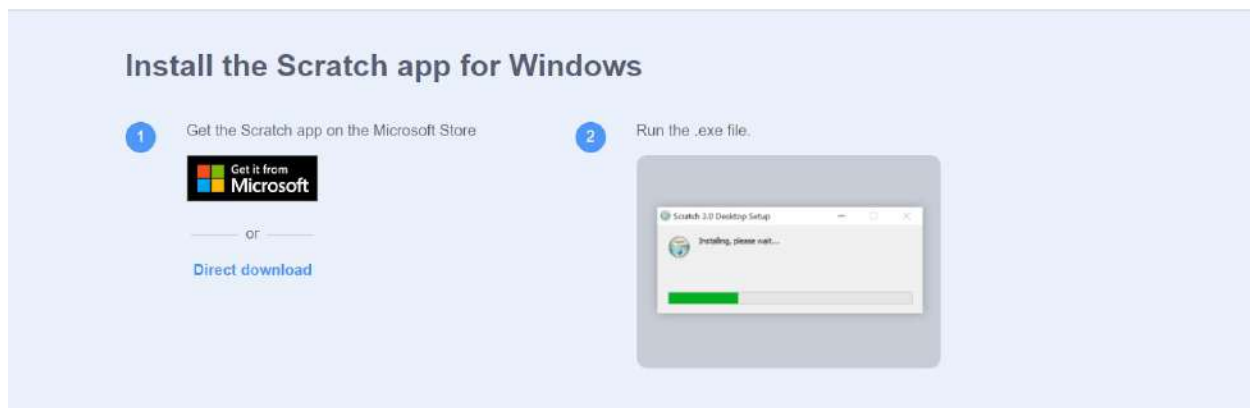


## Installation Of Scratch:

- [Download the scratch application](#) by clicking the link.



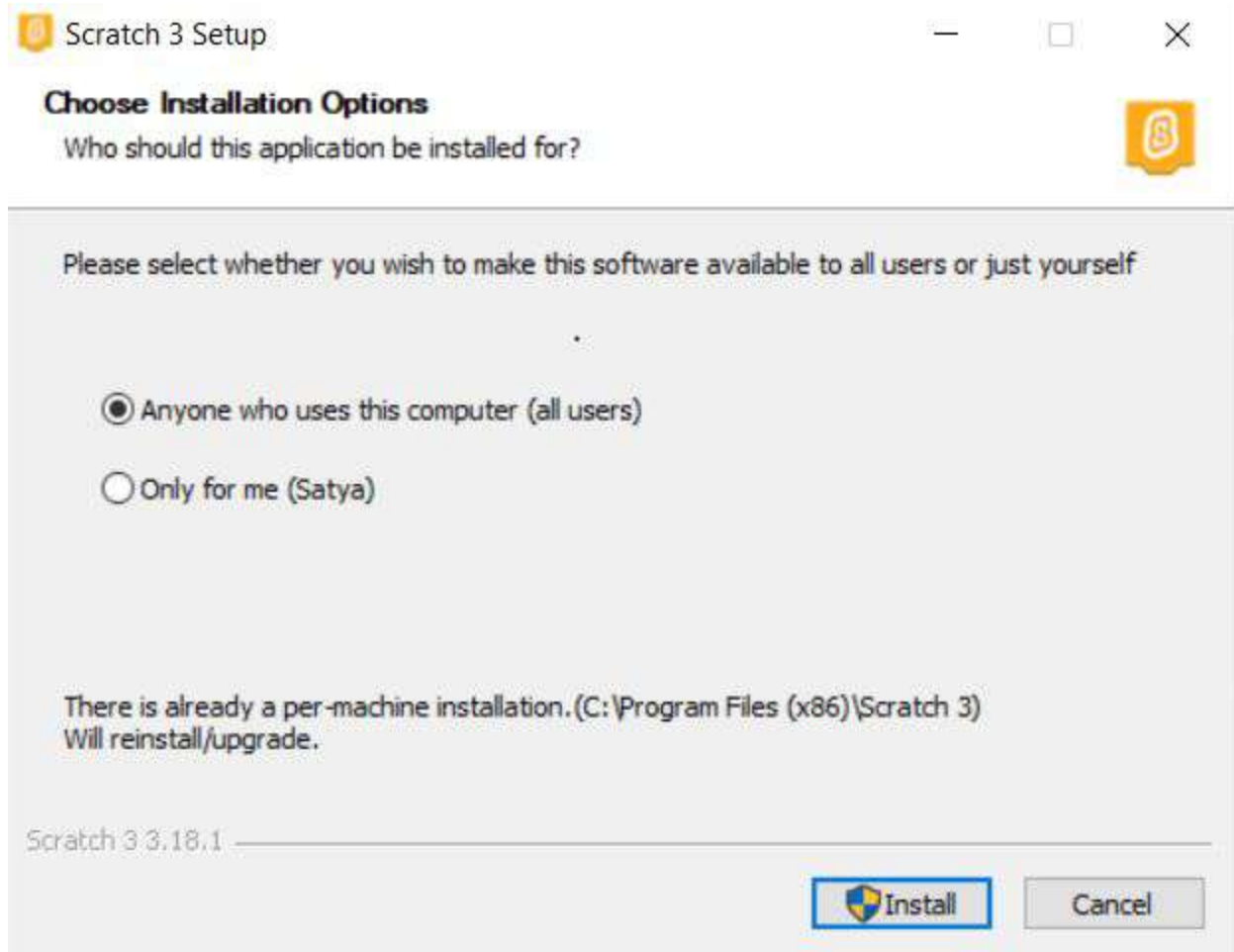
- If your windows user you can directly download by clicking on **direct download**.



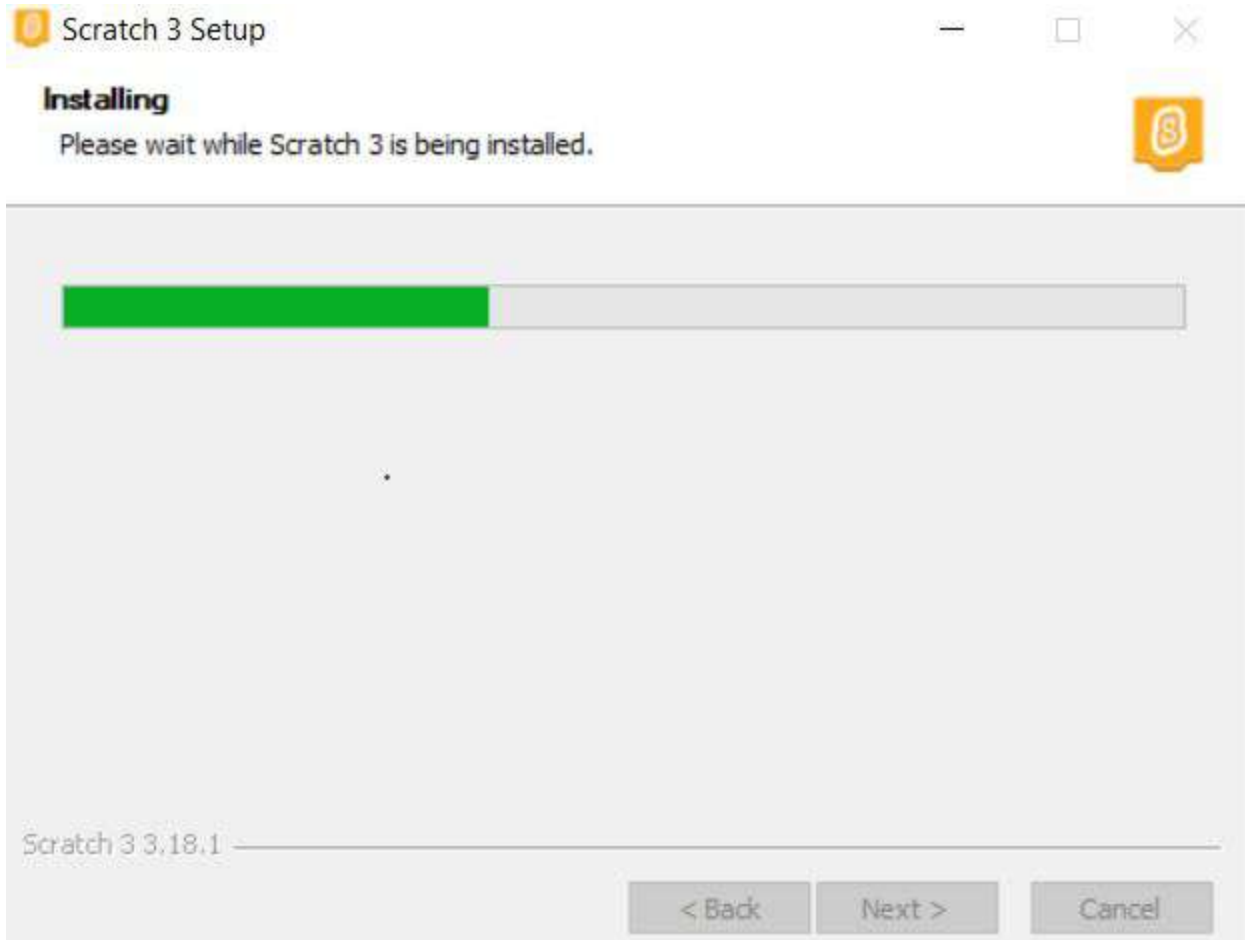
- After download you will get the software with the below icon on your local system.



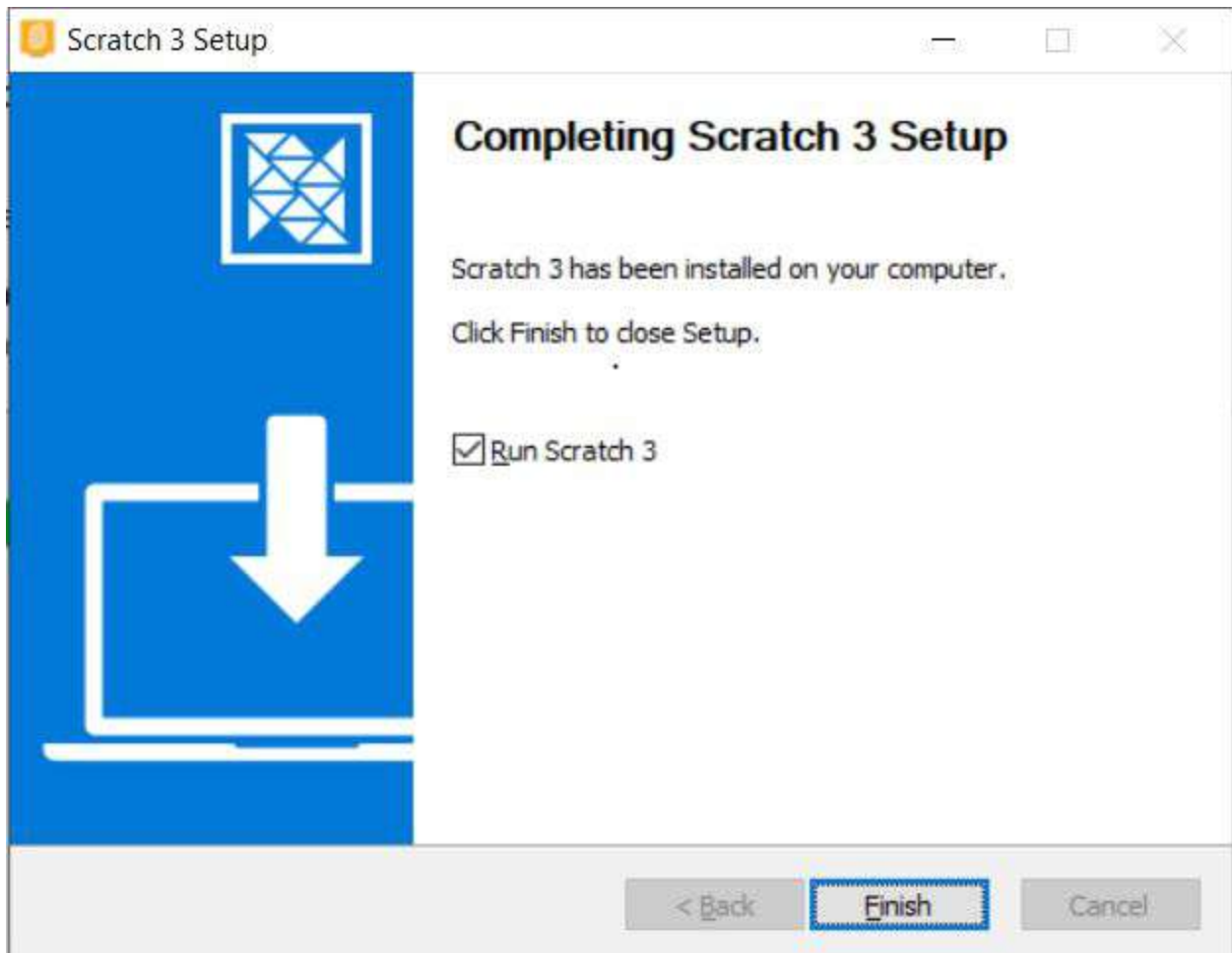
- By double clicking that icon you will get below like that In this we can select anyone who uses this computer(all users) or only for me(specific)



- Click On Install button.



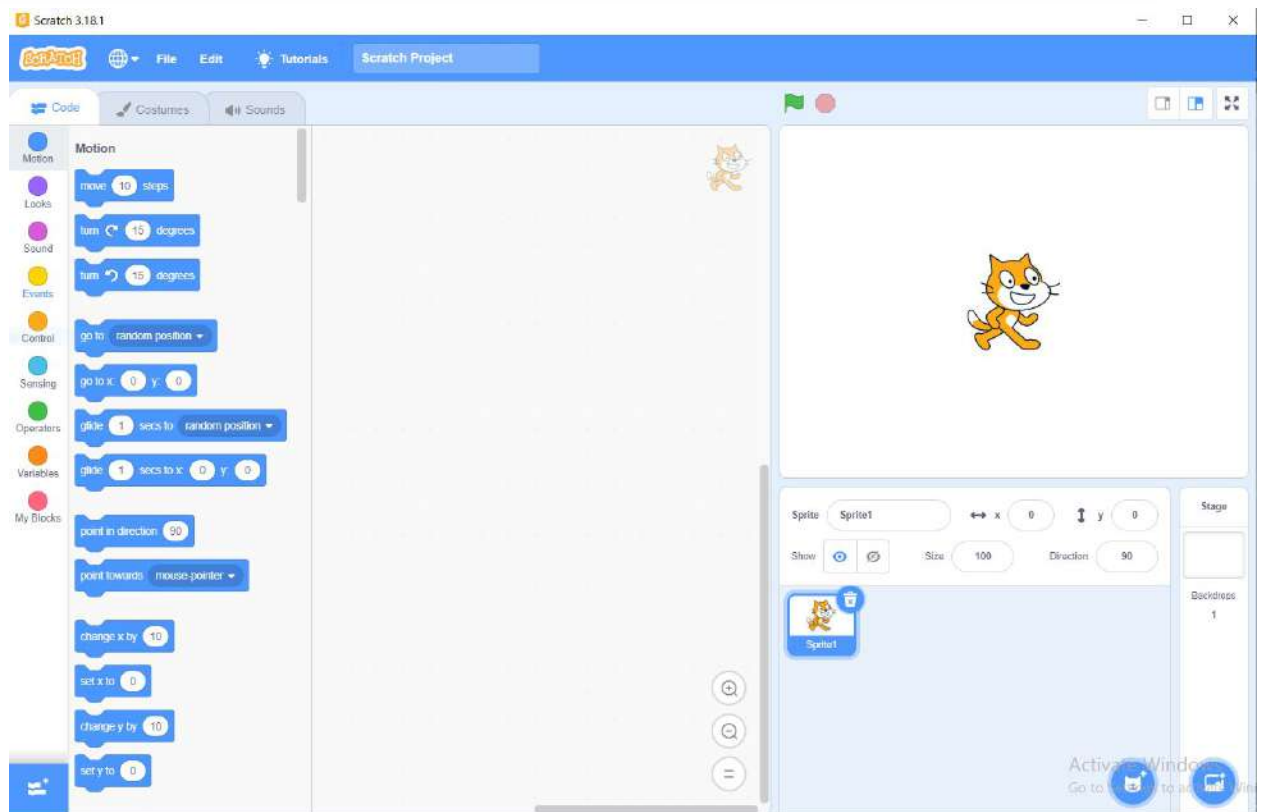
- Installation complete then click on finish Button.

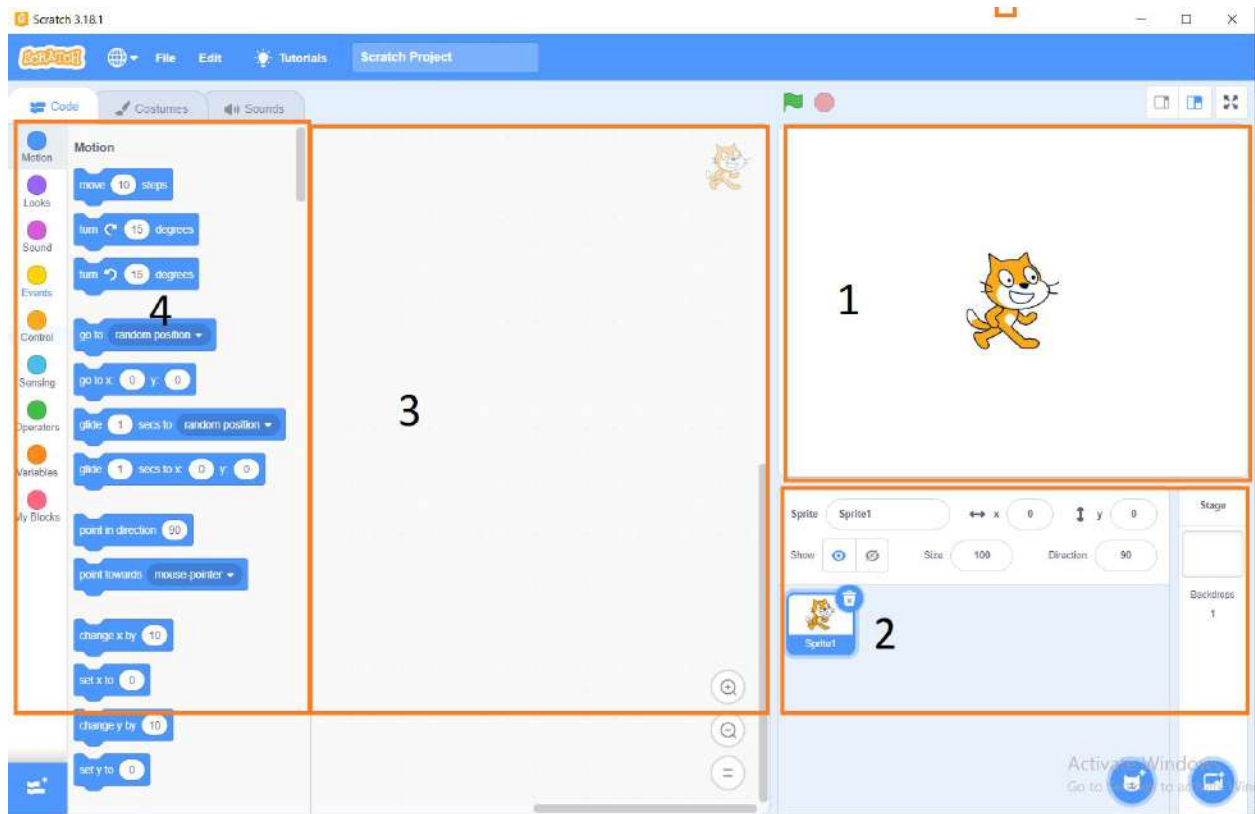


- Successfully Installed Scratch.
- Scratch is a programming language created by the Lifelong Kindergarten group at MIT. It is normally run as a web-based application through a web browser , but there are also offline versions.
- Scratch is usually considered the first choice when looking at a PC based programming language for teaching primary school children.
- The latest version is Scratch version 3 which is primarily web-based and accessed through a web browser using the HTML 5. This is an improvement on the older versions which were reliant on the proprietary flash plug-in.

## Getting started with Scratch

- Scratch uses a drag-and-drop approach to programming making it very easy to use. It comes with a development environment that can be used to create programs without needing to learn any complicated rules about the computer language.
- You can start with Scratch by going to [scratch.mit.edu](https://scratch.mit.edu) or offline software.





## 1.The Scratch stage

- The most important part of the Scratch application is the stage area (1), this is a representation of the screen when the program is running. The look of the game will be designed on the stage area and it's also where you can see the program run. You can enlarge the stage to fill the screen using the small icons to the top right of that section.
- There is a Green Flag, which is used to start the program running and a Red Stop Sign, used to stop the program.

## 2.The sprite list area:

- If the screen is a stage then the sprites are the actors, props and special effects used to create the show. In Scratch a sprite can have it's own costumes, code and sounds associated with it.

- New sprites are created in the sprite list area (2) where they can then be loaded into the sprite editing area.
- The stage is considered a special type of sprite and is always shown in the right part of the sprites list area. The stage can contain multiple backdrops used to change the image shown on the background of the stage.

### **3.The sprite edit area:**

- When we want to change a sprite then we load it into the sprite edit area (3). Sprites are loaded into this section by click on them in the sprite list, where they will then be shown with a border. There are three tabs in the sprite area called Code, Costumes and Sounds.
- In Scratch the program is grouped into code scripts which are accessed through the Code tab. It is fairly common to have several scripts of code associated with each sprite. The stage can also have its own code which is often used to control the sprites or the stage background.
- The costumes tab is used to change the look of a sprite. It does not need to be a different form of clothing (although that is one use of a costume), it could be used to represent a different object or completely different look (such as a firework rocket which changes to a burst of light when it explodes). When editing the stage the costumes tab is replaced with a Backdrops tab which can be used to change the scene.

### **4.The code blocks area:**

- The code blocks area (4) holds the blocks of code that can be built together to make the program. Each block of code is shaped with interlocking tabs which can be connected with other appropriate blocks of code.
- This area will only show when the code tab is selected.
- The blocks of code are grouped into nine different groups which are colour coded. In version 3 of Scratch you can access the different types of code block by scrolling through the code blocks, or you can jump straight to that part by clicking on the colour circle on the left.





**Motion** – moving a sprite around the screen.

## Motion

move 10 steps

turn 15 degrees

turn 15 degrees

go to random position ▼

go to x: 0 y: 0

glide 1 secs to random position ▼

glide 1 secs to x: 0 y: 0

point in direction 90

point towards mouse-pointer ▼

change x by 10

set x to 0

change y by 10

set y to 0

if on edge, bounce



**Looks** – appearance of the sprite. Also used to represent bubble speech.

## Looks

say Hello! for 2 seconds

say Hello!

think Hmm... for 2 seconds

think Hmm...

switch costume to costume2 ▼

next costume

switch backdrop to backdrop1 ▼

next backdrop

change size by 10

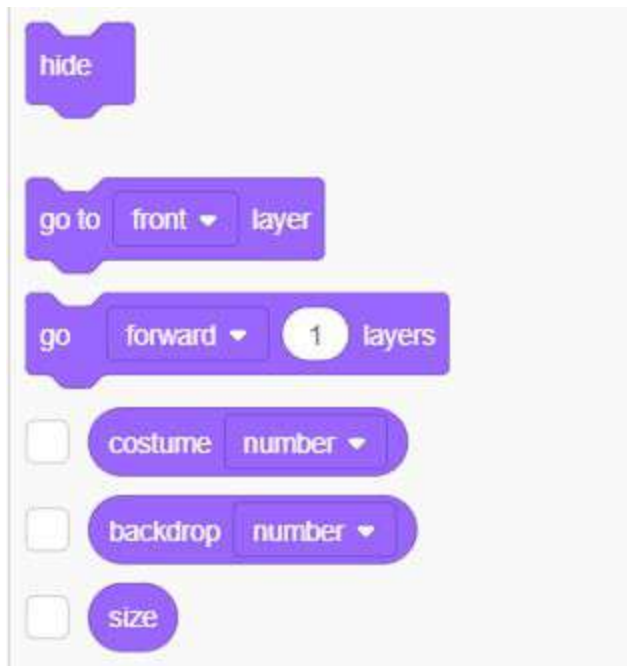
set size to 100 %

change color ▼ effect by 25

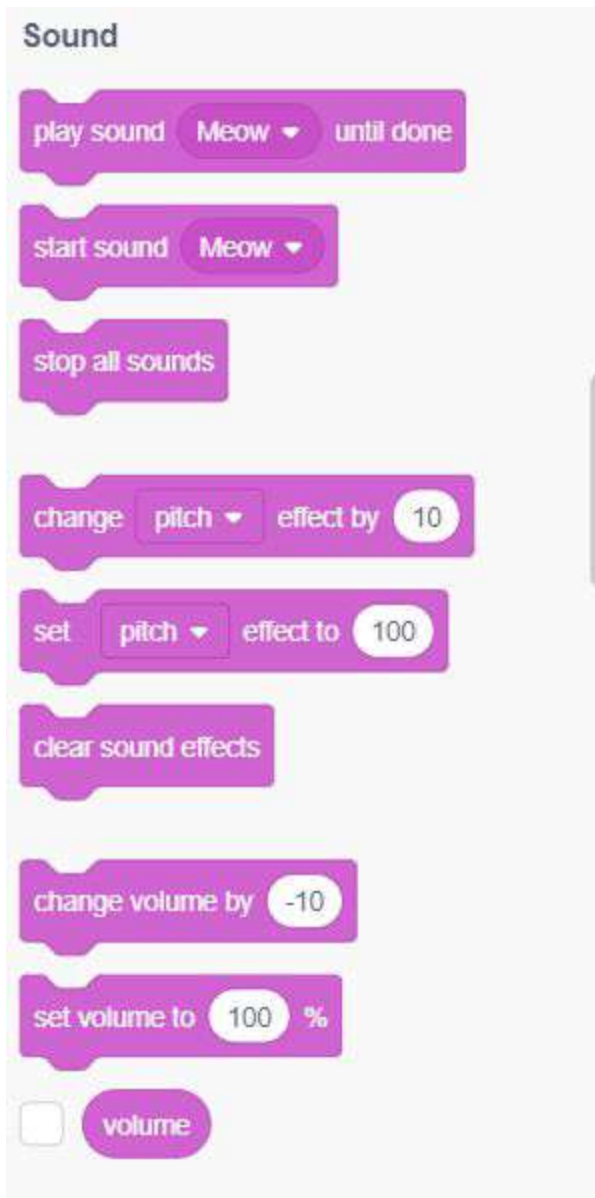
set color ▼ effect to 0

clear graphic effects

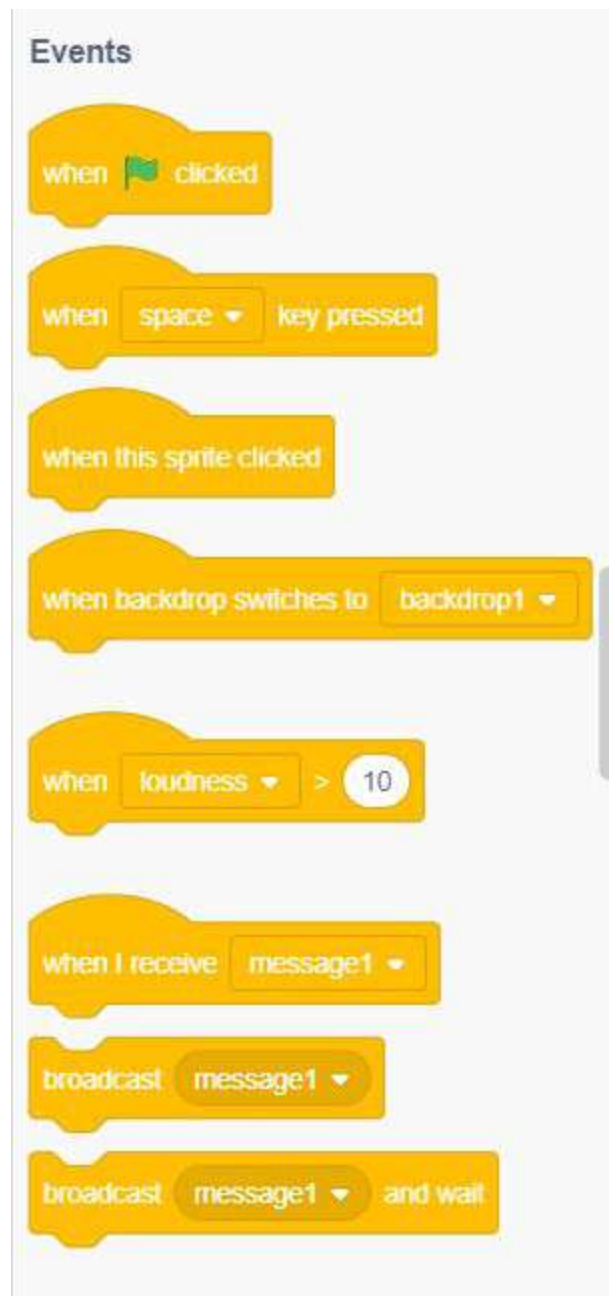
show



**Sound** – make noises and play music



**Events** – blocks that indicate when the code should start running

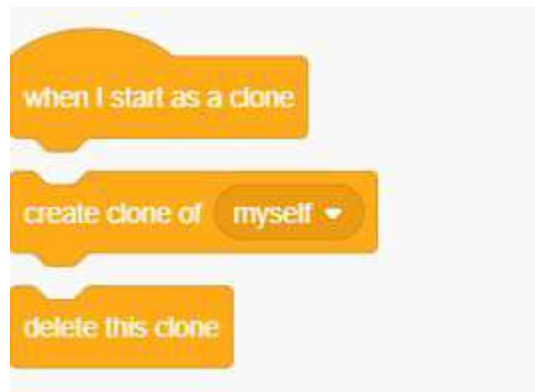


**Control** – used to control the flow of the code and handle decisions



## Control





**Sensing** – detect the position of the sprite and the mouse

## Sensing

touching mouse-pointer ▼ ?

touching color  ?

color  is touching  ?

distance to mouse-pointer ▼

ask What's your name? and wait

☐ answer

key space ▼ pressed?

mouse down?

mouse x

mouse y

set drag mode draggable ▼

☐ loudness

☐ timer

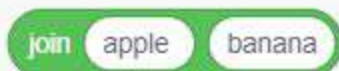
reset timer

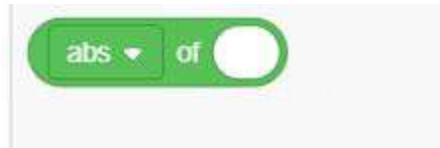
backdrop # ▼ of Stage ▼



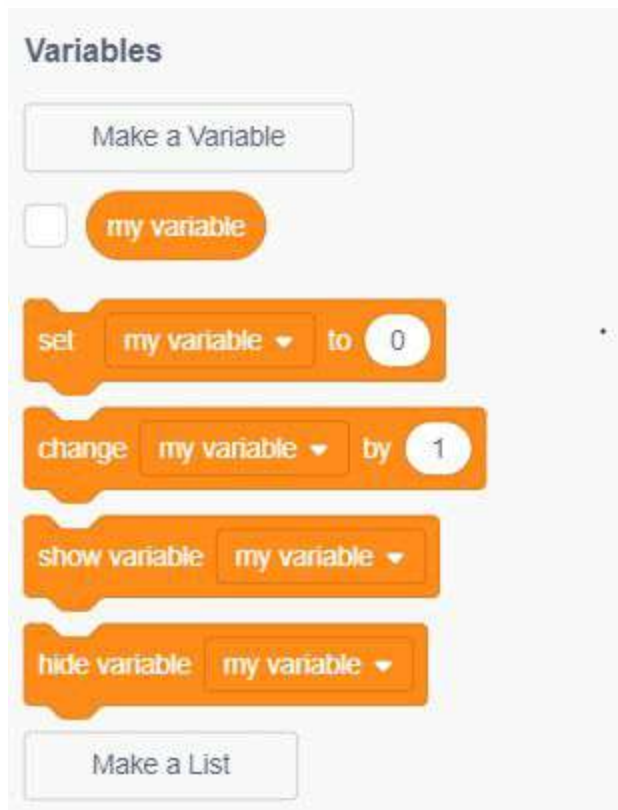
**Operators** – perform logical and mathematical operations

## Operators

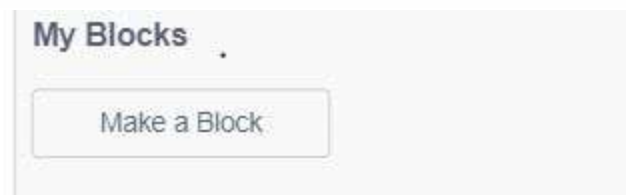




**Variables** – variables which can be used to hold information such as numbers or text



**My blocks** – your own custom blocks



There is also a menu bar across the top of the screen, along with the usual menu options the menu bar is useful for naming and sharing the project or downloading a copy to your local computer.



Before starting making the application it's a good idea to give the project a name. As long as you are logged in the game will then be saved as you work through it.

## **Music and Visual Arts:**

In scratch programming to create Art and Music oriented projects, we can use the pen, looks and sound blocks effectively. By using Looks block we can change the size, colour, costumes and effects to the sprites. The paint or graphic editor allows us to create or import our sprites and backgrounds as well as edit Scratch sprites and backgrounds. The Sound blocks have many built-in sounds, but we can also record sounds in Scratch and we can simply upload recorded sounds from our system.



## Looks

switch backdrop to backdrop1 ▾

switch backdrop to backdrop1 ▾ and wait

next backdrop

change color ▾ effect by 25

set color ▾ effect to 0

clear graphic effects

☐ backdrop number ▾

## Sound

play sound pop ▾ until done

start sound pop ▾

stop all sounds

change pitch ▾ effect by -10

set pitch ▾ effect to 100

clear sound effects

change volume by -10

set volume to 100 %

☐ volume

## Violin sounds project:

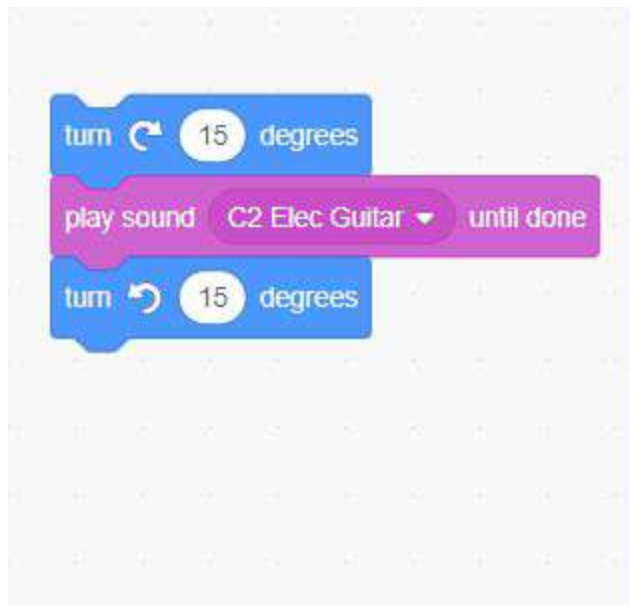
Let's build a sample project by using looks and sounds blocks. First, we have to import some sample violin sounds in new project MusicApp. Take the image that displays when we run our application with music sounds. When we looking to the programming first we have to take when flag clicked block.



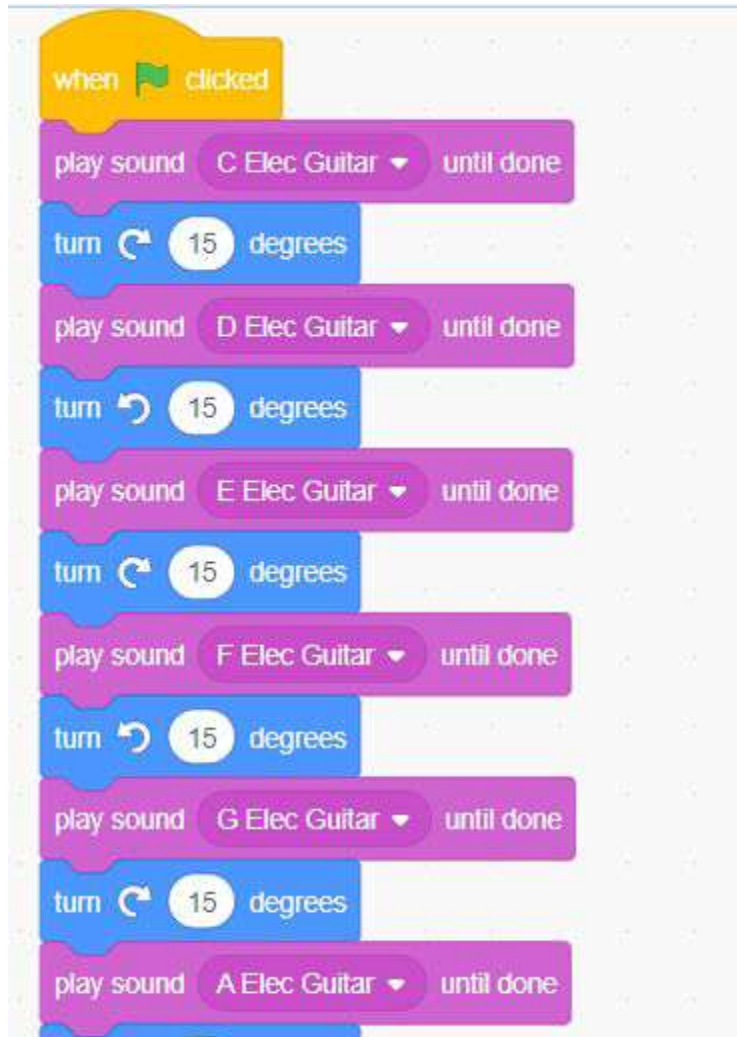
After the Flag Block I took **play sound (sound) until done** block. In this block, we can select which sound should audible when we run.



To change the position of the image for every violin sound we have to take motion block with the required direction



we can add some sounds to our project.



Task on the above content:

Try to build scratch applications using Looks, Motion and Sound blocks.

### Control Blocks:

Control blocks used to control the flow of scripts. Mainly they are 11 blocks (1 Hat block, 5 C blocks, 3 Stack blocks and 2 Cap blocks) are there depending on our requirement we can use those blocks. Mainly we use these control blocks for time duration and control the scripts using control blocks. Let's give some examples of how to use control blocks.

## Pen using draw the triangle:

Initially, to draw any design using Pen first we need to add a pen to our code blocks. At the bottom corner of the left side, we have an extension option. First we have to add the pen to our code blocks. Then only we can draw diagrams using a pen. Let's see how to draw a triangle using the pen. Here we can draw a pen when a flag is clicked.

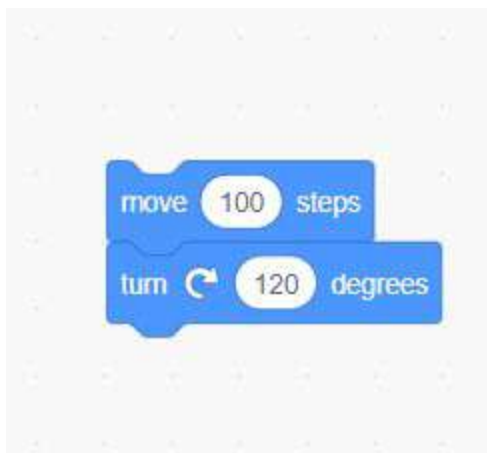
- First, we have to add when the flag is clicked



- From pen blocks select the pen down block to draw a line



- Give length of the line in the format of pixels. To get the triangle to give 120 degrees to motion block



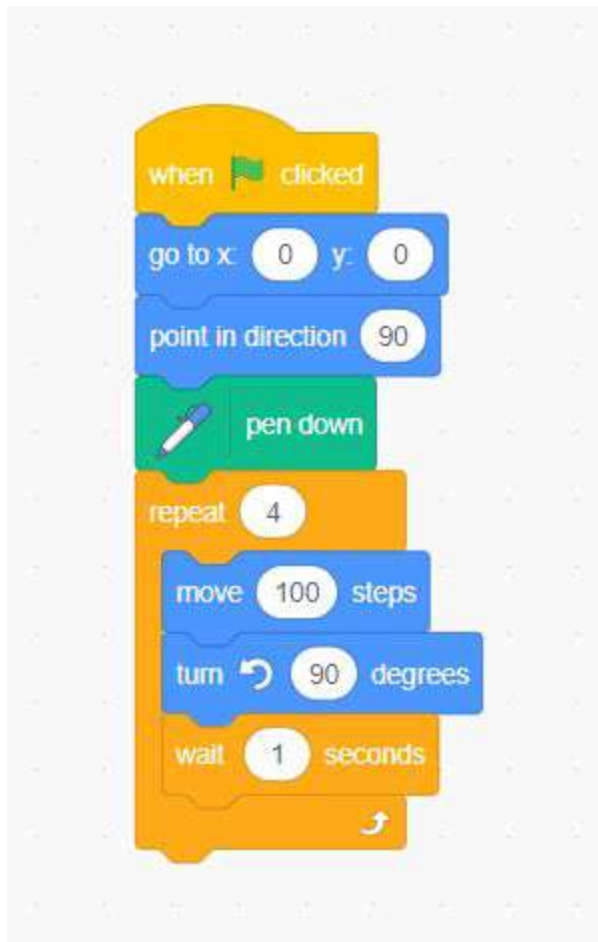
➤

- Add 1-second duration for every side and include this entire blocks in repeat control block with 3 time's repatriation
- 

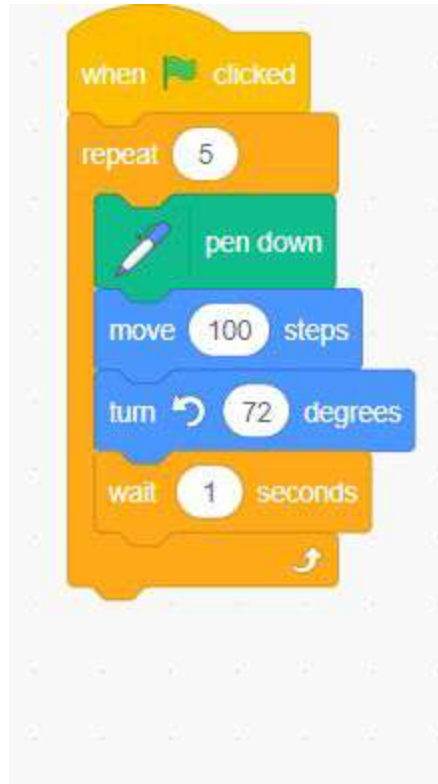
## Draw a rectangle, Square and Hexagon:

We follow the same procedure as a triangle but with different degrees and repetition of occurring.

- For Square :



- For Hexagon:



Task: Draw the Star using Pen

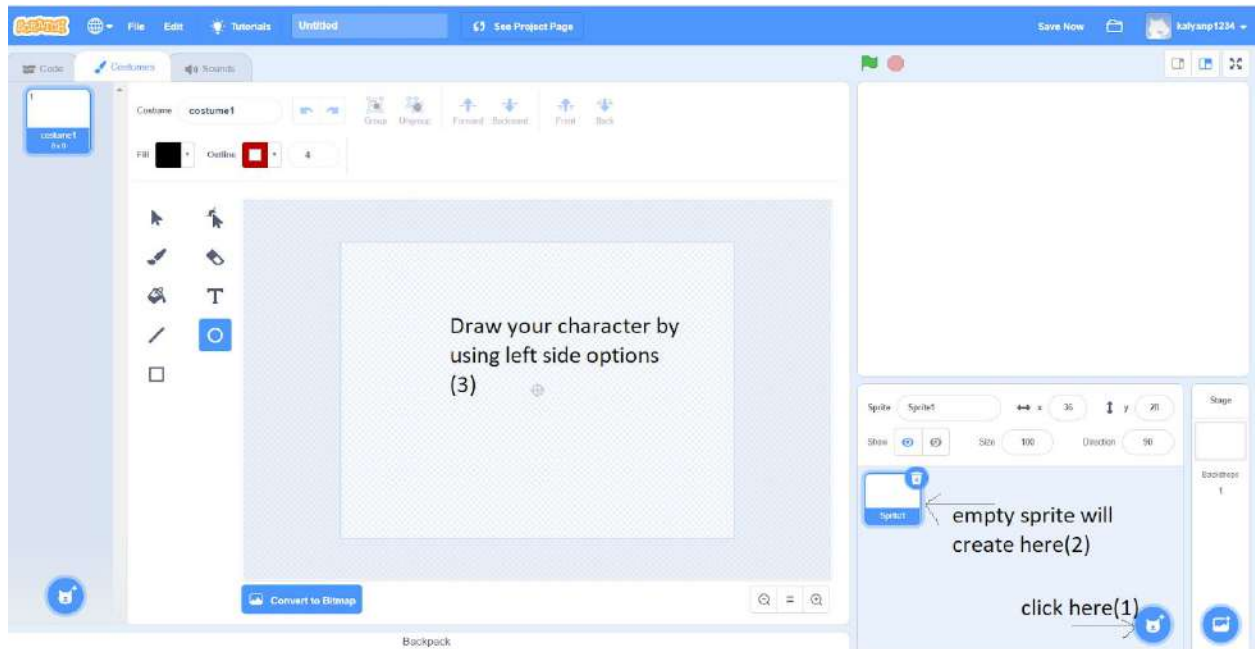
**Section:**  
**Animations:**

**Create a character:**

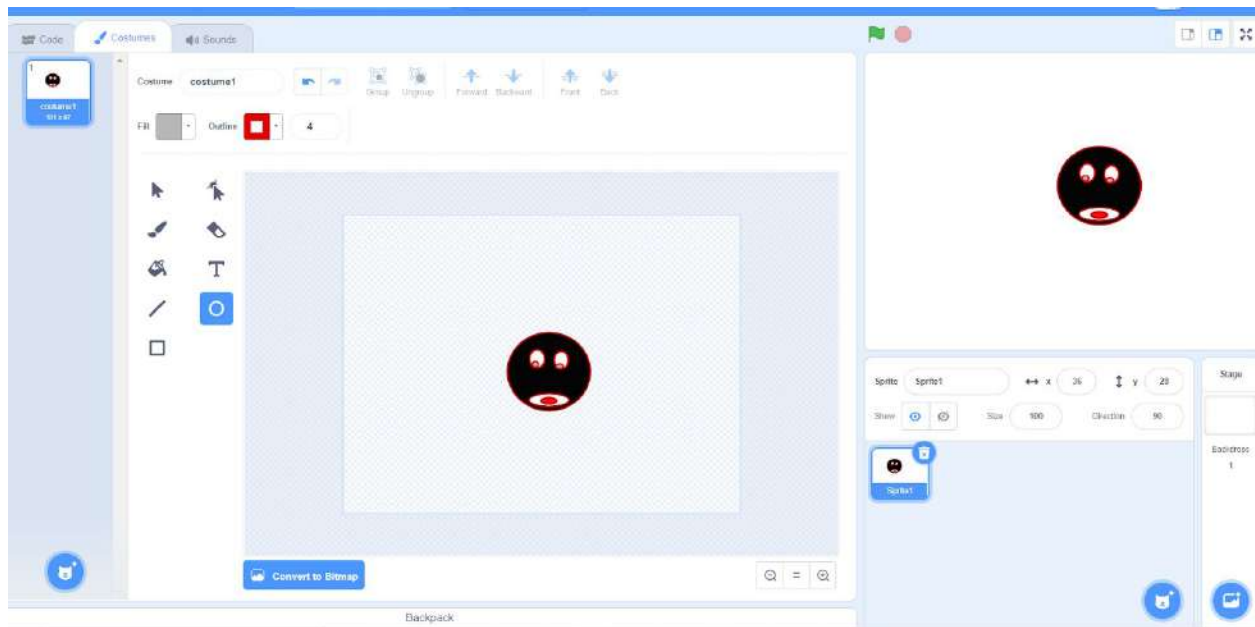
To create any character we can use costumes. In the costumes menu at the bottom of the right side, from the sprite window click on the sprite image. It will show a different list,

- Choose a sprite
- Paint
- Surprise
- Upload from computer

from those list select paint option to draw a character or sprite.



We can draw our character like below



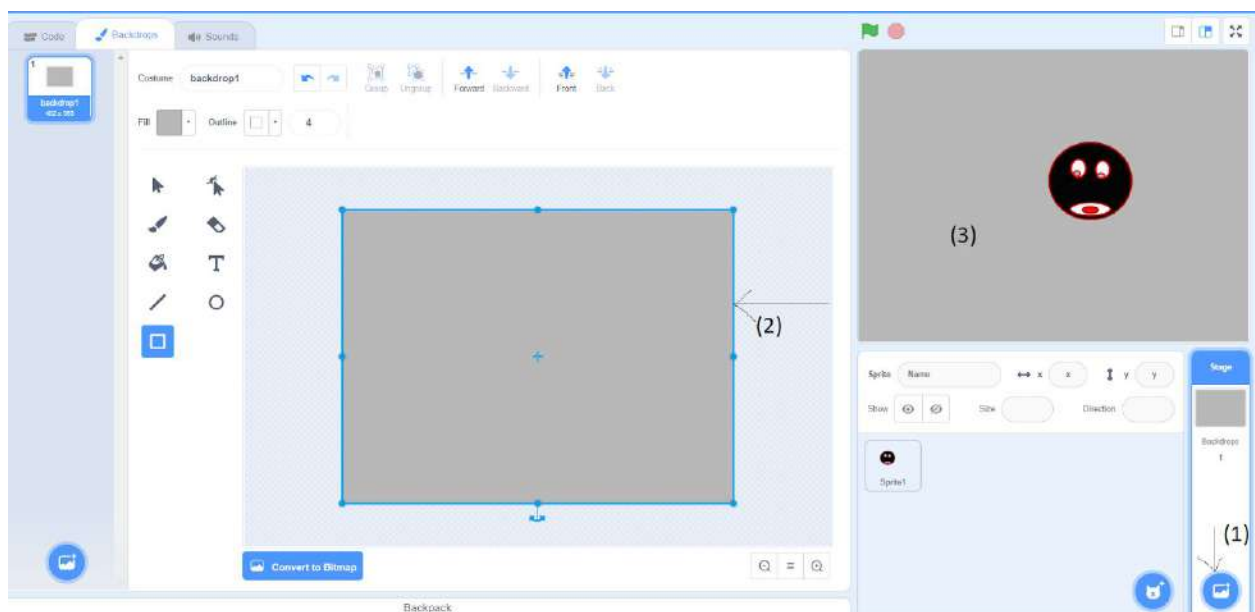
**Adding and changing background:**



Right side sprite window we have a backdrop window. In that click on image then we can see below list

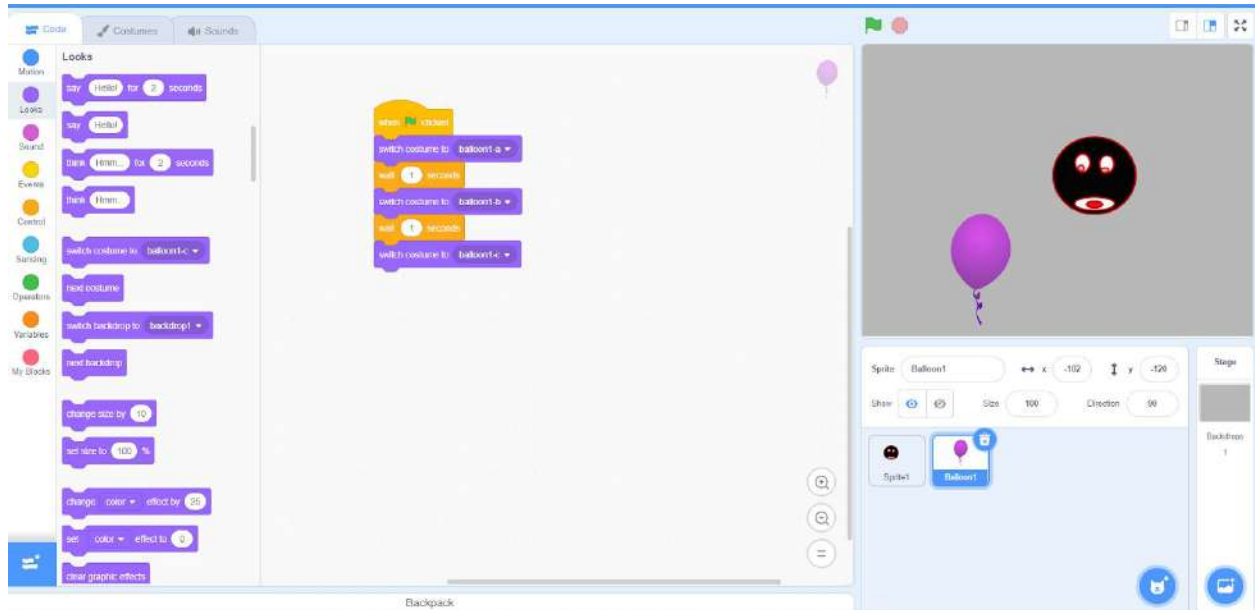
- Choose a backdrop
- Paint
- Surprise
- Upload backdrop

Based on your requirement you can choose any option. To draw a background choose Paint option. Draw your backdrop by using left-side options. Finally, you can see output character with the backdrop on the right side



Ex: Animating a balloon:

First, we need to import a balloon with 3 different colours and then try to code to change sprite for every 1 second and import our newly created sprite to observe the changing of balloon colour.







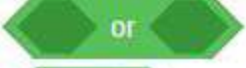


## Operators:

Operators blocks are one of the ten categories of scratch blocks. They are colour-coded light-green and are used to script math equations and string handling.

There are currently 18 Operators blocks:

- 7 Boolean blocks
- 11 Reporter blocks

The following 7 Operators Boolean Blocks:

- 
- 
- 
- 
- 
- 
- 

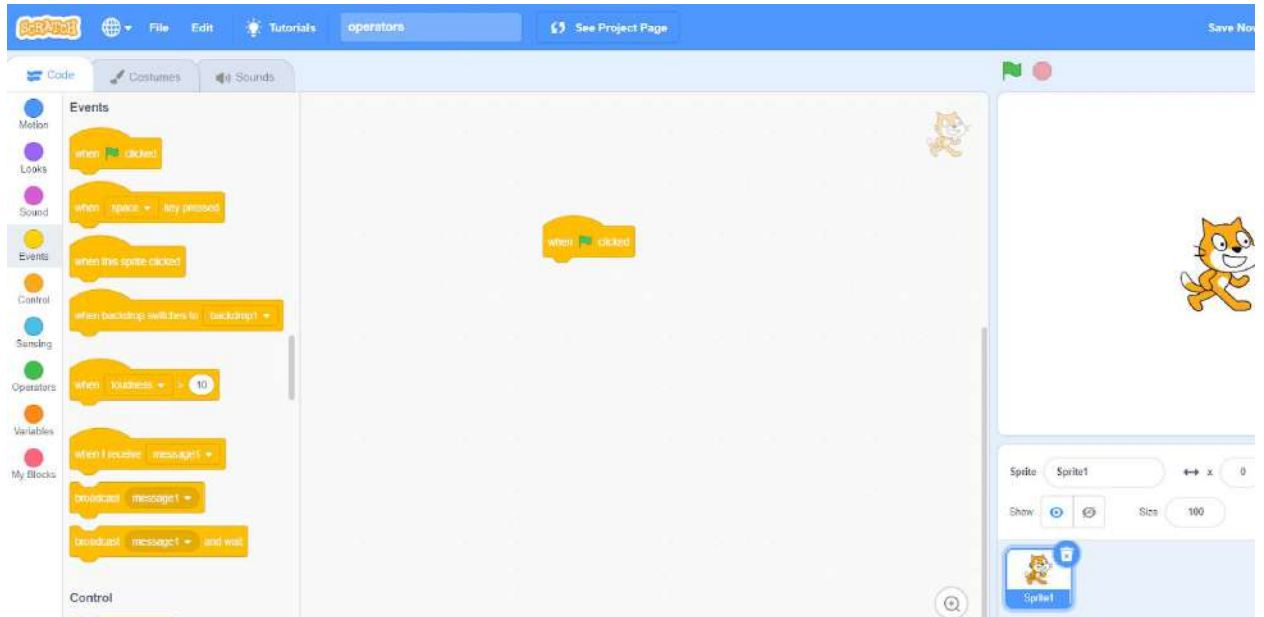
The following 11 Operator Reporter blocks:

- 
- 
- 
- 
- 
- 
- 
- 
- 
- 
- 

Examples for operators:

Now we will see how to the usage of operators with creating speak application.

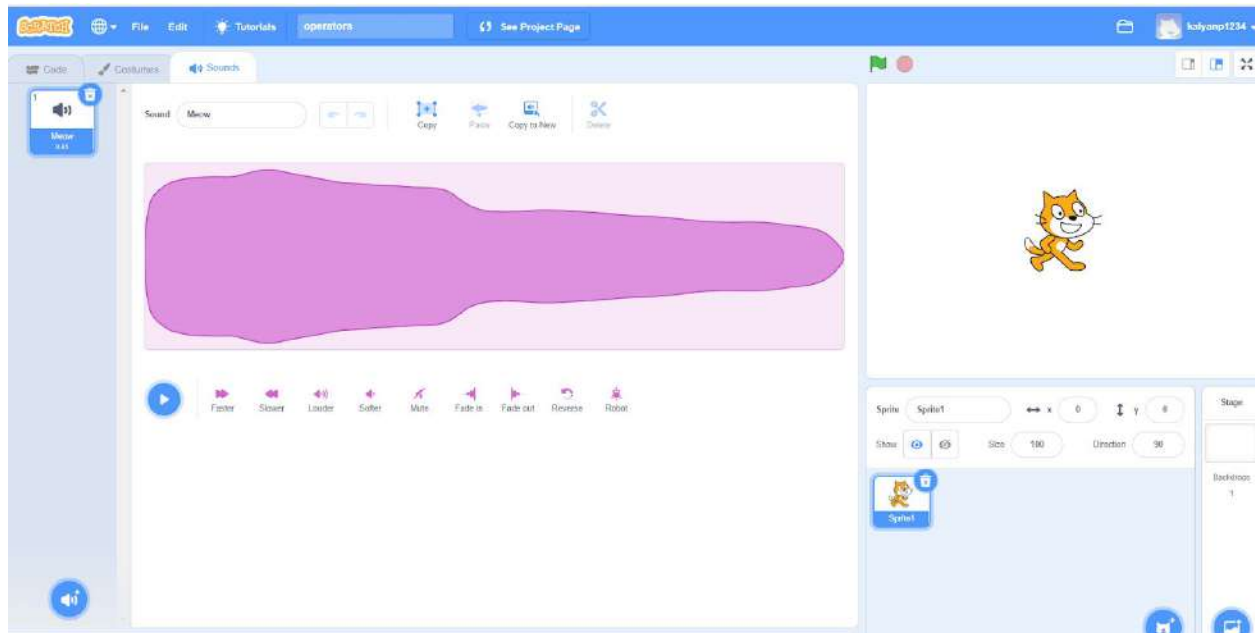
First, we have to take when flag click from events block.



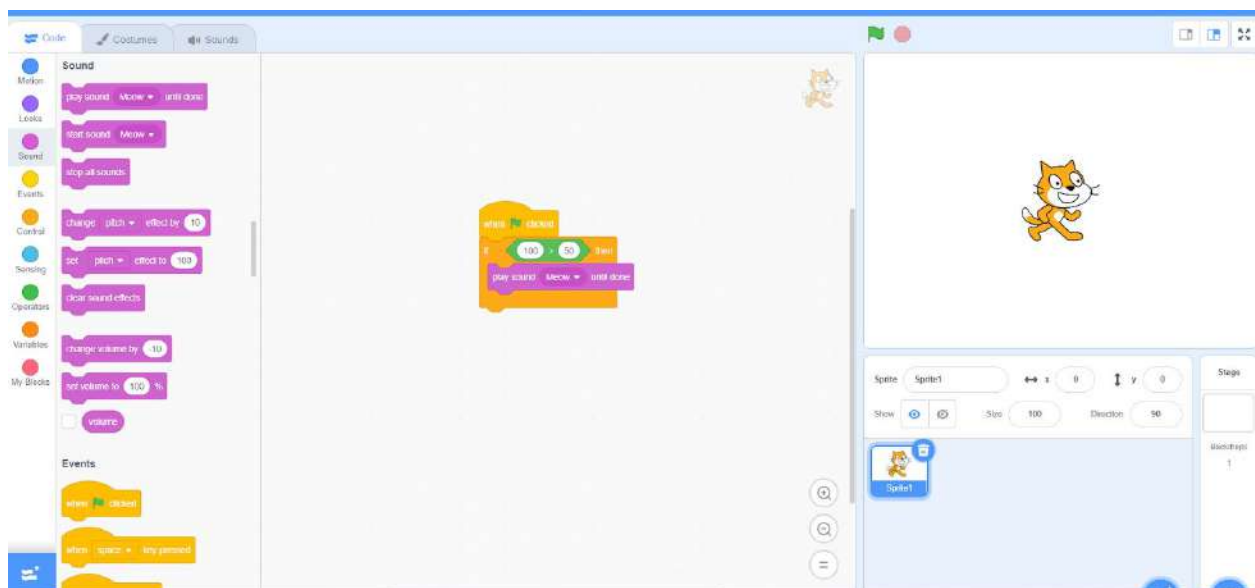
- Then we can use if condition block from control block and add it to the when flag click block



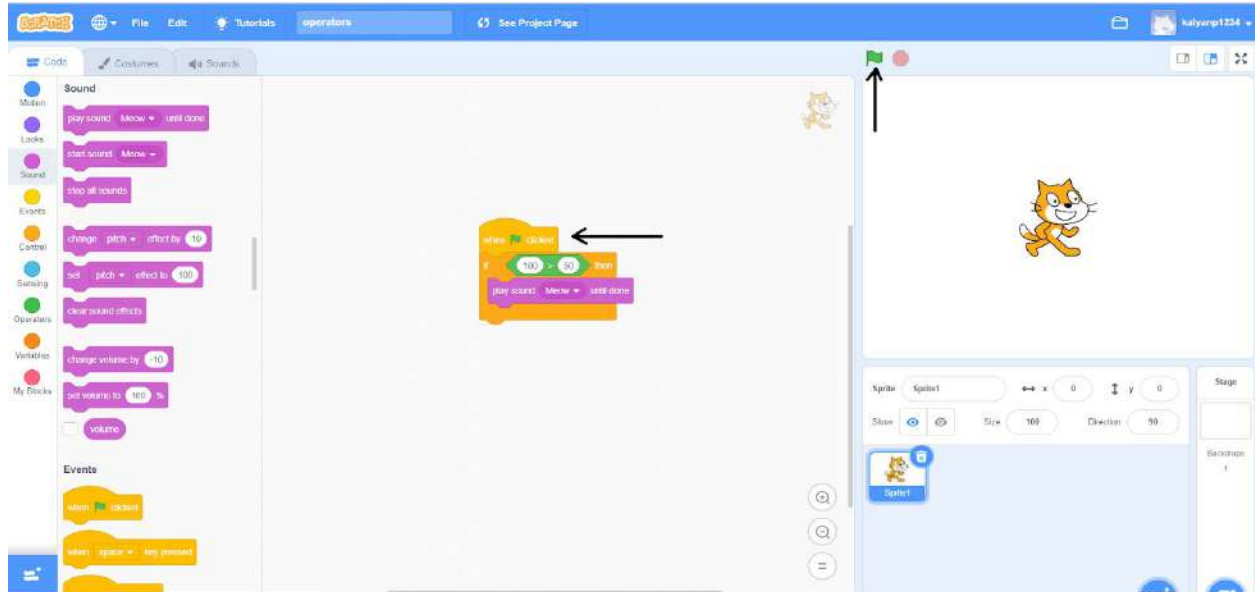
condition block. Right now we can add meow sound which is selected from the choose a sound option in the sounds tab.



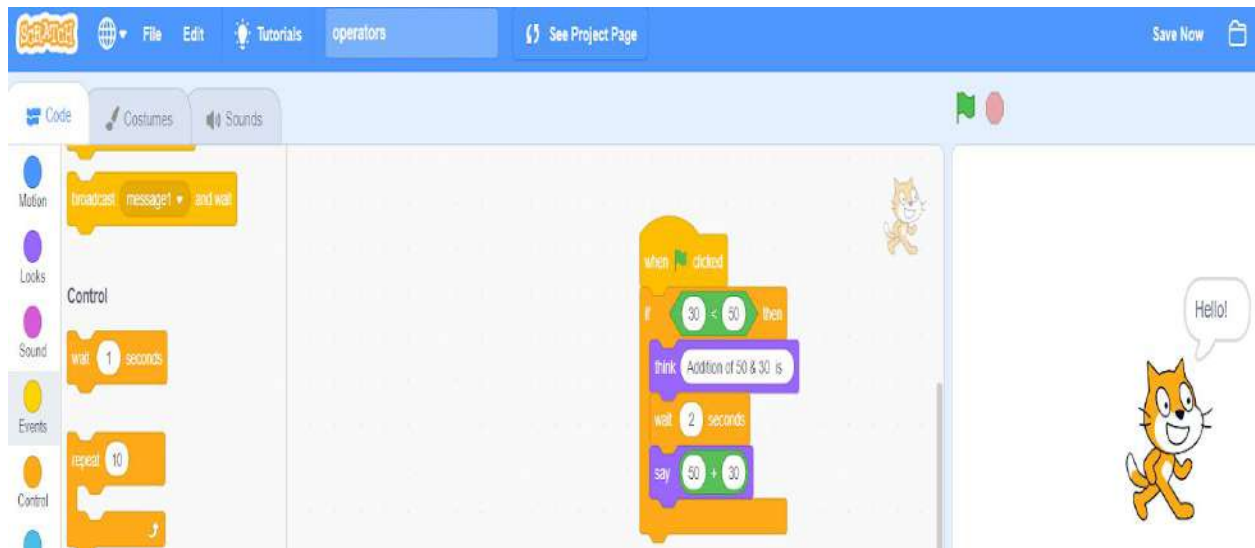
- when the condition is true we can listen to cat(meow) sound by adding play sound until done from the sound block in the code tab



- Finally, we completed scripts in the scripts area to execute our project click on Flag which at the top of the right side or when flag clicked block in scripts.

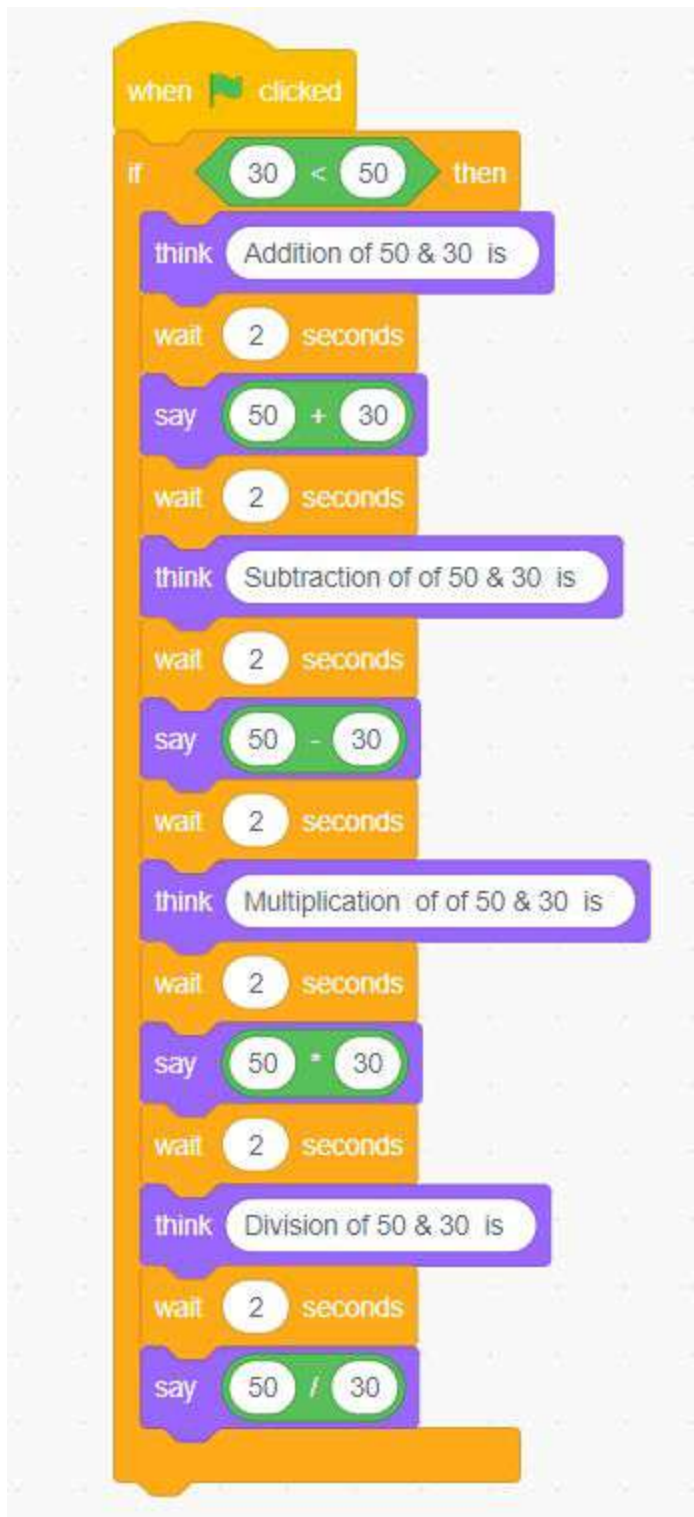


- Let's see how to usage arithmetic operators in Scratch
- Now when the value of 30 is less than 50 then try to execute arithmetic operations using respective blocks. For that here we took if condition when the condition (30 < 50) is true then, display arithmetic operation output with the respective statement.



➤ Similarly, add remaining operations logic to our script





## Variables:

Variables are used to store data in the scratch's memory area. Data will be manipulated by applying some operations. Data may be numbers, strings(text) or booleans. We can declare variables global or local. Variables hold single value at a time, unlike lists.

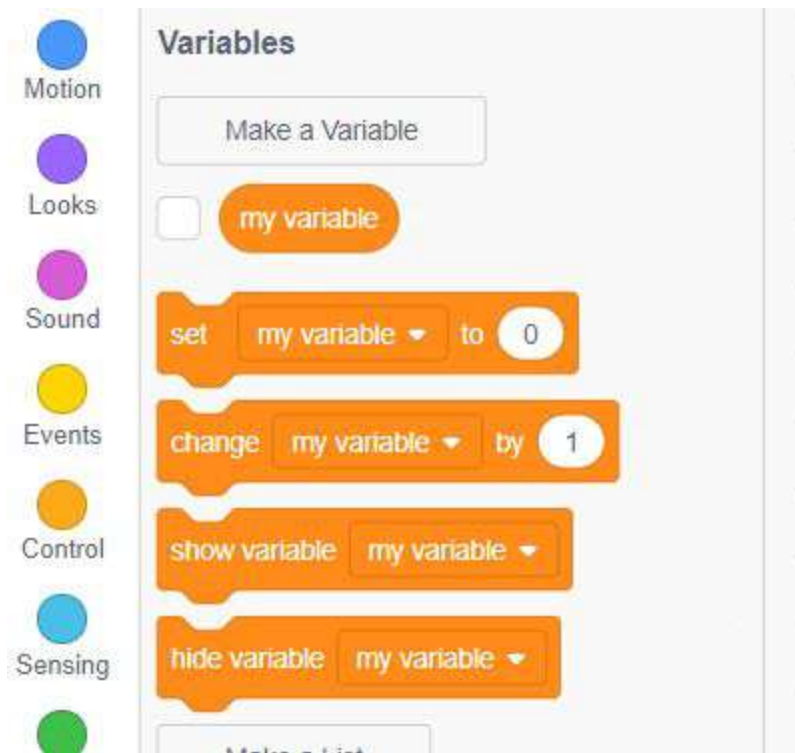
Examples for holding data in variable :

- 123
- 12.334
- Welcome
- true/false
- {Empty string}

Variable creation:

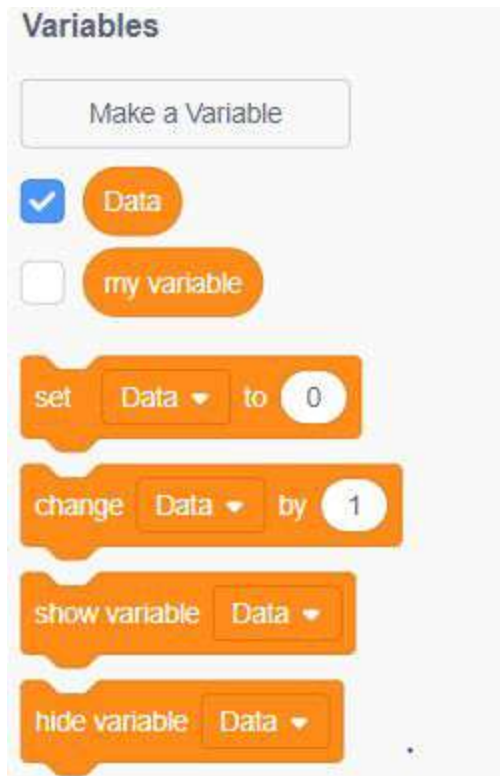
To create variables go to the variable palette, click on make a variable block , and a box will appear. Give name for variable and select whether it should applicable for “for this sprite only” (local variable) or “for all sprite” (global variable) option. Then click OK, we can see created variables in variable palette.

- Lets we can create variable with name of “data” (global)

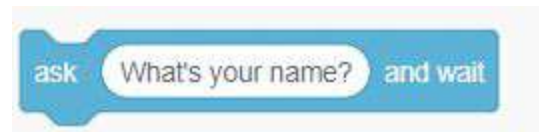




- We can data variable in palette



- Now we can take data from the user and store it in Data variable



- For that we have to drag from sensing palette. When we execute this block whatever the value we are giving it will store in answer block in sensing palette
- Now we have to set that “answer” to “Data” variable by using

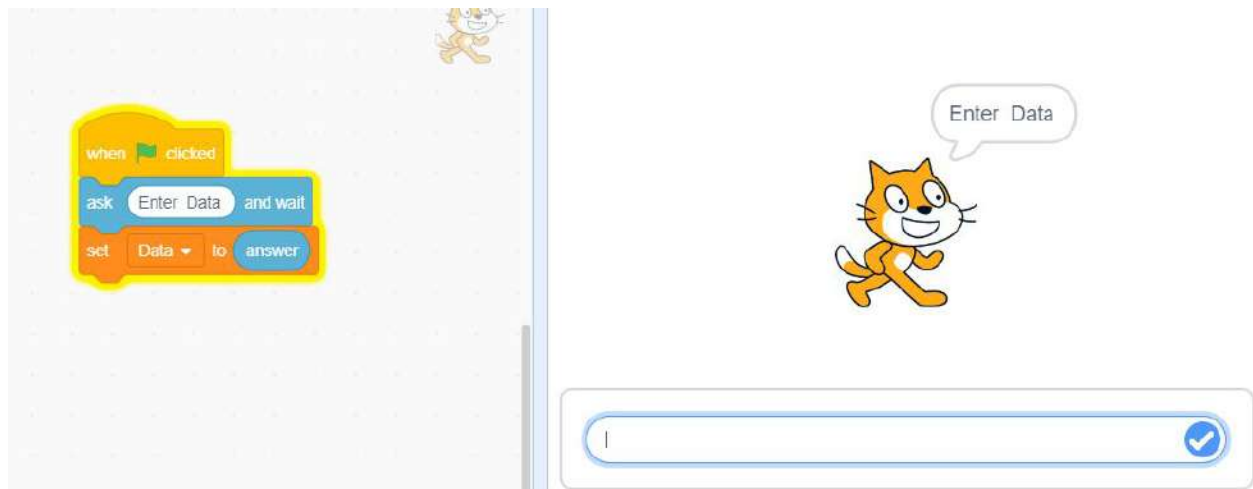


block from variables palette

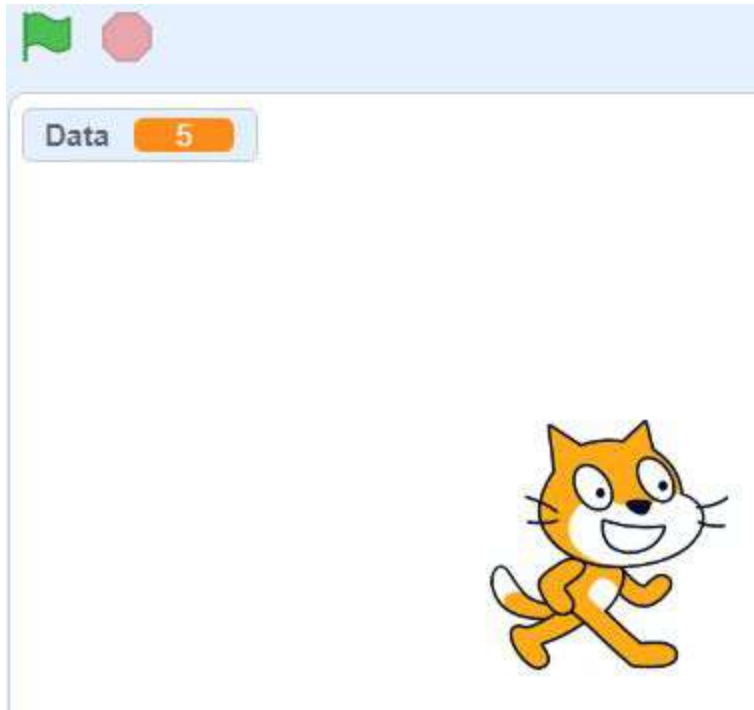
- Finally we can execute when flag is clicked



- In the right side with in the stage we can see our output. Give data value and observe at the top level in stage area value is stored in Data variable



- The value is stored in “Data” by using “answer”

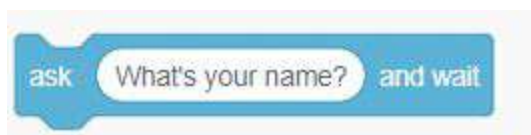


### Multiplication Table generation:

By using variable concept we can build multiplication table

For this from the user we have to take following parameters

- Enter table which you want see
- Enter minimum range from the table you want( $5 \times 1 = 5$ )
- Enter Maximum range upto you want see table ( $5 \times 5 = 25$ )

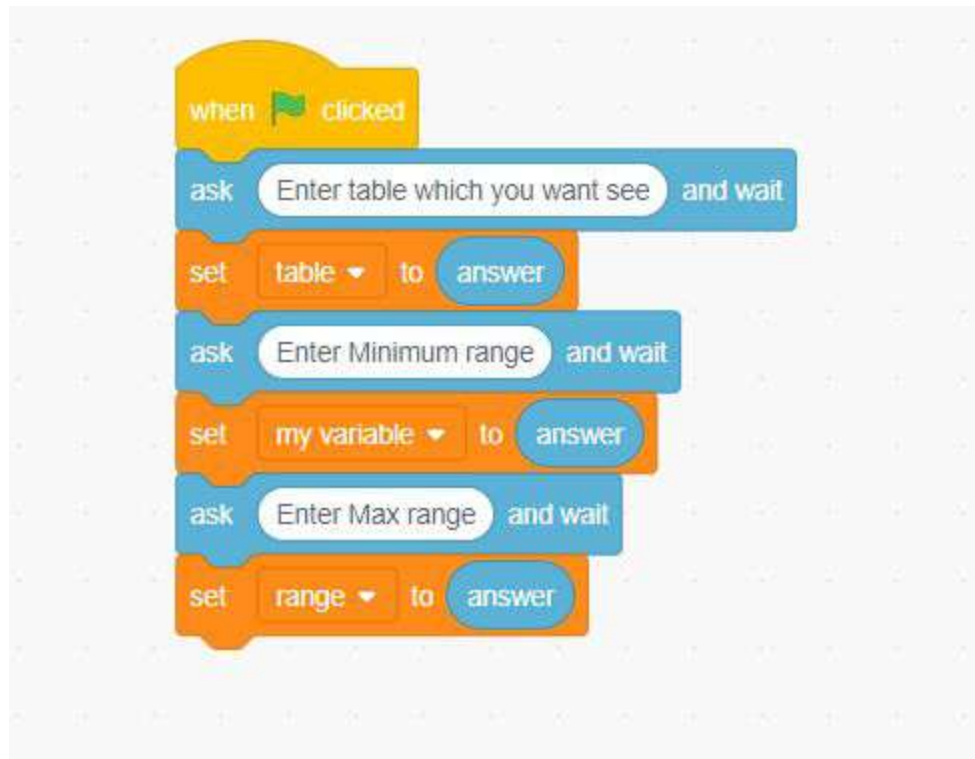


For this use block to take inputs from the user. The data you are entering is stored in respective answer block which is include below **ask** “ “ **and wait block**

variables:

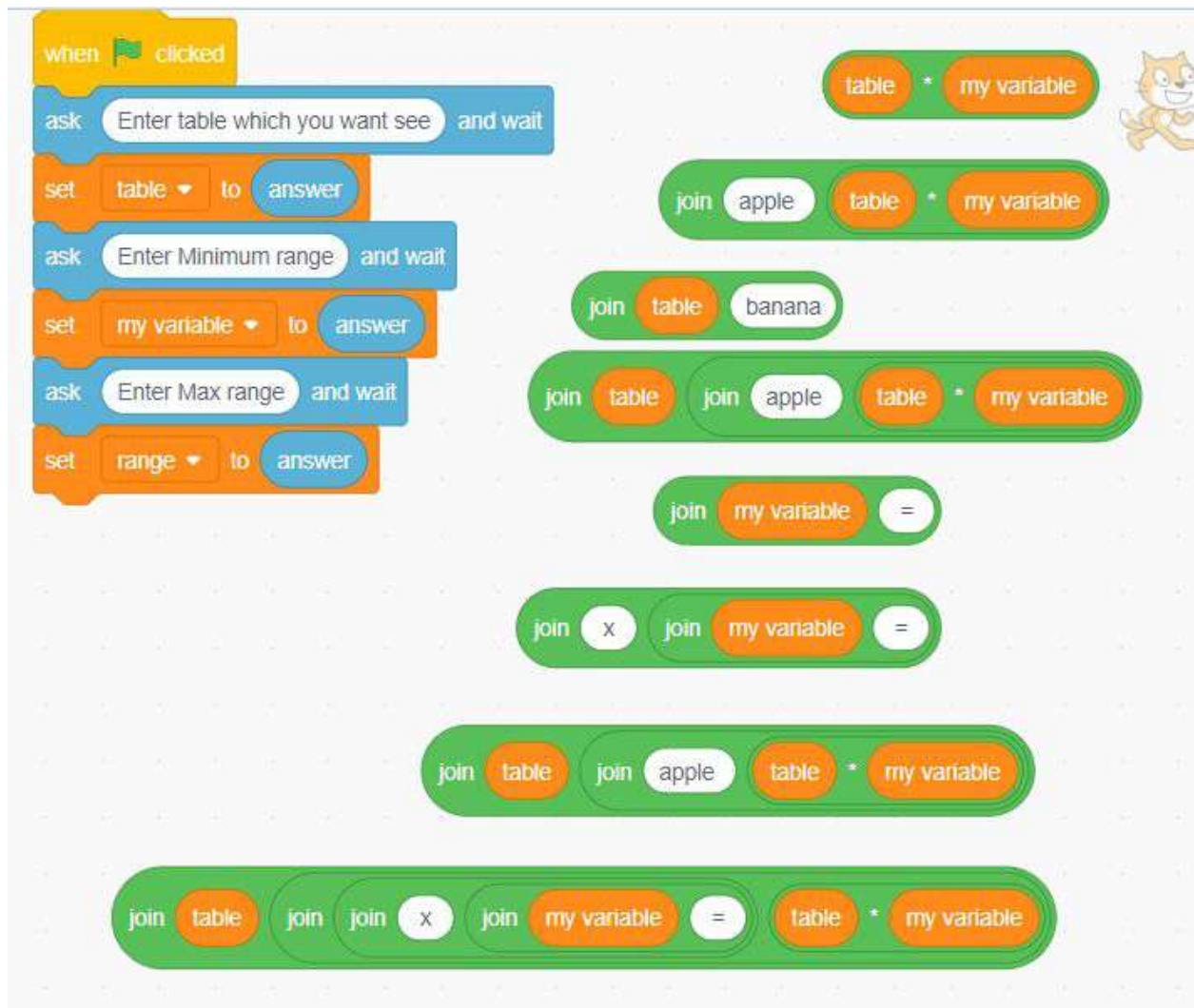
- Myvariable - Minimum range
- Range - Maximum range

- Table - value for generating table

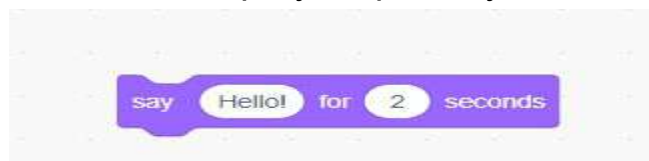


- To get table format like this **5 x 1 = 5** we have to use operators (4-Join, 1- multiplication)
- Let's understood table format **table x myvariable = (table \* myvariable)**





➤ Follow the above block step by step finally we have to use last script

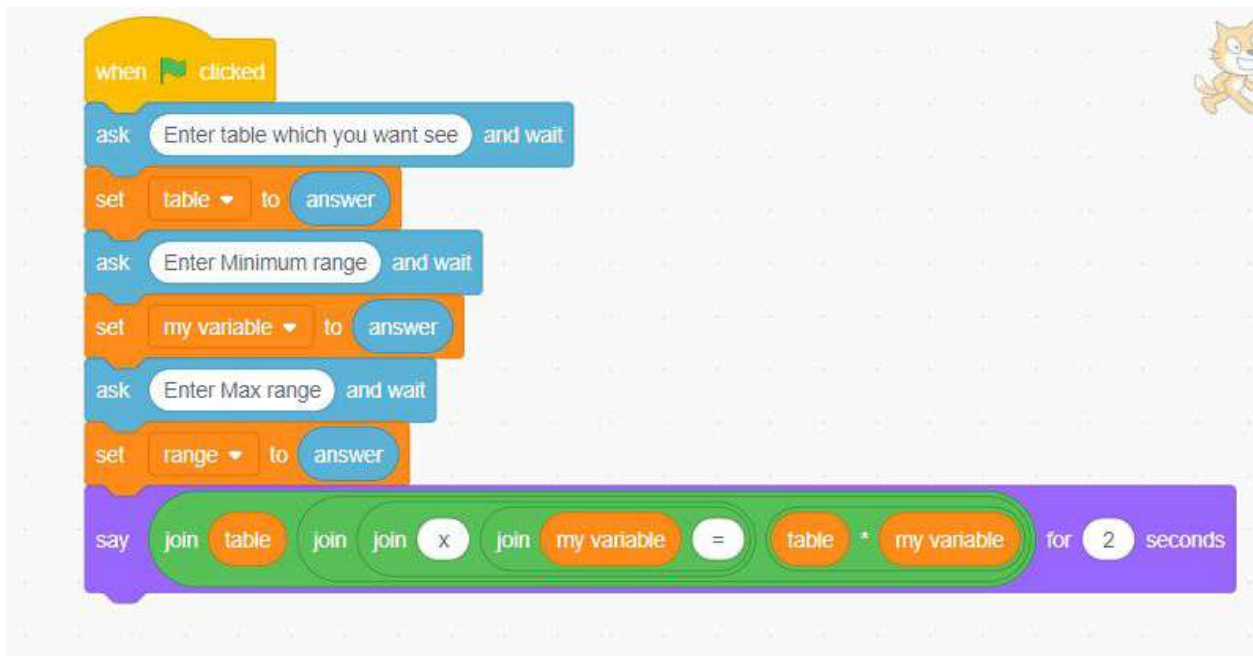


with in the  
time duration to display the data

block and give



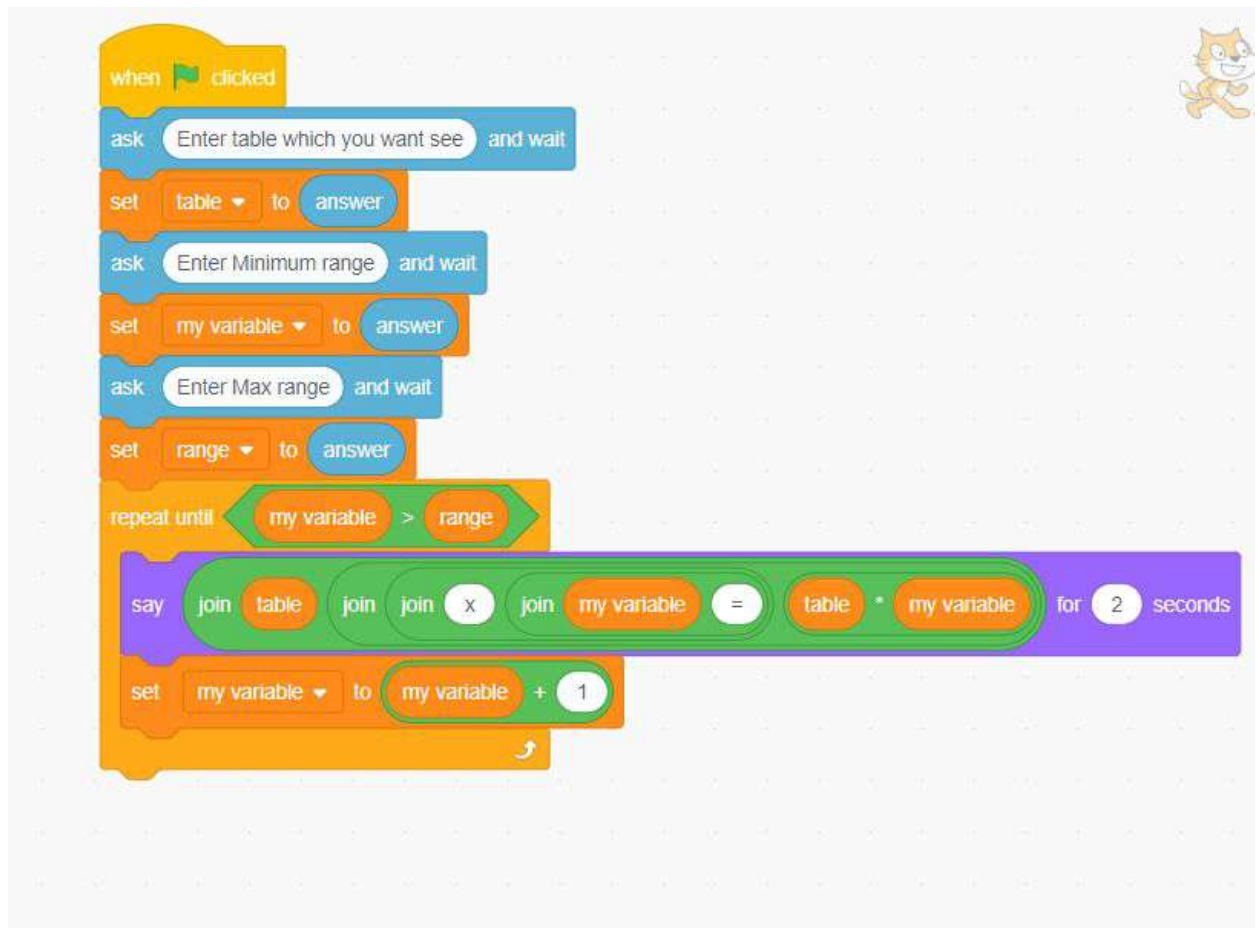
➤ Add the above scripts to the input data and execute it.



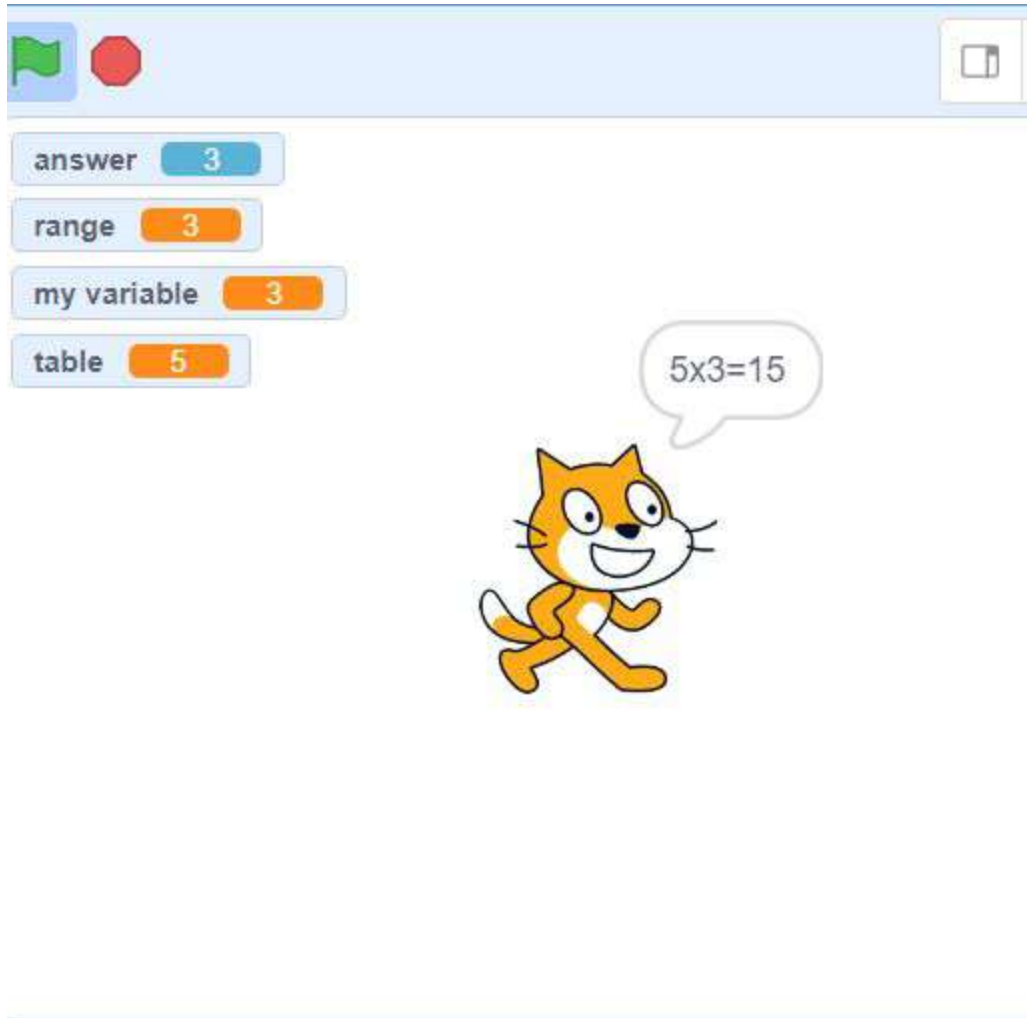
➤ In the stage area we can see output



- Right now we are able to see minimum(**my variable**) range data in table to get upto maximum range we have to use loops. After every row is printed we have to increment myvariable value upto maximum(**range**) range row

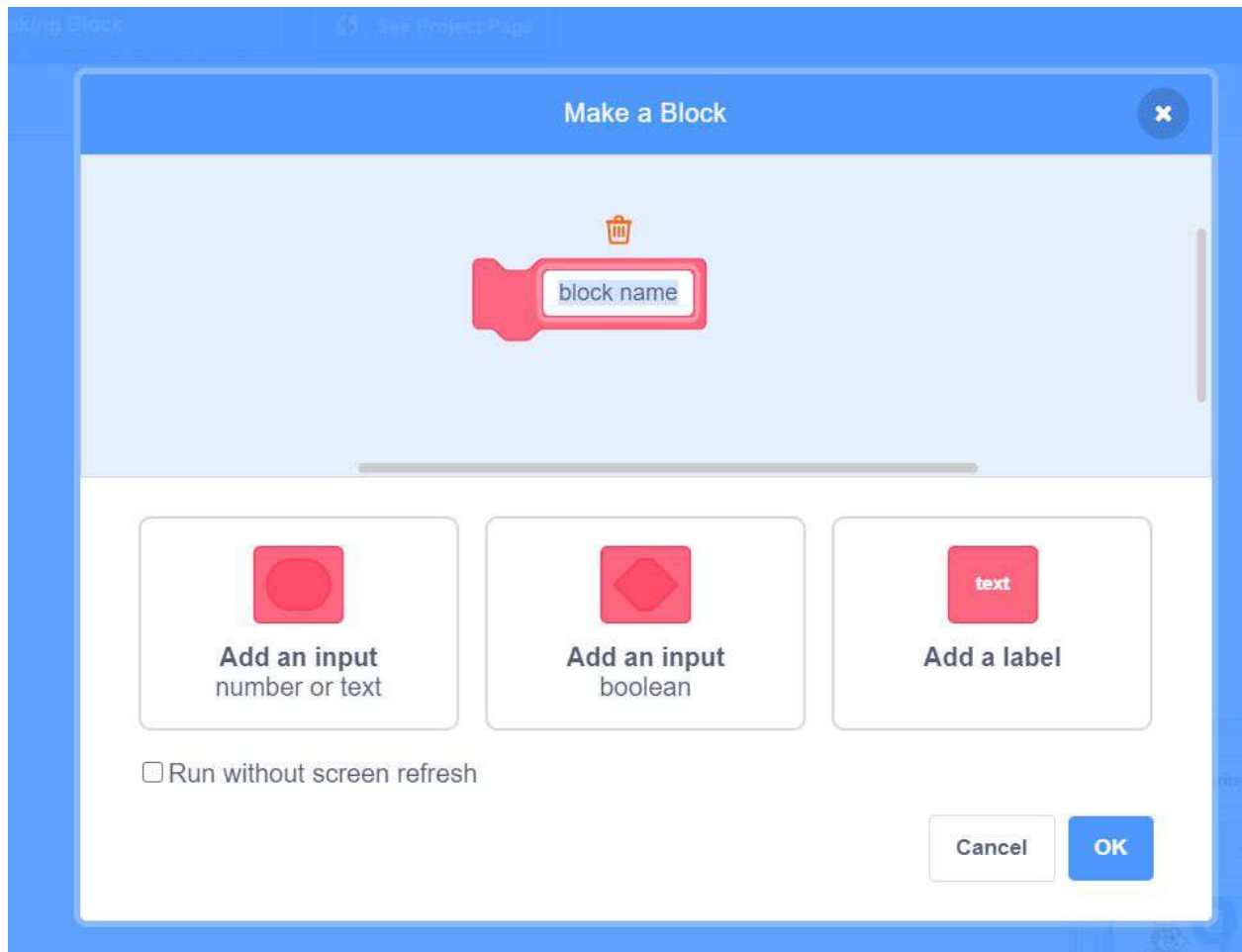


➤ We can see every multiplication table row with duration of 2 seconds



## New Block Creation:

Generally to reuse the same code in programming languages we can use functions. In the scratch programming language **my blocks** provide the ability to reuse the same code a number of times in multiple places without duplicating it. To create a block click on my blocks in all blocks. Right a window will open with a **make a block** button. Click on that button. A new window will open like below



In the block name we can define your newly created block. Then click on Ok button. We can pass above inputs to the block by selecting those in creation of block. Let's take a sample case for new block creation.

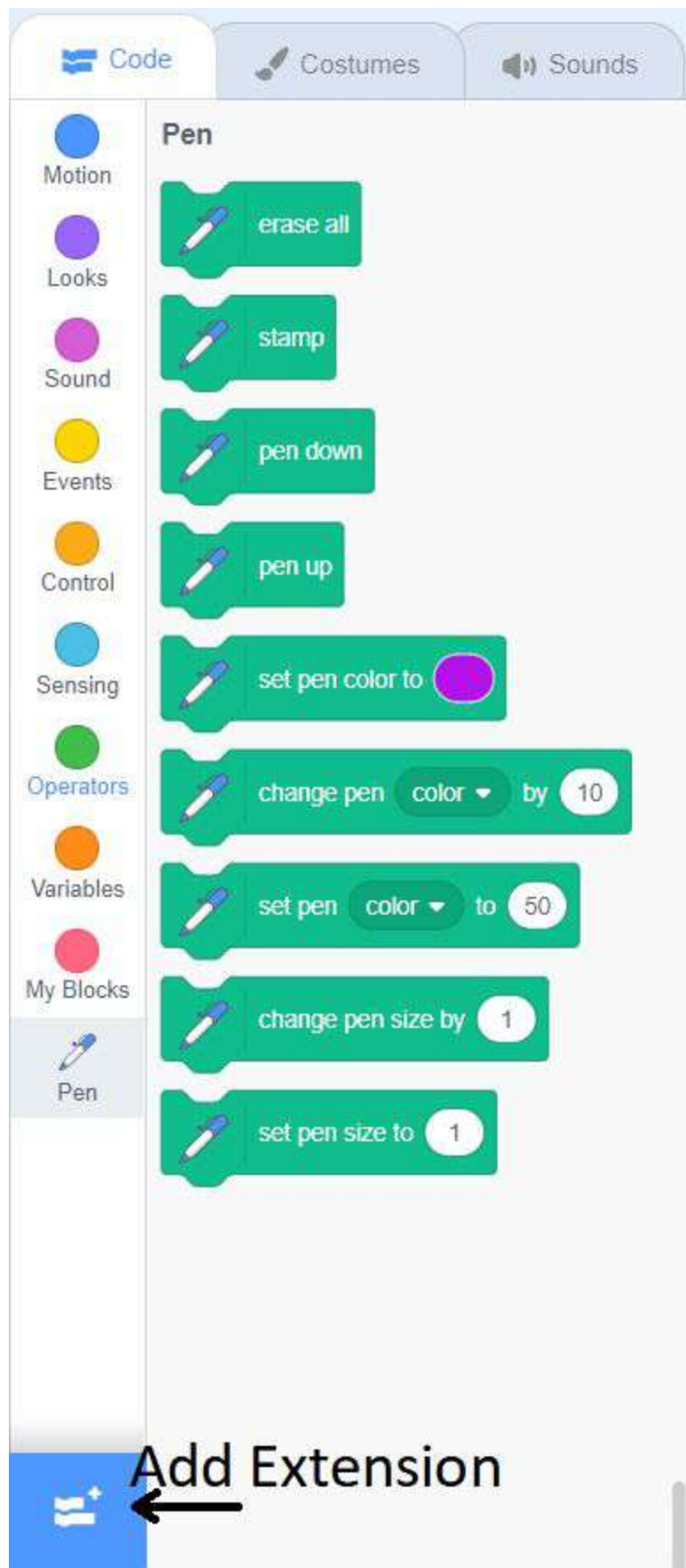
Right now we can create a new block for the pentagon shape. First try to add the pen tool from the Add Extension option to draw a line.

Code Costumes Sounds

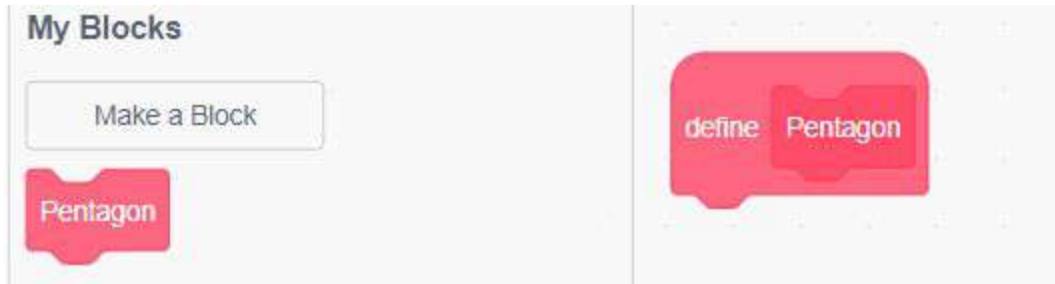
**Pen**

- erase all
- stamp
- pen down
- pen up
- set pen color to
- change pen color by 10
- set pen color to 50
- change pen size by 1
- set pen size to 1

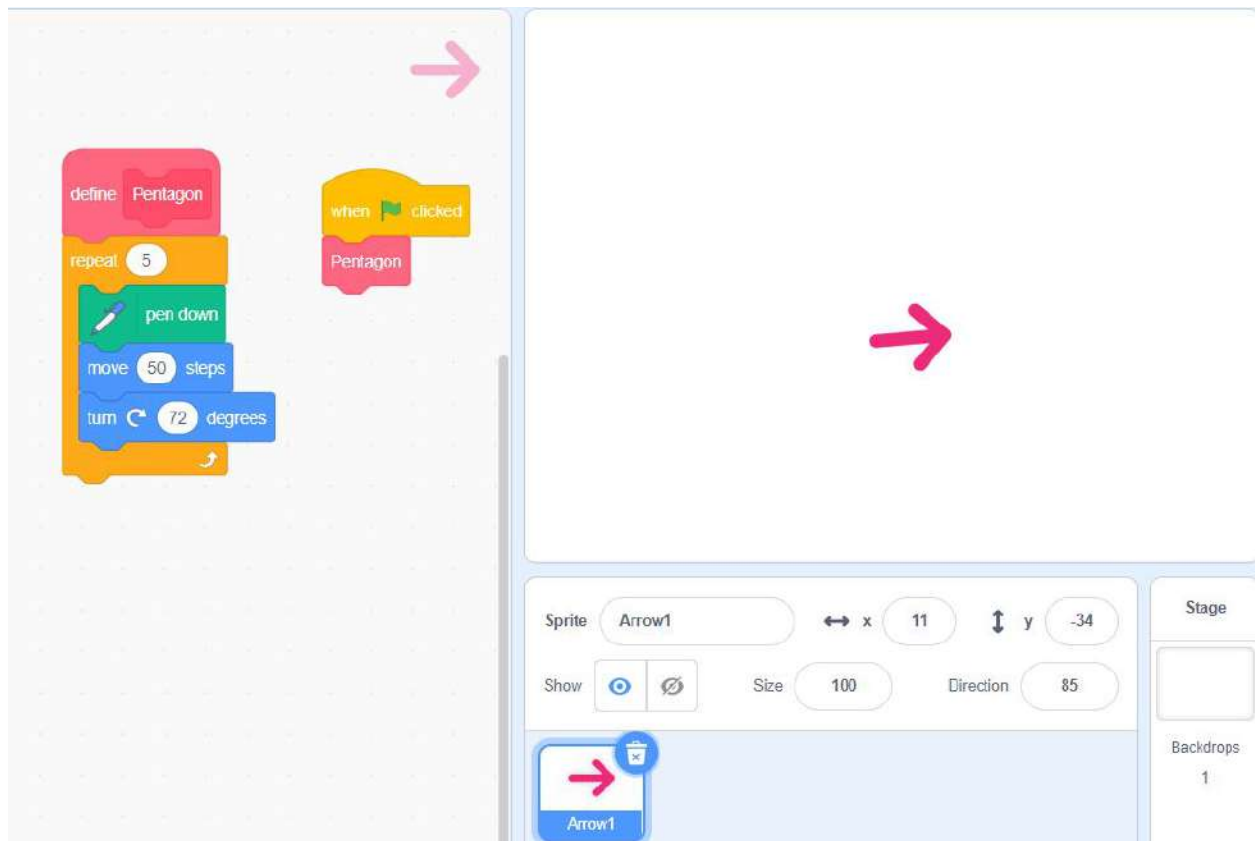
**Add Extension**

The image shows the Scratch interface with the 'Code' tab selected. On the left, a vertical sidebar lists various block categories: Motion, Looks, Sound, Events, Control, Sensing, Operators, Variables, My Blocks, and Pen. The 'Pen' category is highlighted in light blue. To the right of this sidebar, a collection of green 'Pen' blocks is displayed. These blocks include 'erase all', 'stamp', 'pen down', 'pen up', 'set pen color to' (with a color picker showing purple), 'change pen color by 10' (with a dropdown set to 'color'), 'set pen color to 50' (with a dropdown set to 'color'), 'change pen size by 1', and 'set pen size to 1'. At the bottom left, there is a blue button with a white plus sign and the text 'Add Extension'. A black arrow points from the text 'Add Extension' to this button.

Click on the Pen extension it will add to the below My Blocks. Let's start the procedure for pentagon with **my block** name as pentagon. When we create a block we can get blocks like below shown in the figure.



Right now try to add procedure step by step for the **define pentagon** block. Here we added Arrow sprite.



When we click on the pentagon shape, the pentagon shape will draw the sprite Arrow.



