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Science, Technology, Engineering and Math (STEM) are key subjects that support research and help solve problems on Earth and in Outer Space.

In this project, you will learn how to apply computer science to creating your own video game, while also learning about the Solar System and space travel.

Have fun!



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Feedback & Social Media

We welcome feedback! If you encounter any errors or broken links in this project, or have constructive suggestions for improvement, please email Antony Hyett at antony@hyetteducation.com and provide details. Your cooperation and feedback is greatly appreciated.

We'd love to see how you're getting on with this project. Please share students' participation, progress and enjoyment of this project on social media using the hashtag **#RAFCodeCommanders** and follow **@rafyouthengage** and **@hyetteducation** to keep up to date with RAF Youth & STEM and Hyett Education's work with schools.



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Session 1: Getting started!



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Overview



In this project you will:

- Learn to code a space game using the programming tool Scratch Learn key vocabulary in computer science, including algorithm, sequencing, selection, and iteration
- Revise and extend your knowledge of our Solar System
- Consider the challenges of exploring our Solar System and beyond.



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"What is an algorithm?"



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Here's a video clip to help you!

'What is an algorithm?'

https://youtu.be/2Do-q47hKxl



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Watch



From 'What's an algorithm?' by Richard Anderson (TechMentor UK)





... from the dictionary

"An algorithm is a step-by-step procedure for solving a problem or accomplishing some end"

Merriam Webster Dictionary



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... an easier definition

"An algorithm is a set of instructions, placed in the right order to make something happen"



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Algorithms are everywhere!

- Playing music is an algorithm
- Following a recipe is an algorithm
- Algorithms are often used to make computers do what we want them to do.
- Many of your favourite websites use algorithms to decide what to show you: Google, YouTube and Facebook all use lots of algorithms
- We're going to be using a programming tool called Scratch to create our own algorithms.





Can you think of any other examples of algorithms?



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In an algorithm, the order of instructions is very important

- In most algorithms, the order of instructions is critical to making it work properly.
- Getting the sequence of our code correct is very important.
- If the sequence is wrong, it's like playing music with 'the right notes, but not necessarily in the right order'!





Let's get started!

- Log into your Scratch accounts with your username and password
- Open up the Scratch template at scratch.mit.edu/projects/419026147. Type this carefully!
- Click on the 'Remix' button at the top of the webpage to create your own copy.
- Give your project its own name by typing into the box at the top of the screen.
- Scratch should save your project on its own, but, if you see 'Save Now' at the top right, click that to save your work.



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Learn

Sarah's Space Game



Session 1: Exploring Scratch



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In Scratch

- code is the instructions that we use
- coding is putting those instructions together to create algorithms
- an **algorithm** is one set of instructions combined together
- a computer program is all of those algorithms together - the whole project.





A computer program is made from more than one algorithm



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Exploring Scratch

• Watch this video clip, which introduces you to the basic layout of Scratch:

https://youtu.be/uBUU4j9gsFA

- Don't click onto anything in your Scratch project yet!
- Make sure that you don't drag items around, or place any new objects into your project!



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Watch





Correcting mistakes

- If you make a mistake when using Scratch e.g. by deleting pieces of code accidentally - and are using a device with a keyboard, you can 'undo' that mistake by pressing the **Ctrl** key (to the left of the space bar) and the **Z** key together. There is a limit to how many steps back you can take though, so do this as soon as you realise your mistake.
- If you accidentally delete a sprite, go to 'Edit' at the top of the screen and click 'Restore sprite'.



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"What are the names of the planets in our Solar System?" Which planet is closest to The Sun, and which is furthest away? What order are they in as you move away from The Sun? Which planet is the smallest and which is the largest?



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Exploring Scratch

- To check your answers, click onto the in your Scratch template
- Click onto Costumes Code **()** Sounds
- Click onto each of the costumes to check your knowledge on the order and size of the planets. **Don't drag** the planets around the stage.
- Discuss: why do you think the last costume is a balloon?



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70 x 67





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Video clip: 'Solar System 101': https://youtu.be/libKVRa01L8



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The probe in our game is Voyager One

- A probe launched from Earth in **1977** to explore our Solar System
- •Even today, over 40 years later, it still receives data and instructions from Earth.
- After visiting Jupiter and Saturn, it has now left our Solar System, heading to a nearby star called AC + 79 3888, which it should reach in about 40,000 years ...



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The probe in our game is Voyager One

- •Voyager One is currently over 13 billion miles away from Earth.
- •It carries 'The Golden Record', a time capsule which contains information about Earth and humans for any aliens who might find the probe in the distant future!
- •The probe sprite in our template has a costume. Can you think why?



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Decomposition

- It is difficult to create all of our algorithms at once, so it is often better to break down the finished program into a set of simpler problems.
- We solve each of these problems in turn.
- We call this **decomposition**.



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Looking at the completed project

- To help us break down (decompose) our finished project into smaller steps, you're going to watch a video clip now of the finished game being played. • While you are watching, think about, and discuss
- the questions on the next slide.
- Look over the questions on the next slide first, then watch the video, then discuss the questions again.







1. How does the player start the game?

4. What happens to the probe when it touches a planet?

2. How does the player control the movement of the probe?

5. What happens to a planet when it is touched by the probe?

3. How does the player launch the probe?

6. What happens if the probe hits the edge of the screen?

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Watch the gameplay demo video



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https://youtu.be/QhOCT0MfLol





1. How does the player start the game?

4. What happens to the probe when it touches a planet?

2. How does the player control the movement of the probe?

5. What happens to a planet when it is touched by the probe?

3. How does the player launch the probe?

6. What happens if the probe hits the edge of the screen?

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1. How does the player start the game?

2. How does the player control the movement of the probe?

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By clicking the green flag

By setting the trajectory (angle) and power for the probe





Getting our probe launching!

- You're going to learn how to get the probe moving!
- Video clip: <u>https://youtu.be/Ml_aPduxKeo</u>
- Listen and watch carefully.
- At some points in the video, you'll be asked to pause playback.
- You will be asked to predict what will happen, or to experiment with your code to create algorithms in Scratch.





I've lost my probe ... what do I do?

- If your probe disappears off the edge of the stage, click onto the Motion code blocks, and look for the 'Go to' command.
- Select 'Start' from the drop-down menu.
- Double-click onto the code block to move the probe back to the red cross. (You do not need to drag this block into the coding area).







Iteration

- The word iteration means to repeat sections of code to make them run more than once.
- Iteration is sometimes called repetition.
- You might also hear the word 'loop' to describe iteration.
- In Scratch, all code for iteration are listed under 'Control'.
- Examples are 'forever', 'repeat' and 'repeat until







The completed algorithm





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Checking our knowledge and understanding

https://create.kahoot.it/v2/share/raf-codecommanders-session-1-quiz/a5668a3b-e843-4c90abe2-e05307ae69a2



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Next time

- Making the Launch button work
- Learning what a variable is
- Learning how to reset our program every time the green flag is clicked
- Considering ways in which our game is realistic and very unrealistic compared to launching a real space probe.









Project credits

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Special thanks to Flt Lt Michelle Randall (RAF Youth & STEM), Antony Hyett (Hyett) Education – www.hyetteducation.com) & Richard Anderson (TechMentor UK – www.techmentor.uk).



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