Clock

Program Aim Can the users create a working clock using some of the principles learnt in the counting machine project?

Computer Science Concepts

-Repeat x times loops

-Variables in a loop

-Reading and amending a flowchart

-input & broadcasts

-Using a variable within a say command
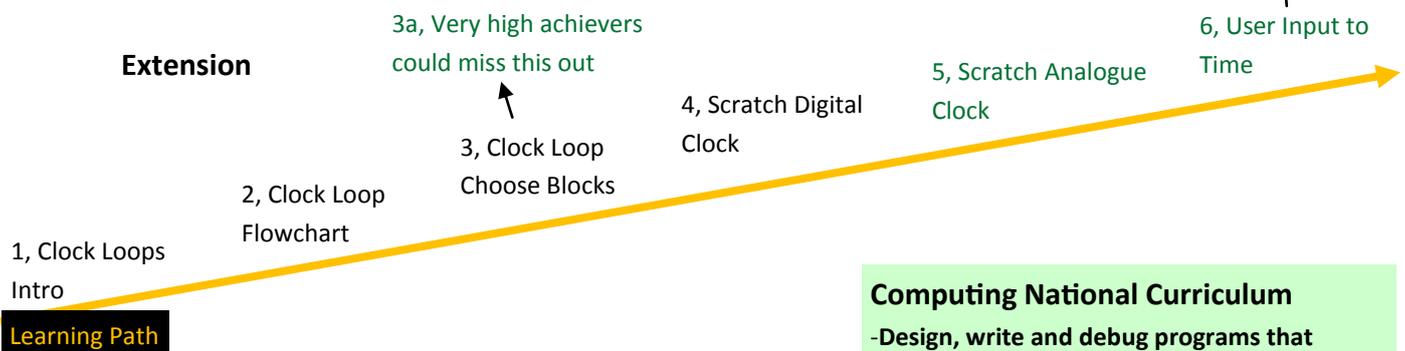
Maths Concepts

-60 seconds in a minute

-60 minutes in an hour

-24 hours in a day

-360 degrees in circle

-12 & 60 divide by 360

Differentiation and Assessment for Learning At the beginning of each session the *learning intention sheet* is shared and the learning journey expanded through success criteria. Pupils feed their progress back to the teacher through annotating this sheet with smiley faces at the end of the lesson. Teachers can also annotate the sheet to indicate those who need more or less help in future lessons. These extra resources can be found on the code-it.co.uk website.

Dependencies
Recommend you complete the Counting Machine Plan first & Playground Games Flow Charts

Learning Path

1, Clock Loops Intro

2, Clock Loop Flowchart

3, Clock Loop Choose Blocks

3a, Very high achievers could miss this out

Extension

4, Scratch Digital Clock

5, Scratch Analogue Clock

6, User Input to Time

6b, Zurgon Year

6a, Zurgon Month

1, Clock Loop Intro

Explain to the class that today they are going to design and program a clock.

Show them this online digital clock and get them to work in pairs to record what is happening over three minutes
http://www.online-stopwatch.com/large-digital-clock/

Encourage verbal feedback. You are looking for anything that brings out steps such as increasing seconds by 1 and then waiting for 1 second when seconds reach 60 set seconds back to 00 and increase minutes by 1. This can take 5 minutes.

Computing National Curriculum
-**Design, write and debug programs that accomplish specific goals,** including controlling or simulating physical systems;
-**Solve problems by decomposing them into smaller parts use sequence, selection, and repetition in programs; work with variables** and various forms of input and output
-**Use logical reasoning** to explain how some simple algorithms work and **to detect and correct errors in** algorithms and **programs**

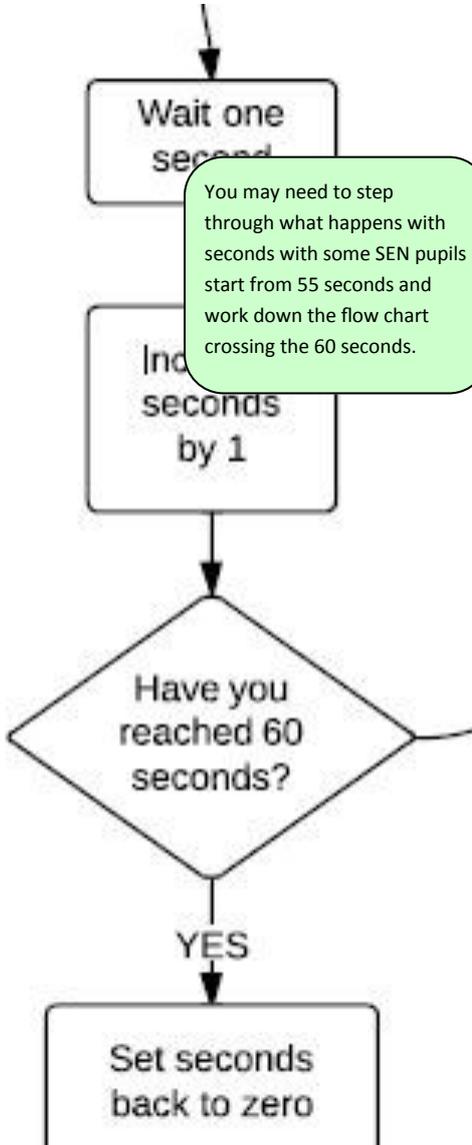Important to get pupils to think about what is happening before programming or planning

Clock P2

Wait one second

You may need to step through what happens with seconds with some SEN pupils start from 55 seconds and work down the flow chart crossing the 60 seconds.

Inc seconds by 1

Have you reached 60 seconds?

YES

Set seconds back to zero

2, Clock Loop Flowchart

Give pupils the unfinished flowchart and ask them to work in pairs to complete it. If they struggle explain that the pattern is repeated so they can look back to finished parts of the flowchart to see how. Don't explain how a flowchart works apart from to say start at start. Can they see the connection between the flow chart and their sequence ideas for the clock.

There is a finished version of the flowchart so you can check to see if groups have completed it successfully.

Show pupils a working copy of the clock without any code. http://scratch.mit.edu/projects/20995628/ Explain that the first part to get working is the digital part of the clock that the cat speaks and the variables record. Ask them how many variables they will need to create? (Answer Three seconds, minutes & hours)

3, Clock Loop Match Scratch Blocks to Flow Chart

Hand out the scratch blocks and briefly remind pupils of where they may have used some of these before. Explain that there is one block that won't link to flow chart but could be used in the coding (repeat 60). Remind them that there is more than one solution to coding a clock.

Explain that their job is to work in pairs matching the scratch blocks to where they would fit on the flowchart. Don't place them over the flow chart shapes.

You can use the blocks match sheet to check if they have got these correct before they can code.

repeat 60

wait 1 secs

when 🚩 clicked

set seconds to 0

set minutes to 0

Clock P3

4, Scratch Digital Clock

Allow pupils plenty of time to work in pairs but code individually. Explain that they are not allowed to start coding the analogue hands until they have a fully functioning digital clock.

You may want to explain during the session that setting the wait until less that 1 second will speed the clock up for testing purposes

Here are some of the possible solutions. Before they start draw out which blocks are outside the loop and which inside. For pupils that are stuck after a period of time you may want to focus them on parts of the code to work on at a time. See the block split sheet.
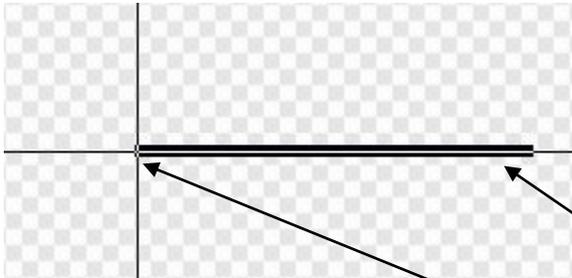
Junior Computer Science

Clock P4

Set costume center

5, Scratch Analogue Clock

You may wish to show pupils how to create hands that will easily rotate.

Create a new spite and name it seconds

Draw a thin straight line for the second hand making sure it is drawn facing right

Use the centre tool to set the centre on the far left end of the line

Do the same for the minutes and hours

Arrange them all so the left hand ends all line up

Don't help with the coding of these other than to remind pupils that there are 360 degrees in a circle.

They will need to divide 360 by 60 for the
seconds and minutes

They will need to divide 360 by 12 for the hours

This will produce code like this

Encourage pupils to run the code over a longer period of time and come back and tell you what is happening

They will find that the hands move increasingly out of synch with the digital clock

See if they can think of a reason why this is? Answer (The if blocks all take a short period of time to be checked this slows this loop down slightly)
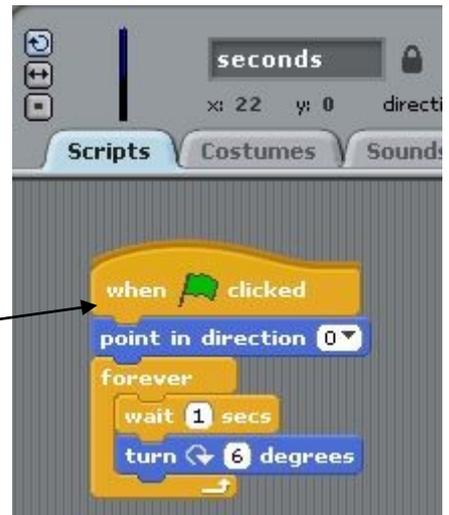
One solution is to use a broadcast command so that they are both in time and reduce the second wait in the main loop slightly
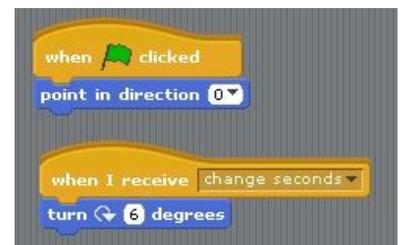
Clock P6

6, User Input to time

Clocks need to be set to the correct time
Can the pupils think of a way to do this?
Ask input blocks feeding into initial variable setting would be easiest way.
Can pupils think of a way to stop someone inputting a number that was outside the range of correct possibilities such as 25 hours? Good opportunities for initial discussion around error checking by programs.

6a, Zurgon Month

Can pupils extend the clock for the planet Zurgon that has 10 30 day months in a year. Earth months are a lot harder as they have varying lengths.

6b, Zurgon Year

Can pupils extend the clock for the planet Zurgon that has a 300 day year. Earth years are a lot harder due to a leap year.

6c, Clock Face

Can pupils design a clock face to go with their analogue clock which features 1/4 past the hour and 1/4 too the hour when these are being shown by the hands.

6d, Adapt the clock for a totally different planet