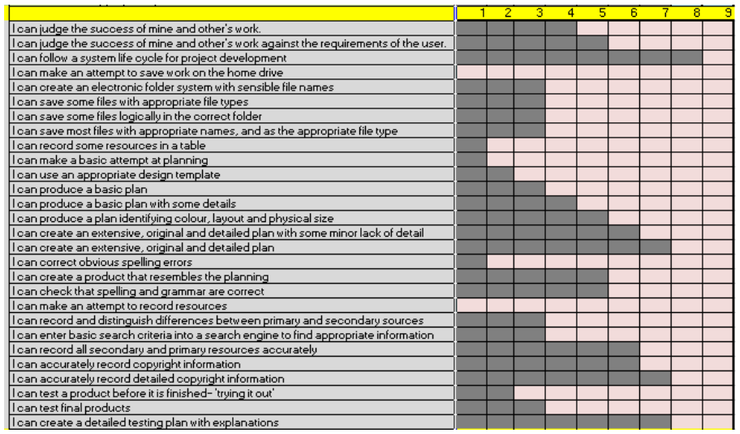
Number of weeks (between 6&8)	**Content of the unit**	**Assumed prior learning (**tested at the beginning of the unit)
6 Weeks	This unit covers the idea of algorithms using flowcharts. It gives students the understanding of a sequence and the importance of getting information correct. The unit will also cover the use of flowcharts in making a working example of how information travels and works	No previous learning is necessary with this unit. Many pupils may have a basic understanding of databases from previous years.

Assessment points and tasks	**Written feedback points**	**Learning Outcomes (tested at the end and related to subject competences)**
Each week there will be exam style questions as part of the teaching which will be assessed. There are also tasks which need to be completed each lesson. This Schemes of work is aimed towards GCSE Grades A*- C	**Students will receive written feedback every 2 weeks**	

Lesson	Clear learning intentions	Clear success criteria	Hook	Presentation of content	Guided practice	Independent practice (homework)	Closure
1	• Identify control flowchart symbols and understand how they are used to describe systems • Develop a control flowchart solution for a simple problem	Define each of the different flowchart symbols and explain how they are used to describe problems. how to load Flowol and how to add the START symbol and link it to an OUTPUT symbol with an arrow	Play the video Link Video Pedestrian Crossing 1948. Use the notes on this slide to give some background on the development of Zebra Crossings. Tell pupils that they are going to use the control software Flowol to produce a flowchart to control a modern zebra crossing.	PowerPoint Guide: Flowol L1 Flowcharts	Ask pupils to create their solution and stress that the lights must flash as seen in the video. Circulate and support pupils getting them to check this and modify the length of their delays if necessary.	Study traffic light sequences as preparation for next lesson.	Ask pupils to discuss in groups examples of other real life situations where computer control is used. Gather responses, recording them on the whiteboard. Refer to the examples on the whiteboard and pick out traffic lights (if pupils did not suggest this, add it and note that this is a very common control system that they overlooked in their discussions). Tell pupils that next lesson they will work on producing a control solution for traffic lights

2	• Understand why a control system might fail and explain the impact this can have on safety • Develop a control solution for a system that uses two flowcharts operating in sequence	What are the implications of a failure in a control system? Where are other control systems used, and what would be the consequences of a malfunction in these	Display Link Video Traffic Light Malfunction which can also be found at: http://www.youtube.com/watch?v=O6H9ywJ2Cko Direct pupils into small groups and ask them to discuss what is happening. After 2-3 minutes ask for responses, drawing out the idea that the system controlling the lights has developed a fault	PowerPoint Guide: Flowol L2 Sequencing	Ask pupils to create a flowchart to control the lights on the near side of the bridge. Stress that the lights must operate in the same way with delays as listed in Table 2 on their worksheet. Circulate and support pupils as they work. Show the Mimic Video Bridge Light 1. This enables you to demonstrate the correct outcome without displaying the solution. (Shown in Solution Bridge Light 1.) As pupils successfully complete their flowchart, move them on to an extension activity to create a second flowchart alongside the first to control the lights on the opposite side of the bridge. Circulate and support pupils as they work. Mimic Video Bridge Light 2 shows a looped video of the full solution and can be displayed at this point if required. Open the full solution flowchart Solution Bridge Light 2 in Flowol and use it to assess pupil progress. Ask pupils: How does your solution compare to this one? How is your solution different? Which solution is better and why? Which parts of the solution did you find easy and why? Which parts of the solution did you find harder and why?	Question pupils to identify the potential shortcomings of this system (e.g. it is timed and can't respond to traffic flow) and ask how it could be improved (e.g. use sensors to detect approaching cars and adapt to changing traffic volumes or times of day or year). Note how the two flowcharts in Solution Bridge Light 2 need to be exactly synchronised.	

3	• Identify common types of sensors used in control systems • Use decision symbols in a flowchart • Develop a control solution for a system that uses multiple sensors	Describe the parts of the Automatic Home mimic and ask pupils to complete the tasks on Worksheet 3 Automation Tasks: 1. Turn the living room **fan on** when the **temperature** is **above 23** 2. Turn the living room **fire on** when the **temperature** is **below 17** 3. Turn the living room **lamp on** when the **light level** is **below 20** 4. Ring the **doorbell** when the **door switch** is **pressed** (A .wav file, **Doorbell.wav** is provided for this) 5. Turn the **security light on** when the **light level** is **below 30 and** the **garage door sensor** is on (detects movement) 6. Open the garage door when the **entry button** is on and close it when the **close button** is pressed.	What could you use a computer to control inside your home? Ask pupils to discuss the question and come up with suggestions. After five minutes, question pupils, gathering responses and recording them on the whiteboard. You can show the video Home Automation if you wish. It has numerous examples of sensors and control. Explain that a sensor is used to take readings to detect a change in its environment. Ask pupils to identify different types of sensor and their uses.	PowerPoint Guide: Flowol L3 Sensors	Ask pupils to start by creating two flowcharts that will control the fan and the fire heater in the living room (Task 1 and Task 2). Circulate and support pupils as they work. Extension: Pupils who complete every task can extend their solution to open and close the living room blinds depending on the outside light level. For further extension work, pupils can work on the Greenhouse mimic. Flowol Worksheet 3b Greenhouse Tasks documents the tasks and the Flowol file Solution Greenhouse provides a solution. This mimic can also be used in an extra lesson following this one as an activity for some pupils if others need more time to finish their automated home solution.	Research what a subroutine is and how one might be used – there is a useful PDF manual available on the Flowol website that would help them here.	Watch the following video to reinforce the lesson **Link Video Hydroponic Lettuce Factory** is a link to an interesting video which can be found at: https://www.youtube.com/watch?v=o1QXCnC-2h4. It provides a useful background context for this.

4	• Develop a control solution for a system that includes a subroutine • Understand how the use of subroutines can make programs more efficient	Pupils should find the basics of this mimic (without flashing lights) straightforward and be able to add in a decision at the start to check whether the wait button has been pressed. The rest of the sequence will be similar to the traffic lights in the Bridge Light mimic in lesson 2.Allow pupils time to consolidate their learning so far to create the flowchart for the mimic as described, without the flashing lights. They will later add in the flashing light sequence as a subroutine	Show **Video Pelican Crossing (Pedestrians) – 1969**. Explain that this clip is a public information film from 1969 when these crossings were first introduced. Trivia! You could note here that Puffin crossings are more common now. The Puffin crossing (**P**edestrian **U**ser **F**riendly **In**telligent Crossing) was developed to replace the Pelican crossing. Puffin crossings differ from Pelican crossings as they do not have the flashing green man and flashing amber signal. The red and green man are located just above the push button on the same side as the pedestrian and this encourages pedestrians to face the oncoming traffic while waiting for the green man to show. Ask what is the 'default setting' for this control system (red man on, green lights on) and what triggers this to 'change state' (the button being pressed – draw out the idea that the system is constantly checking to see if the button has been pressed). Explain the term 'default'.	PowerPoint Guide: Flowol L4 Subroutines	Ask pupils to load Flowol and open the **Pelican Crossing** mimic. create a subroutine using the Lighthouse mimic to make the lamp flash when it is dark (i.e. when the sun is off). • Identify the outputs that control the green man and amber lights Open **Solution Pelican 2** and hide the flowchart solution behind the mimic window. Run the program and ask pupils to watch this and use it as a guide to the length of the delays in their flowcharts. Pupils who make faster progress can add another 'beep' subroutine to their solution using the **Beep** sound file (see **Solution Pelican 2**). **Mimic Video Pelican 2** is a video clip of the **Solution Pelican 2** running if required. Pupils could also move on to attempt a solution for the **Level Crossing** mimic. This mimic can be used in an extra lesson following this as an activity for some pupils if others need more time to finish their Pelican crossing solution.	Ask pupils to choose a short section of a computer game or animation, and break it down into modules, identifying five modules that may have been programmed by separate members of a team. For each module, they should describe what might have been done.	Display **Solution Pelican (No Sub)** and ask how it differs from their solutions (e.g. no subroutine). Ask which solution they think is the most efficient and why (e.g. using a subroutine – fewer symbols in the main flowchart, much easier to understand). Explain that this approach to programming using subroutines or small sub-programs is referred to as '**modular**'. This is a commonly used approach that helps to break down large and very complex problems into smaller parts that separate teams of programmers can work on. Tell pupils that this is how computer games are developed. Illustrate this idea by displaying **Link Video How video games are made** which can also be found at: http://www.youtube.com/watch?v=u0FoYgZmlMs

5	• Understand what an **actuator** is used for in a control system • Understand what a **variable** is and explain how **variables** can be used to help control systems • Develop a control solution for a system that uses **actuators** and **variables**	Introduce the lesson by playing a light-hearted video of a car park barrier prank, **Link Video Car Park**. Ask pupils to work in pairs or groups and identify what could be causing the problems if they were real. Question pupils to draw out the key ideas that real problems could be due to faulty sensors, poor programing or hardware failure. Load Flowol and open the **3D Car Park Barrier** mimic. *(This mimic is available from Flowol as a supplementary download called 3D Mimics. See: http://www.flowol.com/Secondary3DMimicPack1.aspx)*	Pupils that this lesson will focus on producing their own solutions to control a car park barrier more successfully than the example they have just watched.	PowerPoint Guide: Flowol L5 Actuators	They need to start by creating two subroutine flowcharts for the entry barrier: one to raise it and another to lower it. These subroutines will then need to be combined in a main flowchart. Tell pupils they will deal with the car park sign later. Pupils who complete the entry flowcharts can create two more subroutine flowcharts: one to raise the exit barrier when a car is ready to leave the car park; and another to lower the exit barrier once the car has passed through the exit barrier They will also need to add in symbols to initialise the variable, add or subtract 1 to the variable depending on whether the car is entering or exiting the car park, and add in a decision to prevent the barrier from opening if the car park is full.	Students should create a flowchart on paper representation a thinking of a subroutine for their car park flowol	

6	• Understand how a digital 7-segment display works • Implement the 7-segment display • Complete the assessment	PowerPoint Guide: Flowol L6 Variables	Remind pupils of the use of variables to monitor the number of cars or spaces that are inside the car park. Open the Car Park mimic with the **Solution Car Park Complete** Ask how many spaces this car park has. How does the system 'know' how many cars are in the car park? Draw out the idea that the system must be counting spaces remaining as cars come in and go out of the car park.	PowerPoint Guide: Flowol L6 Variables	Ask pupils to ensure that they have a system which will turn on the 'FULL' sign if the car park is full. Discuss what the class think is the maximum number of cars in the car park. Since there is only a single digit on the Spaces indicator, '9' is the maximum, but for testing purposes, any number up to nine is fine. Ask pupils to plan the outputs in the 7-segment display. Circulate and support pupils as they work, moving them on to create the subroutine and integrate into the main flowchart when ready. Students will be asked to independently complete the assessment questions Ask pupils to complete the assessment portfolio (found in the root folder for this unit). A screenshot of their most advanced program should be included. Pupils may like to use Alt+PrtScrn to take a screenshot of just the active window rather than PrtScrn alone which will capture the entire screen.	Revise for past exam based assessment next lesson	Ask pupils: How much of the solution did you complete? Which parts of the solution did you find easy and why? Which parts of the solution did you find hard and why?