Digital Technologies – 7 and 8_ Data collection, interpretation and representation

Strand			Knowledge and understanding				Processes and production skills													
			Digital systems		Representation of data		Collecting, managing and analysing data		*Creating digital solutions by:*											
									Investigating and defining				Generating and designing		Producing and implementing		Evaluating		Collaborating and managing	
Content Description			Investigate how data is transmitted and secured in wired, wireless and mobile networks, and how the specifications affect performance (ACTDIK023)		Investigate how digital systems represent text, image and audio data in binary (ACTDIK024)		Acquire data from a range of sources and evaluate authenticity, accuracy and timeliness (ACTDIP025)		Analyse and visualise data using a range of software to create information, and use structured data to model objects or events (ACTDIP026)		Define and decompose real-world problems taking into account functional requirements and economic, environmental, social, technical and usability constraints (ACTDIP027)		Design the user experience of a digital system, generating, evaluating and communicating alternative designs (ACTDIP028)		Design algorithms represented diagrammatically and in English, and trace algorithms to predict output for a given input and to identify errors (ACTDIP029)		Implement and modify programs with user interfaces involving branching, iteration and functions in a general-purpose programming language (ACTDIP030)		Evaluate how student solutions and existing information systems meet needs, are innovative, and take account of future risks and sustainability (ACTDIP031)		Plan and manage projects that create and communicate ideas and information collaboratively online, taking safety and social contexts into account (ACTDIP032)	
Sequence of Lessons / Unit	**Approx. time rq'd**	**Year A or B**	CD	Achievement standard #	CD	Achievement standard #	CD	Achievement standard #	CD	Achievement standard #	CD	Achievement standard #	CD	Achievement standard #	CD	Achievement standard #	CD	Achievement standard #	CD	Achievement standard #	CD	Achievement standard #
Computers and binary	9	8	☐		☑	2	☐		☐		☑	4	☐		☐		☐		☐		☐	

Years 5 and 6 Achievement Standard	**Years 7 and 8 Achievement Standard**	**Years 9 and 10 Achievement Standard**
By the end of Year 6: • Students explain the fundamentals of digital system components (hardware, software and networks) and how digital systems are connected to form networks. (1) • They explain how digital systems use whole numbers as a basis for representing a variety of data types. (2) • Students define problems in terms of data and functional requirements and design solutions by developing algorithms to address the problems. (3) • They incorporate decision-making, repetition and user interface design into their designs and implement their digital solutions, including a visual program. (4) • They explain how information systems and their solutions meet needs and consider sustainability. (5) • Students manage the creation and communication of ideas and information in collaborative digital projects using validated data and agreed protocols. (6)	By the end of Year 8 • Students distinguish between different types of networks and defined purposes. (1) • They explain how text, image and audio data can be represented, secured and presented in digital systems. (2) • Students plan and manage digital projects to create interactive information. (3) • They define and decompose problems in terms of functional requirements and constraints. (4) • Students design user experiences and algorithms incorporating branching and iterations, and test, modify and implement digital solutions. (5) • They evaluate information systems and their solutions in terms of meeting needs, innovation and sustainability. (6) • They analyse and evaluate data from a range of sources to model and create solutions. (7) • They use appropriate protocols when communicating and collaborating online. (8)	By the end of Year 10 • Students explain the control and management of networked digital systems and the security implications of the interaction between hardware, software and users. (1) • They explain simple data compression, and why content data are separated from presentation. (2) • Students plan and manage digital projects using an iterative approach. (3) • They define and decompose complex problems in terms of functional and non-functional requirements. (4) • Students design and evaluate user experiences and algorithms. (5) • They design and implement modular programs, including an object-oriented program, using algorithms and data structures involving modular functions that reflect the relationships of real-world data and data entities. (6) • They take account of privacy and security requirements when selecting and validating data. Students test and predict results and implement digital solutions. (7) • They evaluate information systems and their solutions in terms of risk, sustainability and potential for innovation and enterprise. (8) • They share and collaborate online, establishing protocols for the use, transmission and maintenance of data and projects. (9)

Computers and binary

All computer data including text, images and sound is represented using binary. Work between ASCII and Unicode to understand the relationship between them. Encode images using binary. Explore converting between text and sound and the file formats used to store files. Create a website for a user that requires audio support.

Flow of activities				
Short text	Binary system Provide students opportunities to code and encode messages using ASCII, Unicode and Hexadecimal.	Bitmap images Provide online tools that enable students to explore creating images by changing pixels based on a combination of binary digits.	Encoding audio Investigate audio file formats and converting and saving audio files suing relevant software.	Accessible webpage Create a webpage that incorporates images, texts and audio support for text.
Questions to guide exploration	How does a computer encode text?	*How are images encoded?*	*How does a computer encode audio files?*	*How can I design a website that is accessible to users?*
AC alignment	Representation of data (ACTDIK024)	Representation of data (ACTDIK024)	Representation of data (ACTDIK024)	Representation of data (ACTDIK024) Investigating and defining (ACTDIP027)
What is this about?	All computer data is represented using binary notation - a number system that uses 0s and 1s. Binary digits can be grouped together into bytes. All software, music, documents, and any other information that is processed by a computer is stored using binary. Two standard character sets that students should become familiar with are ASCII and Unicode. In each standard a certain sequence of bits (1s and 0s) stands for a letter or other character. ASCII is only used for the English language. Unicode uses between 8 and 32 bits per character, so it can represent characters from languages from all around the world. Hexadecimal is way to write binary numbers more easily. An 8-bit binary number can be written using only two different hex digits.	All computer data is represented using binary notation - a number system that uses 0s and 1s. Binary digits can be grouped together into bytes. Images onscreen are made up of picture elements (pixels). Bitmap images are organised as a grid of pixels. Each pixel is stored as a binary number and represents a specific colour. The colour depth is measured in bits. 1 bit per pixel allows for two values (1) white or (0) black. 3 bits per pixel results in 8 available colours in combinations of RGB (000, 001, 011, 100, 101, 111, 110, 111). 8 Bit colour allows for 256 colours. Commonly images are made up of colours that are a combination of 24 bits. For example, green can be represented in binary as 000000001111111100000000 or in RGB as (0, 255, 0) and as hexadecimal #00FF00. 24-bit colour makes 16,777,216 (256 x 256 x 256) possible colours.	Sounds created on a computer exist as digital information encoded as audio files. An audio file format is a file format for storing audio. Common audio file formats include MP3, AAC, WMA, FLAC, ALAC, WAV, AIFF, and PCM.	Many computers and mobile devices today have built in text-to-speech software. Some people with disabilities, including people who are blind, use specialized software called screen readers. Screen readers provide important functionality such as navigating through headings, speaking image alternatives, and identifying internal and external links. They can also highlight the text as it is being read aloud for people to see and hear the content at the same time. Content must be coded properly so that all of the functionality of the text-to-speech software works with the content.
The focus of the learning (in simple terms)	All number systems rely on positional notation. To understand binary numbers first be familiar with the positional notation we use every day with decimal notation. Provide students opportunities to code and encode messages using ASCII, Unicode and Hexadecimal. Simple conversions can be done between each. Students could present to the class 'Why Unicode was developed'.	Provide online tools that enable students to explore creating images by changing pixels based on a combination of binary digits. Introduce hexadecimal as a way to encode pixels. Students may explore vector graphics and bitmap graphics and scalability. Explore file formats used to store images. Relate the RGB values to other areas where students may be familiar with this use of binary numbers such as when programming an LED on an Arduino board to light up a specific colour or when using Sphero and selecting a particular colour. **Vector and Raster**	Investigate audio file formats, such as MP3, AAC, WMA, FLAC, ALAC, WAV, AIFF, and PCM. How do they differ? Make a list of audio files that students use on their devices. Do this as a group activity and share findings as a class. Use audio recording software such as RecordPAd for windows devices or Audacity for iOS to record an audio soundtrack. There are several tools that convert between different formats. Use Audacity or similar software to save audio projects in different file formats. Explore and analyse the quality of text to speech for example: • audio books • a Smartphone that enables spoken messages to send as an SMS. • A software assistant that uses voice queries to perform actions on a smartphone eg SIRI.	Create a webpage that incorporates images, texts and audio support for text. Build empathy as part of the design process to describe needs of different audiences that may require audio support. Define the functional and data requirements based on user needs. Explore the use of embedded and linked media elements.

		There is a difference between these types of graphic images and the file formats used. You may decide to explore this in more detail.	This activity links with programming. App Inventor or App Lab are free, cloud-based services that enable users to build apps in the web browser. Create an App that uses the functionality of Text to Speech. Consider what prompts the user to speak and what code blocks/code translates the	
Supporting resources and tools and purpose/ context for use.	*Learn more* Positional notation and Number Bases This video explains positional number using base 10 and then base 2. Why Do Computers Use 1s and 0s A short explanation of binary. Binary numbers and place value An introduction to converting binary numbers into decimal. What are binary numbers? James May explains binary numbers. Representing Numbers and Letters with Binary How To Convert Binary To Decimal Tutorial A simple tutorial outlining elementary conversions of binary to decimal and decimal to binary. Intro to Binary Numbers Learn to count in binary, the language of computers. Binary Counter This video shows a wooden binary counter to demonstrate the binary numbers from 0 to 63 (in base 10). Introduction to binary Use this guide for students who are unfamiliar with binary or as a refresher. Hexadecimal An interactive guide to explore hexadecimal system. It is important to note that computers do not use hexadecimal - it is used by humans to shorten binary to a more easily understandable form. A shorthand way of writing binary numbers: Hexadecimal Hexadecimal is a shortcut for representing binary. It is used because large numbers can be difficult to work with in binary.	Learn more Images, Pixels and RGB Hear Instagram co-founder explain how images are represented in binary, and how image filters work on the inside. What are Pixels and how do they work? A basic introduction to what a pixel is, and how it is used to display images, video and content on our screens. iPad 2 Pixels Seen Under a Microscope Live Encoding images An interactive guide to encoding images. Images and colours in the CS Field Guide Section 5.5 explains Images and Colours and representing a colour with bits (binary digits). What are Vector and Raster Graphics? Use this video to explain the difference between vector and raster graphics. The Difference Between Raster and Vector Files & Different File Types This video explains the difference between raster and vector files. *Online tools and resources* Code.org Colour pixilation tutorial An online tool that enables students to explore creating images by changing pixel values in binary and hexadecimal. Pixel Value Interactive Upload your own photos to see the RGB values for each pixel written as 24-bit colour. For example, a blue pixel may be made up of the RGB value (42, 104, 213). Relate these values back to 8-bit binary equivalent eg 42 = 00101010. RGB colour code chart: Rapid table Use these tables to convert RGB to hexadecimal.	Learn more Encoding audio and video Use these guides to learn about digital audio and video that has a sample rate, bit depth and bit rate. Codecs and Formats Explained! (And Why You're Probably Wrong) A video explaining codecs. Digital Compression explained by Aloe Blacc Singer/songwriter Aloe Blacc has built his own sites and created digital pop hits. In this video, he explains how digital compression works. File Formats and CODECs This video explains the main three types of compression and their differences, how lossless compression. Online tools and resources Convert text to speech Explore text to speech. Type in text and save as an audio file. Making mobile Apps with App Inventor https://www.youtube.com/embed/Vdo8UdkgDD8?autoplay=1 You can make an app that has 'Text to Speech' functionality. Find out how by following this video tutorial. App Lab Code.org's App Lab is a programming environment where you can make simple apps. Design an app, code in JavaScript with either blocks or text, then share your app. App inventor course A course that targets beginners to design an app using App Inventor. App inventor: Getting started Set up instructions and tutorials to use App inventor. It is important to read the setup instructions. The resulting app is only for Android devices. An emulator needs to be installed on non-Android devices. There is quite a bit of setting up to do to ensure the emulator runs the latest version Hexadecimal Drum Machine Use this interactive drum machine to explore turning binary numbers into sound. (View in IE requires Flash)	Learn more Web Accessibility Perspectives: Text to Speech Web accessibility is essential for people with disabilities and useful for all. Learn about the impact of accessibility and the benefits for everyone in a variety of situations. Web Accessibility Perspectives: Voice Recognition Learn more about web accessibility and why it is essential for people with disabilities and useful for all. Web Accessibility Tutorials These tutorials shows how to develop web content that is accessible to people with disabilities, and that provides a better user experience for everyone. 10 Free Screen Readers For Blind Or Visually Impaired Users https://usabilitygeek.com/10-free-screen-reader-blind-visually-impaired-users/ VoiceOver on the MAC This is built-in functionality on a MAC. It is in the Utility applications folder. Ten Guidelines To Improve The Usability And Accessibility Of Your Site https://usabilitygeek.com/guidelines-improve-usability-accessibility/

	How To Easily Convert Hexadecimal To Binary And To Decimal Tutorial A simple tutorial outlining elementary conversions of hexadecimal to decimal, through converting the hexadecimal to binary first. Hexadecimal Number System Learn how the Hexadecimal Number System works Lesson ideas Everything is numbers A lesson idea about representing data as text, images and sound. Online tools and resources Creating my own spreadsheet to convert binary to decimal This lesson provides some guidance and Excel files for student and teacher use to convert up to 8-bit binary numbers to a decimal.			
Assessment	**Suggested approaches may include:** Presentation or demonstration Worksheets and quizzes that demonstrate the ability to convert binary to decimal, decimal to binary. Worksheets and quizzes that demonstrate the ability convert hexadecimal numbers to binary and/or decimal formats. **Achievement standard** Explain how text, image and audio data can be represented, secured and presented in digital systems.	**Suggested approaches may include:** Artefact Analysis Adapted worksheet A presentation to explain how RGB values and hexadecimal numbers are used in image manipulation software. **Achievement standard** Explain how text, image and audio data can be represented, secured and presented in digital systems.	**Suggested approaches may include:** Adapted worksheet Record audio and save the recording in different formats. Use a tabular display to demonstrate how the different codecs lead to different file sizes. Make the Text to Speech app using Appinventor. Demonstrate the completed app Achievement standard Explain how text, image and audio data can be represented, secured and presented in digital systems.	**Suggested approaches may include:** Design plan Artefact Analysis Achievement standard Explain how text, image and audio data can be represented, secured and presented in digital systems. Define and decompose problems in terms of functional requirements and constraints.