#  Unit Plan Template

Click on any descriptive text, then type your own.

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| **Unit Author** |
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| School District |  |
| School Name |  |
| School City, State |  |
| **Unit Overview** |
| **Unit Title** |
| Breaking the Code |
| **Unit Summary** |
| In this mini unit, students in grade 6 will engage in mathematics like a computer. Student will learn the basics of the binary number systems and then use their knowledge to decode letters that are seen on computer screens. Computer are just one of many technologies that use the binary number system - zeros and ones - to convey information. Today's students now live in a digital world, and the most important digits are 0 and 1. The binary number system plays a central role in how information of all kinds is stored on computers. Students will examine the connection between binary coding and creating text in a computer. Students will investigate and gain knowledge behind the understanding that coding in computers is represented by numbers in base 2 value (binary). Through their investigations students will make links between realising that for every action on a computer there is a mathematical calculation going on in the computers system.Students in this unit will create codes both manually and using a computer. The overall assessment will connect the links between students understanding of interpreting data displays (mathematics curriculum) that links the digital technologies curriculum by looking at whole numbers and how they are used to represent data in digital form (binary numbers) to create information in software.For the final assessment students will create their own binary message that will be given to another student to decipher, as well as deciphering a code that has been given to them by the teacher. Students will have to use their new knowledge of Technologies and that for every letter, number and symbol they see on the computer has a corresponding binary code to match.  |
| **Subject Area** |
| Technologies – Digital TechnologiesCross CurriculumMathematics – Data Representation and Interpretation |
| **Grade Level**  |
| 6 |
| **Approximate Time Needed**  |
| 5 Lessons – 60 min each |
| **Unit Foundation** |
| **Content Descriptions** |
| **Digital Technologies Knowledge and Understanding** -Assigned content descriptor, New knowledge.* Examine how whole numbers are used to represent all [data](http://www.australiancurriculum.edu.au/glossary/popup?a=T&t=data) in digital systems [(ACTDIK015)](http://www.australiancurriculum.edu.au/curriculum/contentdescription/ACTDIK015)

Elaborations:* Recognising that digital systems represent all types of data using number codes that ultimately are patterns of 1s and 0s (called binary digits, which is why they are called digital systems).
* explaining that binary represents numbers using 1s and 0s and these represent the on and off electrical states respectively in hardware and robotics
* representing whole numbers in binary, for example counting in binary from zero to 15, or writing a friend’s age in binary

**Digital Technologies Processes and Production Skills*** Acquire, store and validate different types of [data](http://www.australiancurriculum.edu.au/glossary/popup?a=T&t=data), and use a range of software to interpret and visualise [data](http://www.australiancurriculum.edu.au/glossary/popup?a=T&t=data) to create information [(ACTDIP016)](http://www.australiancurriculum.edu.au/curriculum/contentdescription/ACTDIP016)

Elaborations:* using data visualisation software to help in interpreting trends, for example uploading data to a web application and building a visualisation of the dataset

**Cross-Curriculum**      **Mathematics -** Data Representation and Interpretation* Interpret and compare a range of [data](http://www.australiancurriculum.edu.au/glossary/popup?a=M&t=Data) displays, including side-by-side column graphs for two categorical variables [(ACMSP147)](http://www.australiancurriculum.edu.au/curriculum/contentdescription/ACMSP147)

Elaborations:* understanding that data can be represented in different ways, sometimes with one symbol representing more than one piece of data, and that it is important to read all information about a representation before making judgments
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| **Student Objectives/Learning Outcomes** |
| Students will be able to:* Use higher order thinking skills to answer and examine the skills needed in this unit.
* Make connections with the internal workings of a computer to see how information is produced and stored.
* Connect computer coding to the base 2 value.
* Learn that computers do not understand language the way we do.
* Learn how to connect simple commands to a computer program to make a game work.
* Create codes using the binary system.
* Work in groups to create and break codes
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| **Assessment Plan** |
| **Develop Assessment** |
| **Formative Assessment*** Observing and monitoring students’ responses through inquiry questions and ongoing work.
* Group work monitoring, students will hand in their group work for monitoring of making connection between binary understanding and coding.
* Lesson 2 offers some great monitoring and inquiry question opportunities when the class work together and then in groups to create coding messages and has to break them as well.
* In the computer task in lesson 4 – students will be told instantaneously from the computer program if they are selecting the right coding message for the task that needs to be performed. Walking around and writing down observations of taking photos could be easily done in this lesson.
* Lesson 5 will be a revision lesson enabling feedback to be given individually to student gathering students overall understanding of creating and decoding binary codes.
 | **Summative Assessment*** Students will take all of their new knowledge to engage in a two part assessment piece that see student decode a message written in binary code. As well as students producing their own written message in binary code for another student to break.
* Part A of the assessment students will be given three skills questions to answer that are used to draw out students understanding of binary code in digital systems.
* From there students will be given 2 of three possible binary codes to break. Each code has been developed to suit the learning needs of students.
* Students will use the ASCII alphabet chart to help them decipher and create both codes needed for this assessment.
* To differentiate this assessment task in part A student will be given a code, lower level readers/low level mathematic skills will be given just 1 word to break in the code. Other students will have the opportunity to decipher two codes one code has to be done and that will be a phrase that needs to be decoded. While the other code will be a small sentence that all students can try.
* This last code will help in determining outcome in the assessment grading process.
* Part B will require students to create their own code for another to student in the class to decode.
* This process can be done at random or just a swop as students finish the task. For lower level students the teacher could create one again for the students to break or work with these students to scaffold their assessment task.
* This part of the assessment will hold a mark for both the person who created the code and the person who decoded the code and if they did it correctly or not and if the person who wrote it did it correctly or not.
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| **Assessment Summary** |
| Students will through each lesson develop the understanding of the elements of computers and their coding system to complete the final summative assessment.The summative assessment is a two part assessment, students will have to use their skills of connecting binary codes to answer question engaging their knowledge of binary coding and then read two coded messages and decode them using their corresponding binary letter to decipher the message given to them by the teacher. Part two requires students to create their own message coding their birthday in letters only to give to another student for them to decode.Each task is requiring students to connect to their computer science understanding of the tools required in a computer to create the messages on a computer screen that allow us to read the information we input into computers.Differentiation of this assessment task will in part one give three different codes made to cater for the leveled needs of students both for literacy understand and mathematical understanding. Code one will be 1 word to decode, the second outcome will be a statement that needs to be decoded, and the third outcome will be a small sentence that needs to be decoded.Task two students in the lower group will have a word they will be given and they have to write the code for it with support if needed. |
| **Unit Details** |
| **Prerequisite Skills** |
| Literacy – writing skillsGroup work understandingMathematics – base value understanding, patterns |
| **Instructional Procedures** |
| **Lesson 1 – 60 minutes****Gaining Background Knowledge on computer science**Introduce the unit by posing the Essential Question to students, How do computers show us all of the information on the screen? Have students answer this question in their journals, have them discuss this question as a group and introduce the image (or if you are able) the inside of a computer. Talk through the different elements of a computer, gauge students understanding of computer systems.Part two of this lesson introduces the students to how whole numbers and how they are used to represent all data in digital systems.* Introduce the binary on – off cards = each cards has numbers in base 2 (find example of base cards in resources), up to 32.
* Bring five students to the front and give them one of the on – off binary cards.
* Have the cards turned over to show the pattern of base 2 value. Each number is doubled and this is goes on past 32, but today we are working up to 32.
* Show students how to add up using the number system (How do we make 3) turn the cards over to on (dotted side) and have students as a class work out how to build 3.
* Explain to student that when the numbers are off this is the 0 value and when they are turned over this is the number system counting up by 1.
* Play around with the cards till the students can see the connection between adding with the binary code system – have students count to 65 using their understanding.
* Show students at the end of the lesson a connection to lesson 2 where after learning all of this binary understanding how would a computer read this information. The computer replaces these numbers for the numbers 0 and 1.
* Show students how each number has a position 0, 1, 2, 4, 8, 16, 32…… and in a computer system everything is stored using a zero or one and on a computer this is called a binary digit = bit on a computer.

**Differentiation*** How students the base 10 system they are used to working in and then model the base to system, they will see the connection between doubling the numbers as they get larger.
* Using lots of visual hands on for students to make connections between the 0 and 1 understanding of computer coding.
* By having the binary coding cards black on one side can develop students understanding that the black can be replaced with the number 0 (meaning off).
* Pair students up with a buddy to help them to clarify understandings.

**Resources*** Binary cards can be made different ways, for a class group activity use black cardboard and glue white paper on it then draw dots to represent the binary number. Also write the numeral as the bottom of each card. Make the cards A4 size.
* For individual or group set binary cards use playing cards and just replace the pictured side with the binary numbers, this way each child could have a set of binary cards each. Have the students make them to build concepts.

Teachers Resources for background understanding – the following videos are a 3 short video’s to show teachers how to introduce the binary coding understanding to students. Computer Science without a computer<http://csunplugged.org/binary-numbers/#Videos>**Lesson 2 and 3 –** both 60 minutes eachLesson 2 will be split into two parts.Part 1 – Build from lesson 1. Students now have developed that concept that codes in computers are represented by the numbers zero and one. But each of these spots represents a number in the base 2 value.* Introduce the ASCII Alphabet code sheet – each letter of the alphabet has a corresponding binary code.
* Have students demonstrate this using the class set of binary cards from lesson 1
* Model for the students and demonstrate on the board how you would code a student’s name in the class.
* Each letter is coded top to bottom with a line break indicating a different word.

 For example – Alana 01000001 01101100 01100001 01101111 01100001 Be sure to show students that one side of the alphabet code is capitals and the other side is lower case letters. The value of each code is also given in decimals, this is what student were doing yesterday when they were adding up in the base 2 value system.**Lesson – part 2 of lesson 2 and all of lesson 3**Students will begin to use their new knowledge to start doing simple coding on the computer.In lesson 2 the teacher will model with the assistance of the class how to code using simple instructions. Using the program Code.org the teacher will go through the steps to show students how the coding they have been doing on paper is transported to computer systems.The class in lesson 2 will work on coding for a Star Wars program/game. <http://code.org/starwars>Lesson 3 students will work by themselves or in pairs (depending on how many computers you have access to) on another computer program that requires students to code using simple instructions to achieve the desired outcome of the coding they have to follow. <http://studio.code.org/flappy/1>**Differentiation –** * Model as a class a one or two codes together to build understanding, also show students a first and second name so they can see the gap that would be given to indicate a new word.
* Group work, give student a copy of the ASCII Alphabet Characters sheet, this will help student to write their codes using the correct sequence of binary coding for the capital or lower case letter.
* When students are confident deciphering codes have them create little codes for other groups to break for example, school name, street name, other teachers names, tree names, shopping centres.
* With the computer coding work in lesson 3 pair up students who may have trouble with reading and following instructions, as they build their confidence with the program allow them to code on their own so they can make connections to understanding for everything that is done on the computer a code has to match the step they want to achieve.
* For fast finishes there are several coding activities in this one are of the code.org, have student select another program to code.

**Resources Lesson 2 and 3 –*** Class set of computers or as many as you can access. IPads maybe used.
* Access to the free internet site Code.org
* Star Wars program/game. <http://code.org/starwars>
* Flappy1 <http://studio.code.org/flappy/1>

**Lesson 4 –** 60 minutes* This lesson is to be used as a revision.
* The first 15 minutes have student revise their understanding of how computer science operates and how does the place value system fit into computer coding.
* Then divide students into pairs and have them experiment with creating codes for each other to decode using the ASCII alphabet sheet to assist in the coding process.
* As a conclusion have the class come together and help them decode an email you had to send to the principal. Make it a great email about your class and how wonderful they are doing at decoding..
* Let the students take turns in decoding the message, offer rewards for students who are engaging and making connections.
* Before the lesson concludes introduce their assessment for the next lesson and have student read and understand expectations.

**Lesson 5 Final Lesson–** Assessment – 60 minutes* This lesson is for the delivery of the final assessment.
* Each student will be handed Part A and B of the assessment and a copy of the ASCII alphabet sheet.
* Part A will require students to answer questions on binary coding and also decode the codes provided for them using the ASCII sheet as a guide (using this sheet is not cheating). Students still have to be able to read the codes to understand if a capital letter has been used or lowercase, students also need to know how to read the code to work out the word. Each word has a line between each word and they have to show their understanding in the written form.
* There will be two codes on everyone’s sheet no matter about their learning ability. Attempts of both will help with students grading later.
* Part B requires students to undertake two task 1. Write a code (using their birthdays in letters only) for another student to decode. 2. Swop their paper and have another student decode student’s code.
* Students will undertake their assessment individually.
* When it comes time to swop their assessment for Part B the teacher will decide how this will be done; Either gathering the class’s assessment and hand them out randomly for other students to break the other students code or pair students up prior to the assessment to swop with.

Differentiation of Assessment* Give students a copy of the ASCII so as they do not have to work out the binary code of all of the alphabet for both the lower and capital letters.
* Students who struggle with literacy or numeracy may sit with a teacher’s aide for clarification of the task asked of them, or for scribing.
* Have different ability codes provided for the students to decode; lower level have to decode 1 word (but are also given the option to decode the phrase).

Other students will be given on their sheet a phrase to decode and a small sentence to decode. If you feel there are students who could be extended even further as them to write a help message to a mother or father using binary coding. Make them use minimum of twenty words.Resources Assessment – See attachments on webpage* Criteria sheets – lower level students
* Criteria sheets – standard plus
* Rubric
* ASCII Alphabet sheet -

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| **Accommodations for Differentiated Instruction**  |
|  | **Resource Student** | * Create a list of websites to gather information from for the research projects.
* Preview key vocabulary as a group prior to starting activities.
* Allow students to work with a partner.
* Allow the students to see examples and rubrics and to ask questions before starting the major tasks in the unit.
* Visual and verbal reinforcement whenever possible.
* Repeat and clarify directions and information whenever necessary.
* Allow adequate wait time for questions.
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| **Materials and Resources Required For Unit** |
| **Technology – Hardware** (Click boxes of all equipment needed)  |

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| [ ]  Camera [x]  Computer(s) [ ]  Digital Camera [ ]  DVD Player[x]  Internet Connection  | [ ]  Laser Disk[x]  Printer [ ]  Projection System [ ]  Scanner [ ]  Television  | [ ]  VCR [ ]  Video Camera [ ]  Video Conferencing Equip.[x]  Other IPad |
| **Technology – Software** (Click boxes of all software needed.) |
| [ ]  Database/Spreadsheet [ ]  Desktop Publishing [ ]  E-mail Software[ ]  Encyclopedia on CD-ROM  | [ ]  Image Processing [x]  Internet Web Browser [ ]  Multimedia  | [ ]  Web Page Development [x]  Word Processing [x]  Other Power Point  |

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| **Background Resources for teachers** | * Binary Code – basic explanation

<http://www.theproblemsite.com/reference/mathematics/codes/binary-code>* How to convert from binary to decimal
* <https://getpocket.com/a/read/9059168>
* Decimal to Binary conversion using the division by 2 method
* <https://getpocket.com/a/read/1206432983>
* Decimal to binary conversion
* <http://courses.cs.vt.edu/csonline/NumberSystems/Lessons/DecimalToBinaryConversion/index.html>
* Unplugged – Computer science without a computer
* <http://csunplugged.org/binary-numbers/>
* Binary numbers in digital systems
* <http://designedbyteachers.com.au/marketplace/binary-numbers-in-digital-systems/>
* ThinkerSmith – Binary Baubles - <https://code.org/files/CSEDbinary.pdf>
* <http://www.thinkersmith.org/circuitDetail.php?classNo=620120001>
* How I taught third graders binary numbers
* <http://www.exploringbinary.com/how-i-taught-third-graders-binary-numbers/>
* Website- Resources for teaching binary numbers
* <https://blogs.msdn.microsoft.com/alfredth/2010/04/01/resources-for-teaching-binary-numbers/>
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# Referencing

ACARA. (2016). *Digital technologies: Year 5 and 6.* Retrieved March 20, 2016 form <http://www.australiancurriculum.edu.au/technologies/digital-technologies/curriculum/f-10?layout=1#level5-6>

University of Canterbury, NZ. (n.d.). *Computer science without a computer.* Retrieved April 16, 2016, from <http://csunplugged.org/binary-numbers/>