## The Journey Inside ${ }^{\text {SM: Digital Information }}$

## Student Handout: ASCII Computer Code

## ASCII Computer Code

Computers work in binary code. Information is coded using 0 s and 1s. Each 0 or 1 is called a bit. In the early years of computer development, different computer companies applied the binary system in their own way. The code for the letters in the word "cat" was often different in different brands of computers.

Eventually, a set of standards was developed. Computer manufacturers agreed to use one code called the ASCII (American Standard Code for Information Interchange). ASCII is an 8 -bit code. That is, it uses eight bits to represent a letter or a punctuation mark. Eight bits are called a byte. A binary code with eight digits, such as $11011011_{2}$, can be stored in one byte of computer memory. The word "CAT" in a word processor becomes $01000011_{2}, 0100$ $0001_{2}$, and $01010100_{2}$. The word "cat" is $01100011_{2}, 01100001_{2}$, and $01110100_{2}$.


Each letter, number, and symbol is represented by an 8-bit ASCII code. Part of the ASCII code is given in this handout. Notice that there is even an ASCII code for a blank space.

Intel ${ }^{\circledR}$ Teach Program
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| Character | Decimal Number | Binary <br> Number | Character | Decimal Number | Binary Number |
| :---: | :---: | :---: | :---: | :---: | :---: |
| blank space | 32 | 00100000 | * | 94 | 01011110 |
| ! | 33 | 00100001 | - | 95 | 01011111 |
| " | 34 | 00100010 | , | 96 | 01100000 |
| \# | 35 | 00100011 | a | 97 | 01100001 |
| \$ | 36 | 00100100 | b | 98 | 01100010 |
| A | 65 | 01000001 | c | 99 | 01100011 |
| B | 66 | 01000010 | d | 100 | 01100100 |
| C | 67 | 01000011 | e | 101 | 01100101 |
| D | 68 | 01000100 | f | 102 | 01100110 |
| E | 69 | 01000101 | g | 103 | 01100111 |
| F | 70 | 01000110 | h | 104 | 01101000 |
| G | 71 | 01000111 | i | 105 | 01101001 |
| H | 72 | 01001000 | j | 106 | 01101010 |
| I | 73 | 01001001 | k | 107 | 01101011 |
| J | 74 | 01001010 | 1 | 108 | 01101100 |
| K | 75 | 01001011 | m | 109 | 01101101 |
| L | 76 | 01001100 | n | 110 | 01101110 |
| M | 77 | 01001101 | - | 111 | 01101111 |
| N | 78 | 01001110 | P | 112 | 01110000 |
| $\bigcirc$ | 79 | 01001111 | q | 113 | 01110001 |
| P | 80 | 01010000 | $r$ | 114 | 01110010 |
| Q | 81 | 01010001 | $s$ | 115 | 01110011 |
| R | 82 | 01010010 | t | 116 | 01110100 |
| S | 83 | 01010011 | $u$ | 117 | 01110101 |
| T | 84 | 01010100 | $v$ | 118 | 01110110 |
| U | 85 | 01010101 | w | 119 | 01110111 |
| V | 86 | 01010110 | x | 120 | 01111000 |
| W | 87 | 01010111 | $y$ | 121 | 01111001 |
| X | 88 | 01011000 | z | 122 | 01111010 |
| Y | 89 | 01011001 | \{ | 123 | 01111011 |
| Z | 90 | 01011010 | \| | 124 | 01111100 |
| [ | 91 | 01011011 | \} | 125 | 01111101 |
| 1 | 92 | 01011100 | ~ | 126 | 01111110 |
| ] | 93 | 01011101 |  |  |  |

## Activities

1. Use the ASCII code to write your first name or nickname in binary numbers beginning with an uppercase letter and continuing with lowercase letters. Put the letters of your name in the first column.

| Letter | Binary representation of the letter |  |  |  |  |  |  |  |  |
| :--- | :--- | :--- | :--- | :--- | :--- | :--- | :--- | :--- | :--- |
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2. On a separate sheet of paper, write a short message in ASCII. Exchange messages with a partner and decode each other's message.
3. The ASCII code for a blank space is the decimal number 32, or the binary number $0010 \mathrm{OOOO}_{2}$. Why do you think it is important to have a code for a blank space?
4. How many characters of text are there in an average book? To help answer this question, select several different books of varying lengths. For each book, estimate the number of characters of text. Remember to count the punctuation marks and include the blank character between words and sentences. Since ASCII is an 8-bit code and requires 8 binary numbers to represent each letter, blank space, or punctuation mark, how many binary numbers does it take to represent the text of an average book? (Hint: Multiply 8 by the average number of text characters.)
