**Julia Kovrigin** **CTP 103**

# Lab 2: Data Representation – 30 points

Objectives:

* Demonstrate how the binary numbering system represents data
* Convert between binary, decimal and hexadecimal numbering systems and describe how each is used
* Decipher ASCII code

Instructions: This lab is designed to be completed in conjunction with the Data Representation PowerPoint presentation unless otherwise directed by your instructor. First begin viewing the presentation and stop and return to the lab as directed.

##### Section I: ASCII – 3 points

Here’s a little message for you to translate – use the ASCII codes in Figure 1-3 on p. 22 of your text. (Note: the letters are case-sensitive.)

|  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| **ASCII** | 01000011 | 01101111 | 01101101 | 01110000 | 01110101 | 01110100 | 01100101 | 01110010 | 01110011 |
| **Character** | C | o | m | p | u | t | e | r | s |

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
| **ASCII** | 01010010 | 01101111 | 01100011 | 01101011 | 00100001 |
| **Character** | R | o | c | k | ! |

##### Section II: Placing Binary Numbers in the Power-of-2-Table – 5 points

Here is an opportunity to practice this new skill you have acquired.

Place the following binary numbers in the table provided. Remember start from the right to enter the numbers. Note: You MUST have eight digits in the table. This requires you to add leading zeros. For example, the binary number 101 would be 00000101. Every box should have a number.

|  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- |
| 27 | 26 | 25 | 24 | 23 | 22 | 21 | 20 |
| 128 | 64 | 32 | 16 | 8 | 4 | 2 | 1 |
| 1 | 0 | 0 | 0 | 1 | 0 | 0 | 1 |

**Problem 1**

10001001

|  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- |
| 27 | 26 | 25 | 24 | 23 | 22 | 21 | 20 |
| 128 | 64 | 32 | 16 | 8 | 4 | 2 | 1 |
| 0 | 0 | 1 | 0 | 1 | 0 | 0 | 1 |

**Problem 2**

101001

|  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- |
| 27 | 26 | 25 | 24 | 23 | 22 | 21 | 20 |
| 128 | 64 | 32 | 16 | 8 | 4 | 2 | 1 |
| 1 | 1 | 1 | 0 | 1 | 1 | 1 | 1 |

**Problem 3**

11101111

|  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- |
| 27 | 26 | 25 | 24 | 23 | 22 | 21 | 20 |
| 128 | 64 | 32 | 16 | 8 | 4 | 2 | 1 |
| 1 | 0 | 0 | 1 | 1 | 0 | 1 | 1 |

**Problem 4**

10011011

|  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- |
| 27 | 26 | 25 | 24 | 23 | 22 | 21 | 20 |
| 128 | 64 | 32 | 16 | 8 | 4 | 2 | 1 |
| 0 | 0 | 0 | 0 | 0 | 1 | 0 | 1 |

**Problem 5**

101

##### Section III: Translating from binary to decimal – 5 points

Translate the following binary numbers to decimal numbers. (Enter the numbers in the table from the right.)

|  |  |  |
| --- | --- | --- |
| **Binary  Number** |  | **Decimal Number** |
| **Problem 1**  10001111 | |  |  |  |  |  |  |  |  | | --- | --- | --- | --- | --- | --- | --- | --- | | 27 | 26 | 25 | 24 | 23 | 22 | 21 | 20 | | 128 | 64 | 32 | 16 | 8 | 4 | 2 | 1 | | 1 | 0 | 0 | 0 | 1 | 1 | 1 | 1 | | **143** |
| **83** |
| **Problem** 1010011 | |  |  |  |  |  |  |  |  | | --- | --- | --- | --- | --- | --- | --- | --- | | 27 | 26 | 25 | 24 | 23 | 22 | 21 | 20 | | 128 | 64 | 32 | 16 | 8 | 4 | 2 | 1 | | 0 | 1 | 0 | 1 | 0 | 0 | 1 | 1 | |
| **200** |
| **Problem 3**  11001000 | |  |  |  |  |  |  |  |  | | --- | --- | --- | --- | --- | --- | --- | --- | | 27 | 26 | 25 | 24 | 23 | 22 | 21 | 20 | | 128 | 64 | 32 | 16 | 8 | 4 | 2 | 1 | | 1 | 1 | 0 | 0 | 1 | 0 | 0 | 0 | |
| **117** |
| **Problem 4**  01110101 | |  |  |  |  |  |  |  |  | | --- | --- | --- | --- | --- | --- | --- | --- | | 27 | 26 | 25 | 24 | 23 | 22 | 21 | 20 | | 128 | 64 | 32 | 16 | 8 | 4 | 2 | 1 | | 0 | 1 | 1 | 1 | 0 | 1 | 0 | 1 | |
|  |
| **Problem 5**  11100 | |  |  |  |  |  |  |  |  | | --- | --- | --- | --- | --- | --- | --- | --- | | 27 | 26 | 25 | 24 | 23 | 22 | 21 | 20 | | 128 | 64 | 32 | 16 | 8 | 4 | 2 | 1 | | 0 | 0 | 0 | 1 | 1 | 1 | 0 | 0 | | **28** |
|  |

##### Section IV – Translating Decimal Numbers to Binary Numbers – 5 points

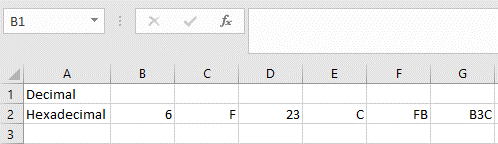
Translate the following decimal numbers to binary numbers and check your answers.

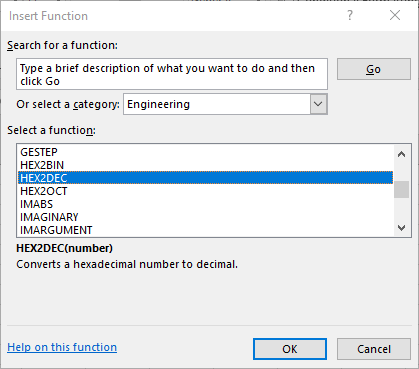
|  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| **Problem 1**  255 | |  |  |  |  |  |  |  |  | | --- | --- | --- | --- | --- | --- | --- | --- | | 27 | 26 | 25 | 24 | 23 | 22 | 21 | 20 | | 128 | 64 | 32 | 16 | 8 | 4 | 2 | 1 | | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | |
| **Problem 2**  18 | |  |  |  |  |  |  |  |  | | --- | --- | --- | --- | --- | --- | --- | --- | | 27 | 26 | 25 | 24 | 23 | 22 | 21 | 20 | | 128 | 64 | 32 | 16 | 8 | 4 | 2 | 1 | | 0 | 0 | 0 | 1 | 0 | 0 | 1 | 0 | |
| **Problem 3**  130 | |  |  |  |  |  |  |  |  | | --- | --- | --- | --- | --- | --- | --- | --- | | 27 | 26 | 25 | 24 | 23 | 22 | 21 | 20 | | 128 | 64 | 32 | 16 | 8 | 4 | 2 | 1 | | 1 | 0 | 0 | 0 | 0 | 0 | 1 | 0 | |
| **Problem 4**  86 | |  |  |  |  |  |  |  |  | | --- | --- | --- | --- | --- | --- | --- | --- | | 27 | 26 | 25 | 24 | 23 | 22 | 21 | 20 | | 128 | 64 | 32 | 16 | 8 | 4 | 2 | 1 | | 0 | 1 | 0 | 1 | 0 | 1 | 1 | 0 | |
| **Problem 5**  7 | |  |  |  |  |  |  |  |  | | --- | --- | --- | --- | --- | --- | --- | --- | | 27 | 26 | 25 | 24 | 23 | 22 | 21 | 20 | | 128 | 64 | 32 | 16 | 8 | 4 | 2 | 1 | | 0 | 0 | 0 | 0 | 0 | 1 | 1 | 1 | |

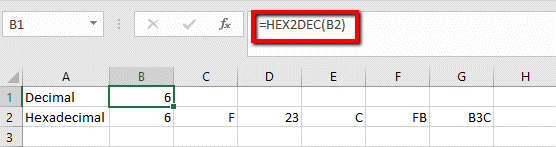
##### Section V – Translating Hexadecimal Numbers to Decimal Numbers – 5 Points

Spreadsheet programs are excellent tools for converting between hex and decimal numbers. This part of the lab uses Microsoft Excel, though you can adapt it for another spreadsheet program.

1. Open **Excel** and enter the following data (Note: right-align the contents in the Hexadecimal row):



1. Make sure your cursor is in cell **B1** and Click on the **arrow** to the right of the function button in the home ribbon (see image to the right.)
2. Click on **More functions**
3. Select the Engineering category, scroll down to **HEX2DEC** and then click on **OK.**
4. Click on cell **B2**
5. Click on **OK**
6. Notice that 6 is the same in both hex and decimal.



1. Use the fill handle to copy the function to the right.
   1. Move your cursor over the small box in the bottom right corner of the cell
   2. Click and drag to the right as far as cell G1. Then let go.

Below is an Excel worksheet object. Practice the above in Excel, then transfer the numbers/calculations to the sheet below by double clicking in it to activate the Excel Worksheet Object. Make sure you enter the HEX2DEC function. Do NOT just type the numbers. Click out of the object when you are finished. Note: if you have a Mac, you need to complete the worksheet and submit it separately in the dropbox.

##### 

##### Summary – Putting it Together – 7 points

1. Be sure to have already read and performed all the tasks in Lab 2.
2. Complete the following table filling in the missing numbers. Note: For binary, you MUST include eight digits, so a binary number of 11100, would be entered as 00011100.

|  |  |  |
| --- | --- | --- |
| **Decimal** | **Binary** | **Hexadecimal** |
| 12 | 00001100 | C |
| 46 | 00101110 | 2E |
| 42 | 00101010 | 2A |
| 61 | 00111101 | 3D |
| 137 | 10001001 | 8A |
| 152 | 10011000 | 98 |
| 250 | 11111010 | FA |

##### Submission Instructions

1. Make sure you have entered your name and section number at the top of the document.
2. Save the document as **LastName\_Lab2.docx**, replacing YourLastName with YOUR last name.
3. Submit the assignment to the Lab 2 dropbox in Canvas by the due date. (Note: if you are using a Mac, make sure your also include your Hexadecimal to Decimal Excel spreadsheet).