Computer Data

Representing Information

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# Introduction

At the lowest level, all computer data is expressed as **binary**. Binary numbers are typically expressed using only 0 and 1, making it a **base 2** numeral system. In contrast, the counting system we are most familiar with (decimal) is **base 10**, using the numbers 0 to 9. Subscript can be used to specify what base a written number is in. For example, 12810 (base 10) is equal to 1000,00002 (base 2).

A single binary digit of information is known as a **bit**. 8 bits (which cover the values 0 to 25510) are known as a **byte**. As you may recall from Lab 3, we use the **kilo**, **mega**, **giga** prefixes to represent 1024 (210), 1,048,576 (220), and 1,073,741,824 (230) bytes respectively. Modern hard drives are now even measured in the **terabyte** range, which is 1,099,511,627,776 bytes!

Since binary numbers can get very long very quickly, we need ways to represent the same numbers with fewer digits. The decimal system is pretty good at this, but **hexadecimal** is even better. Being **base 16**, hex can represent 16 values for every digit. This means 2 hex digits can represent exactly one byte, making it particularly useful for representing many types of computer data. The letters **A** to **F** are used to represent the values 1010 to 1510.

# Submission

Fill in the tables in the tasks below using Microsoft Word, then save this file as **Binary\_Firstname\_Lastname.docx** (using File > **Save As**). Submit your completed document to the Lab dropbox on D2L.

**Note:** This assignment is to be done *individually*. You can help one another with problems and questions, but in the end everyone must do their own assignment.

|  |  |
| --- | --- |
| **Criteria** | **Marks** |
| Task 1: Number System Conversions | 12 |
| Task 2: ASCII | 10 |
| Task 3: Colour | 8 |
| **Total** | 30 |

# Task 1: Number System Conversions

## Instructions

Fill in the missing table cells by converting between these 3 numbering systems.

|  |  |  |
| --- | --- | --- |
| Decimal | Binary | Hexadecimal |
| 45 |  |  |
| 255 |  |  |
|  | 1101,1101 |  |
|  | 0110,0111 |  |
|  |  | 12 |
|  |  | AF |

# Task 2: ASCII

With all computer data being represented as numbers, standards must be developed to make sense of these numbers. Meet the **American Standard Code for Information Interchange**, or **ASCII**, a scheme that encodes characters as numbers.

## Instructions

Using the ASCII standard, translate the following string of base 10 numbers into a sentence of characters. A reference table can be found at <http://www.asciitable.com>.

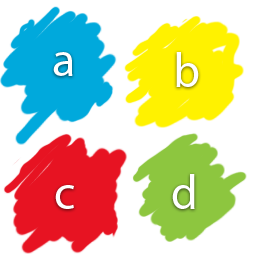
|  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| Code10 | 73 | 116 | 39 | 115 | 32 | 97 | 32 | 115 | 101 | 99 | 114 | 101 | 116 | 33 |
| Char |  |  |  |  |  |  |  |  |  |  |  |  |  |  |

# Task 3: Colour

Like characters, colours can also be represented with numbers. Your monitor is made up of pixels, and each of these pixels mix varying shades of red, green, and blue to create a colour. Most computers support up to 256 different values (8 bits) for each of these three primary colour channels, resulting in over 16.7 million possible colours. This is known as 24bit colour. This is represented pretty handily using 6 hex digits. From the left, the first 2 digits represent the red channel, the second 2 represent the green channel, and the last 2 represent the blue channel. For example, the colour #FFFFFF would represent (FF16 = 25510) 255 red, 255 green, and 255 blue, the maximum value of each colour channel, which mix together to create white. Check out <https://en.wikipedia.org/wiki/Additive_color>for more information on how these colours mix.

## Instructions

Convert each Hex colour code to RGB, then match each code to the corresponding color’s letter.



|  |  |  |
| --- | --- | --- |
| R,G,B | Hex | Color |
| 231,19,34 |  |  |
|  | #00A9DC |  |
|  | #FFF200 |  |
|  | #8DC63F |  |