# Worksheet 2 Bits, bytes and binary

**Task 1**

1. Convert the following decimal values into 8-bit binary bytes:
2. 1010
3. 10410
4. 25510
5. A single byte can be used to represent the decimal values 010 to 25510. For values over 25510 bytes can be joined together. In a computer that has a 16-bit bus width, an integer would be stored in two consecutive bytes.

For example, to represent 65410 the two bytes used would be:

|  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| **Byte 2** | | | | | | | | **Byte 1** | | | | | | | |
| **215** | **214** | **213** | **212** | **211** | **210** | **29** | **28** | **27** | **26** | **25** | **24** | **23** | **22** | **21** | **20** |
| 32,768 | 16,384 | 8,192 | 4,096 | 2,048 | 1,024 | 512 | 256 | 128 | 64 | 32 | 16 | 8 | 4 | 2 | 1 |
| **0** | **0** | **0** | **0** | **0** | **0** | **1** | **0** | **1** | **0** | **0** | **0** | **1** | **1** | **1** | **0** |

Convert the following decimal values into 2 bytes:

1. 12710
2. 318810
3. 6553510
4. Put the following byte prefixes in order of size from smallest to largest:

|  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- |
| **mega** | **gibi** | **kibi** | **tebi** | **kilo** | **giga** | **tera** | **mebi** |

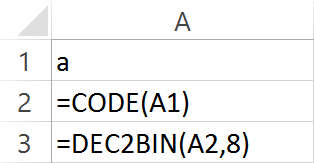
|  |  |  |
| --- | --- | --- |
| **Prefix** | **Symbol** | **Number of bytes** |
|  | k | 1,000 |
|  | Ki | 1,024 |
|  | M | 1,000,000 |
|  | Mi | 1,048,576 |
|  | G | 1,000,000,000 |
|  | Gi | 1,073,741,824 |
|  | T | 1,000,000,000,000 |
|  | Ti | 1,099,511,627,776 |

# Task 2 Representing characters

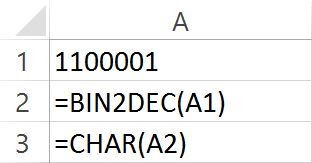
1. Using the ‘ASCII codes’ helpsheet, answer the following questions:
2. What is your forename in ASCII?
3. Convert the following ASCII sentence to text:

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
| **01000100** | **01001110** | **01000001** | **00100000** | **01110111** | **01100001** |
|  |  |  |  |  |  |
| **01110011** | **00100000** | **01100100** | **01101001** | **01110011** | **01100011** |
|  |  |  |  |  |  |
| **01101111** | **01110110** | **01100101** | **01110010** | **01100101** | **01100100** |
|  |  |  |  |  |  |
| **00100000** | **01101001** | **01101110** | **00100000** | **00110001** | **00111001** |
|  |  |  |  |  |  |
| **00111000** | **00110100** | **00101110** |  |  |  |
|  |  | . |  |  |  |

1. Explain why when adding the characters ‘2’ + ‘3’ you don’t get 5:
2. Create a spreadsheet that can convert a word of up to 8 characters into ASCII character codes.



Extend the spreadsheet to convert ASCII binary codes back to regular characters.



# Task 3 Error checking

# Using a barcode on the back of a book, calculate the check digit using the Modulo 10 system.

|  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| **ISBN** |  |  |  |  |  |  |  |  |  |  |  |  |  |
| **Weight** | 1 | 3 | 1 | 3 | 1 | 3 | 1 | 3 | 1 | 3 | 1 | 3 |  |
| **Multiplication** |  |  |  |  |  |  |  |  |  |  |  |  |  |
| **Addition** | Add all the numbers | | | | | | | | | | | |  |
| **Remainder** | Find the remainder when divided by 10 | | | | | | | | | | | |  |
| **Subtraction** | Subtract the result from 10 | | | | | | | | | | | |  |

# The following three bytes are transmitted across a Serial interface using odd parity. Insert the parity bits for each byte that is transmitted.

|  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
|  | 0 | 0 | 1 | 1 | 0 | 0 | 1 |  |  | 1 | 1 | 0 | 1 | 1 | 1 | 0 |  |  | 1 | 1 | 0 | 1 | 0 | 0 | 1 |

# The Luhn algorithm was devised as a checksum formula to ensure credit card numbers are valid when manually or automatically entered into a machine.

The steps in the algorithm are as follows:

|  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| Credit Card Number | 4 | 3 | 6 | 2 | 6 | 2 | 6 | 8 | 7 | 7 | 4 | 3 | 3 | 1 | 1 | 6 |  |
| Double every other number | **8** |  | **12** |  | **12** |  | **12** |  | **14** |  | **8** |  | **6** |  | **2** |  |  |
| Subtract 9 if number > 9 |  |  | **3** |  | **3** |  | **3** |  | **5** |  |  |  |  |  |  |  |  |
| Find sum of all digits | **8** | **3** | **3** | **2** | **3** | **2** | **3** | **8** | **5** | **7** | **8** | **3** | **6** | **1** | **2** | **6** | **70** |

If the sum of all digits is a number divisible by 10, the number will be accepted. If not, it is rejected assuming an error in input.

# Would the following credit card number be accepted? Show your working.

|  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| Credit Card Number | 4 | 4 | 7 | 4 | 8 | 5 | 2 | 4 | 6 | 6 | 7 | 8 | 5 | 4 | 8 | 5 |  |
| Double every other number |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| Subtract 9 if number > 9 |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| Find sum of all digits |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |