# Homework 3 Binary arithmetic

1. Computers store data as bytes.
   1. How many bits make up a byte: [1]
   2. Add the following unsigned 8-bit binary integers: Show your working. [2]

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

* 1. Explain the problem that has resulted from the calculation above using 8 bits. [1]

1. Calculate the largest integer value that can be stored in three combined unsigned binary bytes: Show your working. [2]
2. Two’s complement can be used to perform subtraction. Calculate 12410 – 10110 using 8-bit two’s complement binary (marks awarded for showing working out): [4]

|  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- |
|  |  |  |  |  |  |  |  |
|  |  |  |  |  |  |  |  |
|  |  |  |  |  |  |  |  |
|  |  |  |  |  |  |  |  |

1. Multiply the following unsigned binary values: 111012 x 1102. [3]

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

1. Using one byte to hold each number, with an imaginary binary point after the fourth digit, convert the following decimal numbers into binary: [3]
   1. (i) 4.75

(ii) 3.1875

(iii) 11.6875

* 1. Convert the following binary numbers to decimal, assuming three bits after the binary point: [2]

(i) 10001011

(ii) 00101101

* 1. What are the largest and smallest positive numbers that can be stored in one byte assuming three bits after the point? [2]

[Total 20 marks]