**Binary conversion and addition in GCSE computer science**

**Handout 1 – Working with Binary**

**Part 1 Number Bases**

**Question 1**

The table below uses base 2 place values. Insert the missing place values

|  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- |
| **128** | 64 | **32** | **16** | **8** | 4 | **2** | **1** |

**Question 2**

What is the number base for

101000112 **Binary**

100110 **Denary**

142110 **Denary**

**Question 3**

What is the value of the MSB and LSB in a byte?

MSB **128**

LSB **1**

**Question 4**

What is the place value of the digit with the value 1in the binary number 100002​? **16**

**Part 2 Prefixes**

**Question 5**

The following list of units of measurement are not in order. Rearrange them into the correct ascending order using the initials.

Out of order

|  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- |
| PB | MB | KB | Bit | Nibble | Byte | TB | GB |

In ascending order

|  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- |
| Bit | Nibble | Byte | KB | MB | GB | TB | PB |

**Question 6**

Mr Jones is researching broadband suppliers. A supplier advertises as having a maximum speed equal to 0.75 TB per minute. How many MB is this?

**750,000**

**Part 3 Convert Binary to Denary**

**Question 7**

Convert the number line above from binary to denary **95**

|  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- |
| **128** | **64** | **32** | **16** | **8** | **4** | **2** | **1** |
| 0 | 1 | 0 | 1 | 1 | 1 | 1 | 1 |

**Question 8**

Convert the following binary number into denary.

010101012  **75**

**Question 9**

Is the denary value of the binary number line below odd or even? **Even**

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

**Question 10**

All the place values in a byte have a value of 1 except for the LSB which has a value of 0. What is the denary value of the binary number?

**254**

**Part 4 Convert Denary to Binary**

**Question 11**

Convert the denary value 73 into an 8 bit binary value

|  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- |
| **128** | **64** | **32** | **16** | **8** | **4** | **2** | **1** |
| 0 | 1 | 0 | 0 | 1 | 0 | 0 | 1 |

**Question 12**

Convert the denary value 9210 into a byte

|  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- |
| **128** | **64** | **32** | **16** | **8** | **4** | **2** | **1** |
| 0 | 1 | 0 | 1 | 1 | 1 | 0 | 0 |

**Question 13**

Convert 20510 into binary, use the table to support

|  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- |
|  | **128** | **64** | **32** | **16** | **8** | **4** | **2** | **1** |
|  | 1 | 1 | 0 | 0 | 1 | 1 | 0 | 1 |
| Remainder | 77 | 13 | 13 | 13 | 5 | 1 | 1 | 0 |

205 - 128 = 1 remainder 77

77 - 64 = 1 remainder 13

13 - 32 = 0 remainder 13

13 - 16 = 0 remainder 13

13 - 8 = 1 remainder 5

5 - 4 = 1 remainder 1

1 - 2 = 0 remainder 1

1 - 1 = 1 remainder 0

**Part 5 Binary Addition and Overflow**

**Question 14**

Complete the binary addition

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
|  | **8** | **4** | **2** | **1** |
|  | **0** | **0** | **1** | **1** |
|  | **1** | **0** | **1** | **0** |
| **Result** | 1 | 1 | 0 | 1 |
| **Carry** |  | 1 |  |  |

**Question 15**

Add the 2 denary values as binary numbers. Complete the table

|  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- |
|  | **128** | **64** | **32** | **16** | **8** | **4** | **2** | **1** |
| **12310** | **0** | **1** | **1** | **1** | **1** | **0** | **1** | **1** |
| **9410** | 0 | 1 | 0 | 1 | 1 | 1 | 1 | 0 |
| **Result** | 1 | 1 | 0 | 1 | 1 | 0 | 0 | 1 |
| **Carry** | 1 | 1 | 1 | 1 | 1 | 1 |  |  |

**Question 16**

Take the following two 8-bit binary numbers and add them together.

Would an overflow error occur?

Show your working by completing this table:

|  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
|  |  | **128** | **64** | **32** | **16** | **8** | **4** | **2** | **1** |
| **25110** |  | **1** | **1** | **1** | **1** | **1** | **0** | **1** | **1** |
| **2210** |  | **0** | **0** | **0** | **1** | **0** | **1** | **1** | **0** |
| **Result** |  | 0 | 0 | 0 | 1 | 0 | 1 | 1 | 0 |
| **Carry** | **1** | 0 | 0 | 0 | 1 | 0 | 0 | 0 | 1 |

Overflow **Yes** or No (highlight your answer)