Name: Class:

**Task 1: Hexadecimal conversion**

1. **Denary to Hexadecimal conversion**

 (i) Convert denary 19 to hexadecimal:

 (ii) Convert denary 44 to hexadecimal:

 (iii) Convert hexadecimal 19 to denary:

 (iv) Convert hexadecimal A3 to denary:

1. **Binary to hexadecimal conversion:**

 (i) Convert binary 00110101 to hexadecimal:

 (ii) Convert binary 11010111 to hexadecimal:

 (iii) Convert hexadecimal 1E to binary:

 (iv) Convert hexadecimal FF to binary:

**Task 2: Binary Addition**

Using rules (a)-(e) of binary addition below as a guide, work out the answers to questions 1-10.

1. **0 + 0 = 0**
2. **0 + 1 = 1**
3. **1 + 0 = 1**
4. **1 + 1 = 0** *carry* ***1* = 10**
5. **1 + 1 + 1 = 1** *carry* **1 = 11**
6. Start with this simple addition. (You can use rules (a) and (b) to help you if necessary.) Calculate the denary equivalent to check that it is correct.

|  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- |
|  | **8** | **4** | **2** | **1** |  |  | **Denary equivalent** |
|  | 0 | 0 | 1 | 1 | = |  | 3 |
| + | 0 | 1 | 0 | 0 | = | + |  |
| = |  |  |  |  | = | = |  |

1. Use the same techniques as you did in the last question to find the binary result.

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
|  | 0 | 0 | 0 | 1 |
| + | 1 | 1 | 0 | 0 |
| = |  |  |  |  |

1. Now use rule (d) to help with this problem. Use the carry row at the top for the carried 1.

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
|  |  |  |  |  |
|  | 0 | 0 | 1 | 1 |
| + | 1 | 0 | 1 | 0 |
| = |  |  |  |  |

1. This one will carry into a new column. Remember that like in denary addition, the last carry just makes the number bigger and is added on to the left of the number.

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
|  |  |  |  |  |  |
|  |  | 1 | 0 | 1 | 0 |
| + |  | 1 | 0 | 1 | 1 |
| = |  |  |  |  |  |

1. Use rule (e) in this question. Use the carry row again and remember: 1+1+1 = 1 carry 1.

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
|  |  |  |  |  |  |
|  |  | 0 | 1 | 1 | 0 |
| + |  | 1 | 1 | 1 | 0 |
| = |  |  |  |  |  |

1. Now try a full 8-bit binary number. Apply the same rules as before.

|  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- |
|  |  |  |  |  |  |  |  |  |
|  | 1 | 0 | 0 | 0 | 1 | 0 | 1 | 1 |
| + | 0 | 1 | 0 | 0 | 1 | 0 | 1 | 0 |
| = |  |  |  |  |  |  |  |  |

1. Here is another 8-bit number that requires you use all of the rules.

|  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- |
|  |  |  |  |  |  |  |  |  |
|  | 1 | 0 | 0 | 1 | 1 | 1 | 1 | 0 |
| + | 0 | 1 | 0 | 1 | 1 | 0 | 1 | 0 |
| = |  |  |  |  |  |  |  |  |

1. Now try without the help of the grid or rules (a) to (e) to refer to.

|  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- |
|  |  |  |  |  |  |  |  |  |
|  | 1 | 0 | 1 | 0 | 0 | 1 | 0 | 1 |
| + | 0 | 0 | 1 | 1 | 1 | 1 | 0 | 0 |
| = |  |  |  |  |  |  |  |  |

An 8-bit binary number holds 256 different numbers – 0-255. When the result of the addition is greater than 255, an overflow error occurs

1. Work out the answer here using all the normal rules and explain what happens.

|  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
|  |  |  |  |  |  |  |  |  |  |
|  |  | 1 | 1 | 1 | 1 | 0 | 0 | 1 | 1 |
| + |  | 1 | 0 | 1 | 0 | 0 | 1 | 0 | 1 |
| = |  |  |  |  |  |  |  |  |  |

1. a) Apply a right shift of one binary place on the following byte.

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

b) Convert the original and shifted binary numbers into denary.

c) What is the effect of the logical binary shift right?

1. a) Apply a left shift of one binary place on the following byte.

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

b) Convert the original and shifted binary numbers into denary.

c) What is the effect of the logical binary shift right?