**Homework 4: Binary addition**

# Use the rules a – e of binary addition below as a guide to work out the answers to the questions

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***

1. Calculate the decimal equivalent of your answer and check that it is correct [1]

|  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- |
|  | **8** | **4** | **2** | **1** |  |  | **Decimal** |
|  | 0 | 1 | 0 | 0 | = |  |  |
| + | 0 | 0 | 1 | 1 | = | + |  |
| = |  |  |  |  |  | = |  |

2 Add the two binary numbers shown. Use the carry row at the top for the carried 1 [1]

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

3. Add the two binary numbers shown. Use the carry row at the top for the carried 1 [1]

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

4. Add the two binary numbers shown. Use the carry row at the top for the carried 1 [1]

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

5. Add the two 8-bit binary numbers shown.

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

6. Add the two 8-bit binary numbers shown. [1]

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

7. (a) Add the two 8-bit binary numbers shown. [1]

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

(b) Explain what happens when the two numbers are added. [1]

8. How do computers hold integers greater than 255? [1]

9. Multiply the following 8-bit binary number by 4, leaving the result in binary: [1]

00101110

10. Which **one** of the following binary numbers is **even**? [1]

01010101

11100010

10011001

[Total 10 marks]