Tutorial 3
Basic Operations

Exercise 1

1. Perform the following binary additions:
   - 10101010 + 11001110
   - 110111 + 101100 + 110010
   - 1110111 + 1110111 + 1001011 + 101110

2. Perform the following octal additions:
   - 467 + 671
   - 2276 + 657 + 125

3. Perform the following hexadecimal additions:
   - B796 + CAFE
   - 8979 + 3965
   - 324 + 99F + B2A

4. Perform the following binary subtractions:
   - 11101101010 – 110101110
   - 10110001 – 10011111
   - 1101111 – 111010

5. Perform the following binary multiplications:
   - 1101101 × 10101
   - 10010010 × 101001

6. Perform the following binary divisions:
   - 1011100 / 101 (5 digits after the point)
   - 1010101010 / 1101 (4 digits after the point)

Exercise 2

1. How many different numbers can be made with 1 bit, 2 bits, 3 bits and *n* bits?

A memory device has 14 address lines (each address line can be either 0 or 1):

2. How many addresses are available? Use power-of-two, decimal and hexadecimal notations.
3. What is the hexadecimal value of the highest address?

A memory device has 16 address lines (each address line can be either 0 or 1):

4. How many addresses are available? Use power-of-two, decimal and hexadecimal notations.
5. What is the hexadecimal value of the highest address?

The memory space of a microprocessor is made up of 4 memory devices (**M1**, **M2**, **M3** and **M4**). **M1** and **M2** both have 14 address lines. **M3** and **M4** both have 16 address lines. **M1** should be located in the lowest part of the memory space, followed by **M2**, **M3** and **M4**. The lowest address of the memory space is 0.

6. Write down the lowest and highest addresses for each device in the memory space. You should draw a table and use hexadecimal notation.
7. Write down the total number of addresses. Use hexadecimal notation.
8. Write down the minimum number of address lines required by the microprocessor.