# S1 – Examination 1
# Computer Architecture

**Duration: 1 hr 30 min.**

Family name: ..... First name: ..... Class: .....

**Answer on the worksheet**
**Do not show any calculation unless you are explicitly asked.**
**Do not use a pencil or red ink.**

## Exercise 1 (5 points)

Convert the following numbers from the source form into the destination form. Do not write down the result in a fraction or a power form (e.g. write down 0.25 and not ¼ or $2^{-2}$). Write down the result only (do not show any calculation).

| Number to Convert | Source Form | Destination Form | Result |
|---|---|---|---|
| 110111011 | Binary | Decimal | |
| 1BA | Hexadecimal | Decimal | |
| 171 | Decimal | Binary | |
| 632 | Decimal | Hexadecimal | |
| 10101.11011 | Binary | Decimal | |
| 18.5 | Hexadecimal | Decimal | |
| 38.42 | Decimal | Binary (5 digits after the point) | |
| 28.35 | Decimal | Hexadecimal (4 digits after the point) | |
| B7.53 | Hexadecimal | Binary | |
| 10101101.111111 | Binary | Hexadecimal | |

## Exercise 2 (4 points)

Perform the operations below. **Show all calculations.**

Base 2

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

Base 16

| | | | | | | |
|---|---|---|---|---|---|---|
| | | | 8 | 5 | 4 | |
| + | | | E | B | 9 | |
| | | | 6 | A | 7 | |

Base 2

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

Base 2

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

## Exercise 3 (5 points)

Perform the following 8-bit binary operations (the two operands and the result are 8 bits wide). Then, convert the result into unsigned and signed decimal values. If an overflow occurs, write down 'ERROR' instead of the decimal value.

| Operation | Binary Result | Decimal Value | |
|---|---|---|---|
| | | Unsigned | Signed |
| 01010011 – 10010111 | | | |
| 00100101 + 00101010 | | | |
| 11010110 – 00101110 | | | |
| 01111111 + 00000001 | | | |
| 11111111 + 00000001 | | | |

## Exercise 4 (6 points)

1. Convert the numbers below into their **single-precision** IEEE-754 representations. Write down the final result in its **binary form** and specify the three fields.

| Number | S | E | M |
|---|---|---|---|
| 298 | | | |
| 59.75 | | | |
| 0.15625 | | | |

2. Convert the **double-precision** IEEE-754 words below into their associated representations. If a representation is a number, use the base-10 following form: $k \times 2^n$ where $k$ and $n$ are integers (either positive or negative).

| IEEE-754 Representation (base 16) | Associated Representation |
|---|---|
| 3688 0000 0000 0000 | |
| 0015 8000 0000 0000 | |
| 7FF0 0000 0000 0000 | |

Feel free to use the blank space below if you need to: