

## Exercise Sheet 1 (Block A - 1)

(16 points)

Submission until Wednesday, 2nd November 2016, 16:00o'clock

Discussion begins on Monday, 7th November 2016

Please take a look at the notes at the end of the document for the submission.

### 1.1 Conversion to Binary-, Decimal and Hexadecimal Representation (4 points)

For the following subproblems please convert a given number in a representation with base 2,10 or 16 into a representation with a different base.

- $(100101)_2$  should be converted into a representation with base 10.
- $(A54)_{16}$  should be converted into a representation with base 10.
- $(10110110011)_2$  should be converted into a representation with base 16.
- $(12F)_{16}$  should be converted into a representation with base 2.

### 1.2 Division-Method (4 points)

- Please use the division-method (algorithm 1 on slide 47 on slides V\_01\_Einleitung from the lecture) to convert the decimal number 55 into a binary number. Please write down all the steps of the algorithm.
- Please use the division-method to convert the decimal number 428 into a hexadecimal number. Please write down all the steps of the algorithm.

### 1.3 Conversions (3 points)

- Please convert the following 6-bit binary numbers into decimal numbers. The representation of the binary number is always given.
  - Absolute value (Betragzahl): 001101
  - Fixed-point absolute value (Festkomma-Betragzahl): 1110,01
  - Signed absolute value (Vorzeichen-Betrag): 011001 und 111011
  - Ones' complement (Einerkomplement): 001001 und 101000
  - Two's complement (Zweierkomplement): 001111 und 101001
  - Offset binary (Exzessdarstellung), Bias 20: 000101 und 111001

### 1.4 Character Encoding (1 point)

- Please decipher the following two "secret" messages:
  - 0 1010 010 0 1010 011 0 0110 001 0 0110 110 0 0110 001 0 0110 111
  - 41 6C 61 6E 20 54 75 72 69 6E 67

### 1.5 Number Sorting (4 points)

The following bit patterns are given: 0100, 0011, 1100, 1000. Please insert these bit patterns into the columns of the following table. Insert them sorted in ascending order from top to bottom according to its value for the given representation in the column. You do not need to convert the numbers, you can use the binary representation.

Representation	Ones' complement	Two's complement	Signed absolute value	Offset binary with bias 32
Sorted bit pattern				

**Notes:**

Submission until Wednesday, 2nd November 2016, 16:00 pm in the mailbox number 40 at Otto-Hahn-Straße 12.

You can find the mailboxes in the first floor of the Otto-Hahn-Straße 12 near the transition to the ground floor of the Otto-Hahn-Straße 14. The mailboxes are labeled with "Rechnerstrukturen", the exercise group number and time/place of the exercise. The English exercise group is number 31 and the mailbox is number 40.

Please write your **name**, your **student registration number** and your **exercise group number** at the top right corner of your submission. You can make submissions in teams with up to two more students. To make a team submission put names, student registrations numbers and group numbers of all members of the team on the submission. Only one submission per team has to be made.

Tack you submission. Please do not fold your submission and do not put it into an envelope. Use the correct mailbox, you will need your exercise group number for that.

In total there are 12 exercises in 3 blocks (A, B, C). In each block you have to achieve at least 30 points of 64 possible ones to get access to the exam.