

Computer Systems and -architecture

Assignments: Resit

1 Ba INF 2017-2018

Stephen Pauwels
stephen.pauwels@uantwerpen.be

Time Schedule

Exercises are made individually. Put all your files in a tgz archive, as explained on the course's website, and submit your solution to the exercises on Blackboard. **Write down all intermediate results on how you obtained the results.**

- Deadline: **August 31, 23u55**

Data Representation

1. Convert these positive numbers to base 10.
 - (a) $(1110001110)_2$
 - (b) $(14A6)_{16}$
 - (c) $(10110)_2$
 - (d) $(1246)_8$
2. Convert to base 10.
 - (a) $(11001001)_2$ (2's complement)
 - (b) $(11)_2$ (2's complement)
 - (c) $(.123)_4$
3. Convert to base 2.
 - (a) $(666)_{10}$
 - (b) $(9876)_{10}$
 - (c) $(32AD)_{16}$
 - (d) $(3.14)_{10}$
 - (e) $(EA)_{16}$
4. Convert to base 2. Represent the negative numbers with 8 bits in *signed magnitude*, *one's complement*, *two's complement* and *excess 128*.
 - (a) $(-96)_{10}$
 - (b) $(-1)_{10}$
 - (c) $(-69)_{10}$

- (d) $(-15)_{16}$
5. For the following single-precision IEEE 754 bit patterns, show the numerical value as a base 2 significand with an exponent (e.g. $+1.11 \cdot 2^5$).
- (a) 0 10101011 101110100000000000000000
- (b) 1 10000000 100100000000000000000000
- (c) 0 00000000 111101000000000000000000
- (d) 0 11111111 11010000010010010010000
- (e) 1 00001110 111001100000000000000000
- (f) 1 11111111 000000000000000000000000
- (g) 0 00001011 111011000000000000000000
6. Represent these numbers in the *IEEE-754 (single precision)* format.
- (a) $(2314.25)_{10}$
- (b) $(2017)_{10}$
- (c) $(12.123)_{10}$
- (d) $(11.11 * 2^{-131})_2$ (denormalized)
- (e) $+\infty$
- (f) $+0$
7. Suppose we are using a 22 bit floating point, in a normalized, base 16 floating point format, with a sign bit, followed by a 5-bit exponent with a certain bias, followed by four base 16 digits.
- (a) Determine the bias we have to use for the exponent, assuming we do not want to change the range of exponents we would have reached when using a 5-bit 2's complement exponent.
- (b) Represent the number $-0.1775 * 10^2$ in our new format (with the bias from the previous question) as a binary string.
- (c) What is the largest possible error that can be made using this representation?
- (d) What is the smallest gap using this representation?