Solution TD2

Exercise 1: (Already seen in cours, it's just a reminder)

	Base 2	Base 8	Base 10	Base 16	Smallest Base
1010	**Yes**	**Yes**	**Yes**	**Yes**	**2**
1020	**No**	**Yes**	**Yes**	**Yes**	**3**
108141	**No**	**No**	**Yes**	**Yes**	**9**
2A0GF00	**No**	**No**	**No**	**No**	**17**
01AFB	**No**	**No**	**No**	**Yes**	**16**
CEE	**No**	**No**	**No**	**Yes**	**15**
BAC	**No**	**No**	**No**	**Yes**	**13**

Exercise 2:
Make the following conversions:

Base 10	**Base 2**	**Base 8**	**Base 16**	**X**	**Base X**
555	**1000101011**	**1053**	**22B**	9	**676**
120,25	**1111000.01**	**170,2**	**78,4**	4	**1320.1**
14,5	**1110.1**	**16.4**	**E,8**	3	**112.11111**
35,05	**100011.00001**	**43.031**	**23,0C**	7	**50.0231**
45	101101	**55**	**2D**	14	**33**
7.34375	111.01011	**7.274**	**7,58**	6	**11.20213**
5.625	101.101	**5.5000**	**5,A**	3	**12.12**
91	1011011	133	**5B**	4	**1123**
31	**11111**	37	**1F**	5	**111**
684.125	**1010101100.001**	1254,1	**2AC.2**	13	**408.18**

190,656	**10111110.1010**	276,52	**BE,A8**	4	**2332.222**
162	**10100010**	**242**	A2	11	**138**
2655,375	**101001011111.011**	**5137.3**	A5F,6	12	**1653.46**
45773,164	**1011001011001101.001**	**131315.124**	B2CD,2A	7	**250310.1101**
17,8	**10001.110011**	**21.63146315**	**11.CCCCCC**	5	32.4
5	**101**	**5**	**5**	3	12
28	**11100**	**34**	**1C**	12	24
41	**101001**	**51**	**29**	9	45

Exercise 3:

Determine the bases in which the following numbers are expressed:

1- $(34)_x = 3*x^1 + 4*x^0 = 22 \Rightarrow 3x+4=22 \Rightarrow 3x = 18$

X=6

2- The same process is applied for the rest …

Base x	**Base 10**	**x**
34	22	6
75	117	16
1110101	117	2
24	14	5
13	7	4
70	56	8
1111	40	3
402	102	5
135	75	7
1023	75	4

Exercice 4:

1- 7*3= 21; Convert 21 to octal: $(21)_{10}=(25)_8$

So, the octal number that is triple the value of 7 in decimal is 25.

2- 11×2=22; Convert 22 to binary: $(22)_{10}=(10110)_2$

So, the binary number that is double 11 in decimal is 10110.

3- convert 130 from decimal to ternary (base 3) => 11211 (palindrome).

Exercise 5:

$(N)_6$= x2y => $x \times 6^2 + 2\times 6^1 + y\times 6^0$ => 36x+12+y

$(N)_5$= 3x2 => $3\times 5^2 + x\times 5^1 + 2\times 5^0$ => 75+5x+2

36x+12+y = 75+5x+2 =>36x-5x=77-12-y => 31x= 65-y

y takes values from 0 to 4 =>

y = 0 => x?

y=1 => x?

y=2 => x?

y=3 => x=2

y=4 => x?

$(N)_6$= x2y => $(223)_6$= $(87)_{10}$

Exercise 6:

Convert 41346460 from decimal to base 5:

$(41346460)_{10}$= $(410\ 410\ 41320)_5$ = $(\text{COT COT CODET})_5$

C=4

O=1

T=0

D=3

E=2

Exercise 7: (Already seen in cours, it's just a reminder)

1. $a_i<5$ so, $a_i \in \{0, 1, 2, 3, 4\}$; $b_i<7$ so, $b_i \in \{0, 1, 2, 3, 4, 5, 6\}$;

2. $\begin{cases} A+B= (138)_9 \\ A-B= (200)_6 \end{cases}$ The sum of these two equations gives : $2A= (138)_9 + (200)_6$

You must convert the two operands to the same base to perform the operation.
The best choice is to convert them to a decimal base.

$$\left.\begin{aligned} (138)_9 &= 1\times9^2 + 3\times9^1 + 8\times9^0 = (116)_{10} \\ (200)_6 &= 2\times6^2 + 0\times6^1 + 0\times6^0 = (72)_{10} \end{aligned}\right\} \begin{aligned} &2A = 116 + 72 \leftrightarrow A = (94)_{10} \\ &B = 116 - A \leftrightarrow B = (22)_{10} \end{aligned}$$

$\begin{cases} A = (94)_{10} = (??)_5 \\ B = (22)_{10} = (??)_7 \end{cases}$ By the method of successive divisions, we find: $\begin{cases} A = (334)_5 \\ B = (031)_7 \end{cases}$

By identification: $a_3 = 3$; $a_2 = 3$; $a_1 = 4$
$b_3 = 0$; $b_2 = 3$; $b_1 = 1$

3. $\begin{cases} A = (94)_{10} = (1011110)_2 \\ B = (22)_{10} = (10110)_2 \end{cases}$

A	1	^{1}0	^{1}1	^{1}1	^{1}1	1	0
+							
B	0	0	1	0	1	1	0
=	1	1	1	0	1	0	0

A	1	0	1	1	1	1	0
-							
B	0	0	1	0	1	1	0
=	1	0	0	1	0	0	0

			B			
1	0	1	1	0.	0	1 0 0
		1	1			1 0 1. 1
		1	1	0		
			1	0.	0	

A					1	0	1	1	1	1	0
*											
B/100								1	0	1,	1
=											
					$^{11}1$	$^{0}0$	$^{1}1$	$^{1}1$	1	1	0
+				$^{0}1$	0	1	1	1	1	0	.
+			$^{11}0$	0	0	0	0	0	0	.	.
+	^{1}	$^{1}1$	0	1	1	1	1	0	.	.	.
=	1	0	0	0	0	0	0	1	0	1,	0

A	B
1 0 1 1 1 1 0, 0 0	1 0 1 1 0
1	1 0 0, 0 0 1
1 1	
1 1 $^{1}0$ $^{1}0$ 0	
- 1 $^{1}0$ $^{1}1$ 1 0	
0 0 0 1 0	
....	

Exercise 8:

$(1011.1101)_2 + (11.1)_2 = (1111.0101)_2$

$(1010.0101)_2 - (110.1001)_2 = (11.11)_2$

$(110)_2 * (1.01)_2 = (111.1)_2$

$(91B)_{16} + (6F2)_{16} = (100D)_{16} = (10015)_8$

Exercise 9:

Decimal	Binary	SVA	C1	C2	Excess
1	00000001	00000001	00000001	00000001	10000000
-1	00000001	10000001	11111110	11111111	1111110
-99	01100011	11100011	10011100	10011101	00011100
-24	00011000	10011000	11100111	11101000	01100111
127	01111111	01111111	01111111	01111111	01111111
-128	0000000010000000	1000000010000000	1111111101111111	1111111110000000	1011101001110001

Exercice 10:

Example:

13.25

Method

- Integer part : $13 \Rightarrow 1101$
- Decimal part : $0,25 \Rightarrow 0,01$
- $(13.25)_{10} = (1101,01)_2$
- Normalization : $1101,01 \times 2^0$ <=> 0.110101×2^4
- Pseudo-normalization IEEE 754 : <=> 1.10101×2^3 (in format of 1,xxxx where xxx = pseudo mantissa)

Decomposition of Number into its various elementss:

- Sign bit: 0 (Number positif)
- Exponent on 8 bits biased by $127 \Rightarrow 3 + 127 = 130 \Rightarrow 1000\ 0010$
- Pseudo mantissa on 23 bits: 1010 1000 0000 0000 0000 0000

Sign	Biased exponent	Pseudo mantissa
0	1000 0010	1010 1000 0000 0000 0000 000

Decimal	**Representation in IEEE 754-32 format**		
	Sign	**Exponent**	**Mantissa**
N1=$(-6.53125)_{10}$	1	10000001	10001000000000000000000
N2 = $(-32.625)_{10}$	1	10000100	10100000000000000000000
N3= $(-11.8561)_{10}$	1	10000011	11100011000001111101000

Exercice 11:

1

Sign	exponent	Mantissa
1	1000 0010	1010 1000 0000 0000 0000 000
-	$130 = 127 + 3 \Rightarrow puissance3$	10101
-	2^3	$\times 1.10101$

The result is $-1.10101 \times 2^3 = (-1101.01)_2 = (-13.25)_{10}$

2

Sign	exponent	Mantissa
1	1000 0100	1001 0100 0000 0000 0000 000
-	$132 = 127 + 5 \Rightarrow puissance\,5$	1001 01
-	2^5	$\times 1.1001\ 01$

Result is $-1.1001\ 01 \times 2^5 = (-110010.1)_2 = (-50.5)_{10}$

3

Sign	exponent	Mantissa
0	10001010	11111000000000000000000
+	$138 = 127 + 11 \Rightarrow puissance\,11$	1111 1
+	2^{11}	$\times 1.1111\ 1$

The result is $+1.1111\ 1 \times 2^{11} = (+1111\ 1100\ 0000)_2 = (+16128)_{10}$