



Cairo University

Department: Computer Science

Academic Year: 2018-2019 Semester: First

Date: 27/11/2018

Level: Diploma



Course Title:

Introduction To CS

Course code:

CS500

Time:

2 Hours

Exam marks:

100

Exam Sheets:

1 (1 Page)

Exam Instructions: ANSWER ALL QUESTIONS STEP-BY-STEP**Question One: (30 Marks)**

1. Convert directly the binary number $(1110110.1100011)_2$ to its equivalent numbers in the following number systems: [9 Marks]

(a) Base 4

(b) Octal

(c) Hexadecimal

2. Calculate the following operations: [21 Marks]

(a) $1101.11 + 11101.011$ (b) $11100.001 - 11010.11101$ (Using Direct Subtraction)(c) $11101.010 - 11001.101$ (Using 1's Complement)(d) $11010.11001 - 11100.00011$ (Using 2's Complement)**Question Two: (10 Marks)**

2. Find the decimal value of the binary number $(1111)_2$ in the following systems: [6 Marks]

(a) Unsigned Integer

(b) Signed-Magnitude.

(c) Signed 1's Complement.

(d) Signed 2's Complement.

(e) Excess.

2. Assuming a signed 2's complement notation in 8-bits, calculate the following: [4 Marks]

 $(-127) - (+125)$.**Question Three: (60 Marks)**

Assuming a floating-point binary pattern represented in IEEE-32 notation, find the following:

(a) Code the decimal value $(-431.390625)_{10}$.[28 Marks](b) Decode the pattern $(C3D1E000)_{16}$ to its equivalent decimal value.[22 Marks](c) Decode the pattern $(7FA9B543)_{16}$ to its equivalent decimal value.[10 Marks]

Base 4

Q1.1)

a)
$$\begin{array}{ccccccc} \begin{array}{|c|} \hline 0 \\ \hline \end{array} & \begin{array}{|c|} \hline 1 \\ \hline \end{array} & \begin{array}{|c|} \hline 2 \\ \hline \end{array} & \begin{array}{|c|} \hline 3 \\ \hline \end{array} & \begin{array}{|c|} \hline 0 \\ \hline \end{array} & \begin{array}{|c|} \hline 1 \\ \hline \end{array} & \begin{array}{|c|} \hline 2 \\ \hline \end{array} \\ \downarrow & \downarrow & \downarrow & \downarrow & \downarrow & \downarrow & \downarrow \\ (1 & 3 & 1 & 2 & . & 3 & 0 & 1 & 2)_4 \end{array} \rightarrow (?)_4$$

b)
$$\begin{array}{ccccccc} \begin{array}{|c|} \hline 0 \\ \hline \end{array} & \begin{array}{|c|} \hline 1 \\ \hline \end{array} & \begin{array}{|c|} \hline 2 \\ \hline \end{array} & \begin{array}{|c|} \hline 3 \\ \hline \end{array} & \begin{array}{|c|} \hline 0 \\ \hline \end{array} & \begin{array}{|c|} \hline 1 \\ \hline \end{array} & \begin{array}{|c|} \hline 2 \\ \hline \end{array} \\ \downarrow & \downarrow & \downarrow & \downarrow & \downarrow & \downarrow & \downarrow \\ (1 & 6 & 6 & . & 6 & 1 & 4)_8 \end{array} \xrightarrow{\text{Octal}} (?)_8$$

c)
$$\begin{array}{ccccccc} \begin{array}{|c|} \hline 0 \\ \hline \end{array} & \begin{array}{|c|} \hline 1 \\ \hline \end{array} & \begin{array}{|c|} \hline 2 \\ \hline \end{array} & \begin{array}{|c|} \hline 3 \\ \hline \end{array} & \begin{array}{|c|} \hline 0 \\ \hline \end{array} & \begin{array}{|c|} \hline 1 \\ \hline \end{array} & \begin{array}{|c|} \hline 2 \\ \hline \end{array} \\ \downarrow & \downarrow & \downarrow & \downarrow & \downarrow & \downarrow & \downarrow \\ (7 & 6 & . & C & 6)_{16} \end{array} \xrightarrow{\text{Hexa.}} (?)_{16}$$



A	10
B	11
C	12
D	13
E	14
F	15

Q1.2) Calculate the following
operations:

a) $01101.110 + 11101.011$

$$\begin{array}{r} 01101.110 \\ + 11101.011 \\ \hline \end{array}$$

$$\boxed{101011.001}$$

b) $11100.001 - 11010.111$

(using Direct subtraction)

$$\begin{array}{r} 11100.001 \\ - 11010.111 \\ \hline 00001.001 \end{array}$$

Q1.2) c)

11101.010 - 11001.101

(using 1's Comp.)

+ 11101.010
00110.010 ← 1's Comp.

100011.100
00011.101

Q1.2) d)

11101.11001 - 11100.00011
26 28

(using 2's Complement)

11101.11001
+ 00011.11011

11110.10110 ←
The result = -2's Comp. of
00001.01010

3

Q2.1)

find the decimal value of the binary

number $(\underline{1111})_2 \rightarrow$

8 4 2 1
1 1 1 1

$(\overset{3}{1} \overset{2}{1} \overset{1}{1} \overset{0}{1})_2$
 $(1 \times 2^3) + (\dots)$

1) unsign.

$\rightarrow (15)_{10}$

2) signed.

$(\textcircled{1} \overset{4}{1} \overset{2}{1} \overset{1}{1})_2$
 $\rightarrow (-7)_{10}$

3) signed 1's Comp.

$(\textcircled{1} 1 1 1)_2$

$\rightarrow = -1's \text{ Comp. of } (1111)_2$
 $= (-0)_{10}$

4) signed 2's Comp.

$(\textcircled{1} 1 1 1)_2$

$\rightarrow = -2's \text{ Comp. of } (1111) \rightarrow -0001$
 $\rightarrow (-1)_{10}$

5) EXcess.



(4)

$$(1111)_2 \rightarrow (?)_{10} \text{ using EXcess}$$

4 bits.

8 4 2 1

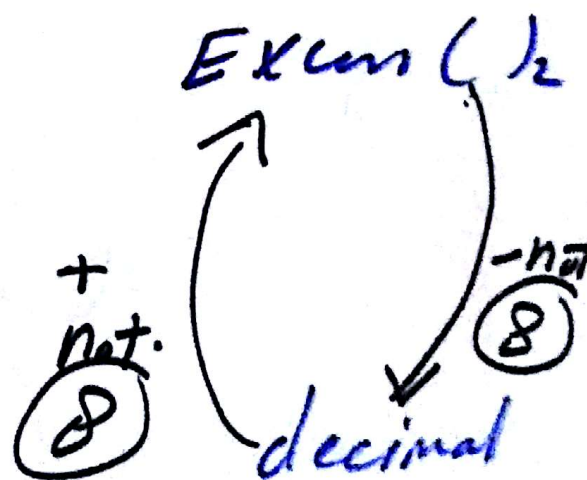
EXcess 8

4 bits
 $n=4$

$$\begin{aligned} \text{notation} &= 2^{n-1} \\ &= 2^3 \\ &= \boxed{8} \end{aligned}$$

$$(1111)_2 - 8$$

$$15 - 8 \Rightarrow \boxed{(+7)_{10}}$$



Q 2.2)

Assuming a signed 2's complement notation in 8-bits. Calculate:

$$(-127) - (+125)$$

n = 8 bits

$$(2^7)$$

Signed 2's comp.

$$[-2^{n-1}, +2^{n-1}-1]$$

$$[-128, +127]$$

$$\begin{array}{r} 1 \\ -127 \end{array} \rightarrow \checkmark$$

$$-125 \rightarrow \checkmark$$

$$\begin{array}{r} -252 \end{array} \rightarrow \text{out of Range}$$

(Overflow)

(6)

Q3)

a) Code decimal Value $(-431.390625)_{10}$

① $(\underline{431.390625})_{10} \rightarrow (?)_2$

	integer	remainder		frac.	int
$2 \div$	431		$2 \times$	0.390625	
	215	1		0.78125	0
	107	1		0.5625	1
	53	1		0.125	1
	26	1		0.25	0
	13	0		0.5	0
	6	1		0	1
	3	0			
	1	1			
	⑨				

$(-110101111.011001)_2$

⑦

② $1.f \times 2^e$

$$- \underbrace{1 \mid 10101111 \mid 011001}_{\substack{\text{integer} \quad \text{frac.}}} \times 2^{+8}$$

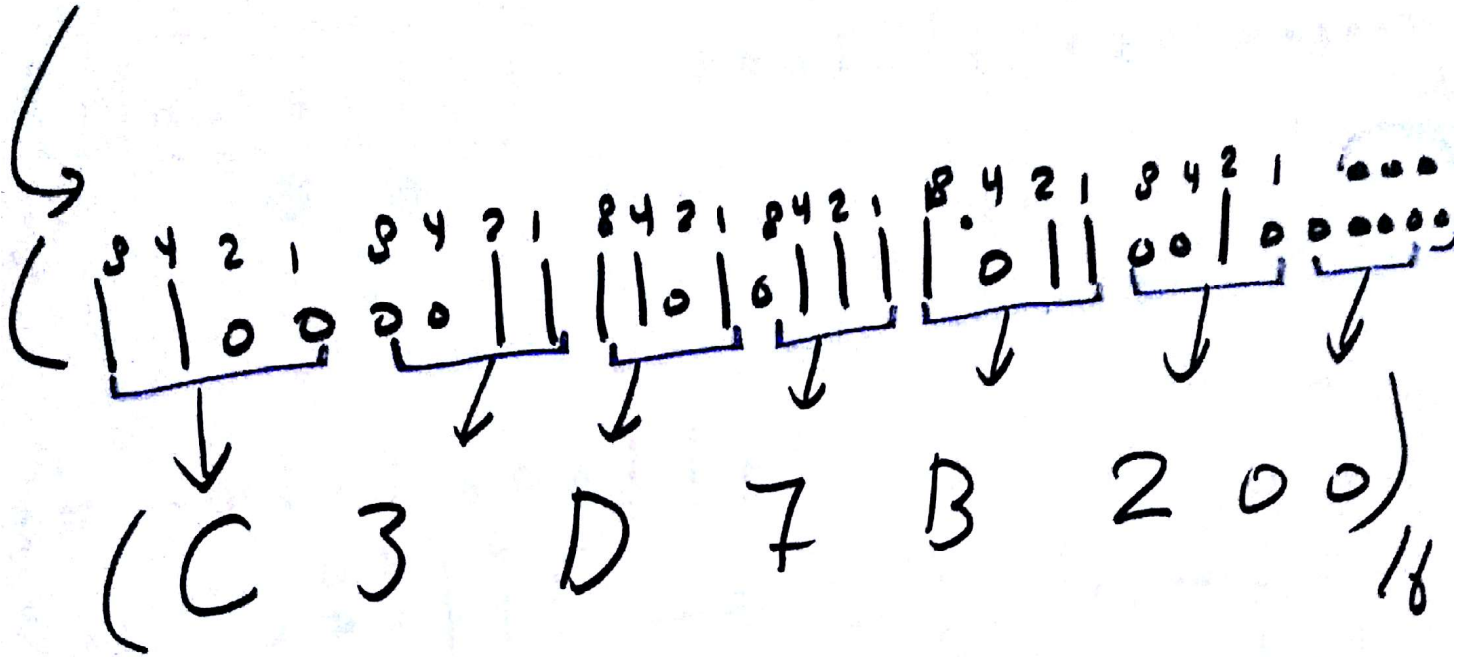
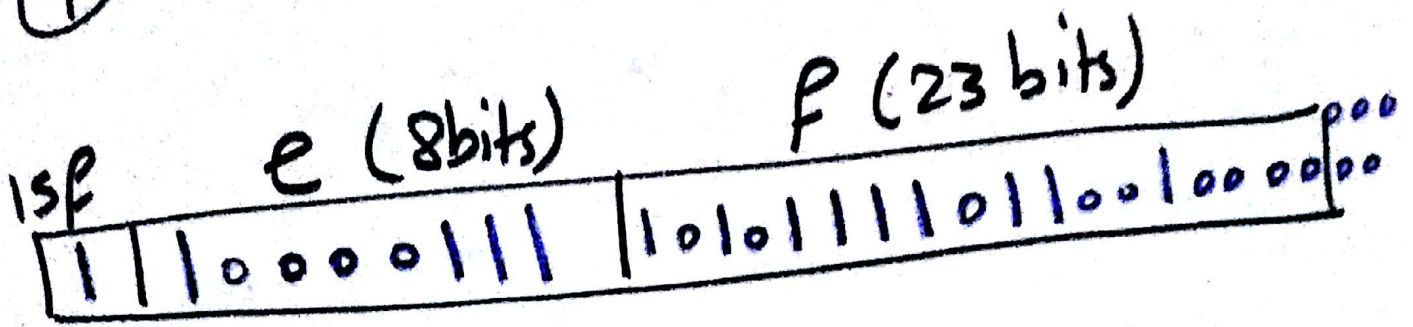
③ $f = -0.10101111011001$
 $e = (+8)_{10} \rightarrow (?)_2 \text{ in EXH, 127}$
 $= 8 + 127 \rightarrow 135$
 $= (10000111)_2$

$$2 \div \begin{array}{c|c} \text{integer} & \text{frac.} \\ \hline 135 & \end{array}$$

256	128	64	32	16	8	4	2	1
	1	0	0	0	0	1	1	1

⑧

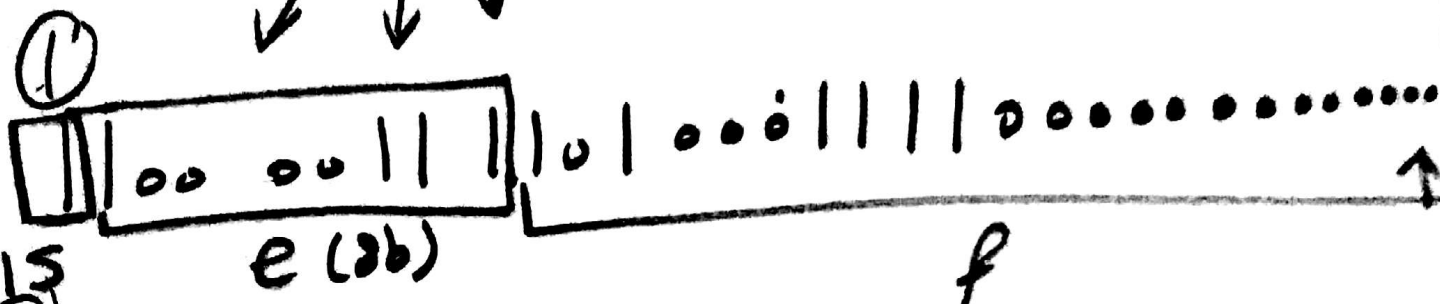
④



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Q3) b)

$$(C3D1E000)_{16} \rightarrow (?)_{10}$$



$$f = -001010001111$$

$$e = (100000111)_2 \rightarrow (?)_{10}$$

using EXC127

$$(4) \quad 135 - 127 \rightarrow \boxed{+8}$$

$$(5) \quad 1.f \times 2^e$$

$$-1.1010001111 \times 2^{+8}$$

$$(-110100011.11)_2 \rightarrow (?)_{10}$$

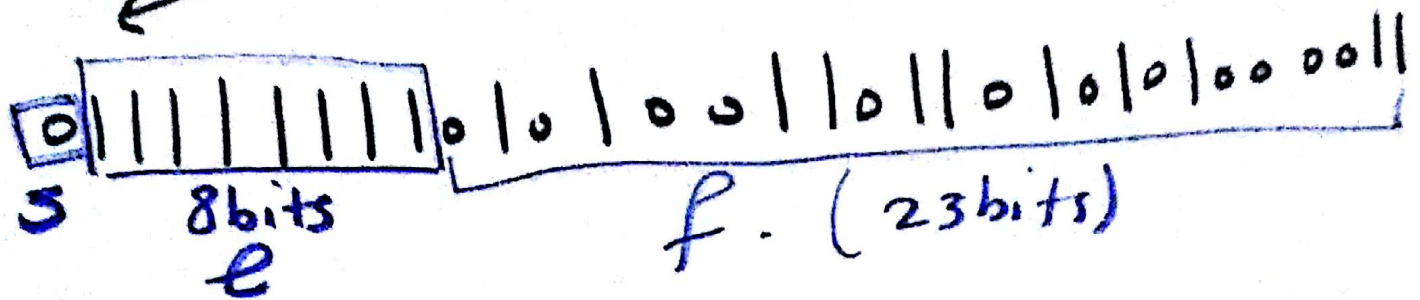
$$(-256 + 128 + 32 + 2 + 1) + 0.75$$

$$(-419.75)_{10}$$

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Q3. c)

Decode $(7FA9B543)_{16} \rightarrow (?)_{10}$



$$e = 1 \rightarrow f \neq 0$$

Not a Number
(NaN)