Hoja 1

1. Expresar las siguientes cifras decimales en binario con el convenio Ca2, Expresarlos con la mínima cantidad de bits posible.

1 (A) $+31,6015625_d$

(I) $+31_d \xrightarrow{b.n}$

31 | 2
1 15 | 2
1 7 | 2
1 3 | 2
1 1 | 2
1 0

$31_d = 11111_b$

(Ca2) $0.11111_b = +31_d$ (Parte entera)

↓ Signo

(II) $0,6015625_d \times 2 = 1,203125$
$0,203125 \times 2 = 0,40625$
$0,40625 \times 2 = 0,8125$
$0,8125 \times 2 = 1,625$
$0,625 \times 2 = 1,25$
$0,25 \times 2 = 0,5$
$0,5 \times 2 = 1,0$

$0,6015625_d = 1001101_b$ (Parte fraccionaria)

RTA: $31,6015625_d = 11111,1001101$

1 (b) $-610,94140625_d$

$|-610,94140625_d| = +610,94140625$

(I) (II)

① Parte enteras (1 Num)

$+610 \xrightarrow{bin(Ca2)} \oplus 610_d$

$Ca2 = SyM \rightarrow$ Paso a bin y agrego MsB con el signo

610 | 2
0 305 | 2
1 152 | 2
0 76 | 2
0 38 | 2
0 19 | 2
1 9 | 2
1 4 | 2
0 2 | 2
0 1 | 2
0 0

$610_d \xrightarrow{bin} 1001100010_b$

$+610_d \xrightarrow{Ca2} 0100110001_{0b}$

⊕

② Parte fraccionaria: $0,94140625 \xrightarrow{bin}$?

(1 Num)

$0,94140625 \times 2 = \boxed{1},88281250$
$0,88281250 \times 2 = \boxed{1},76562500$
$0,76562500 \times 2 = \boxed{1},53125000$
$0,53125000 \times 2 = \boxed{1},06250000$
$0,06250000 \times 2 = \boxed{0},12500000$
$0,12500000 \times 2 = \boxed{0},25000000$
$0,25000000 \times 2 = \boxed{0},50000000$
$0,50000000 \times 2 = \boxed{1},00000000$

$0,94140625_d = 1111000_{16} \rightarrow$ P frac

③ $610,94140625_d = 0100110001_0,1111000_{16}$

$-610,94140625_d \xrightarrow{Abin\ Ca2}$ Ca2 a esto (Flip y le suma 1)

| Num = $0100110001_0,1111000_{16}$
Ca2 Num = $1011001110_1,0000111_0$ ↓ Flip
Ca2 Num = $1011001110_1,0000111_1$ ↓ +1

Rta: $-610,94140625_d = 1011001110_1,0000111_{16}$ (Ca2)

② . idem al anterior, pero con un byte. 6 digitos para la parte entera (incluyendo el bit de signo) y dos digitos fraccionarios. Truncar solamente

Z ⊕ +27,7 d $\xrightarrow{A\ bin}$:

+27,7 d
① , ⑪

① Parte entera: + 27 d $\xrightarrow{bin\ Ca2}$ como SYM

27 / 2 = 13 resto 1
13 / 2 = 6 resto 1
6 / 2 = 3 resto 0
3 / 2 = 1 resto 1
1 / 2 = 0 resto 1

27d = 11011 b
27d = 011011b (Ca2 6 bits)

⑪ Parte fraccionaria: 0,7 $\xrightarrow{bin}$

0,7 × 2 = [1], 4
0,4 × 2 = [0], 8
↓
No sigo ya que solo tengo 2 bits para esta parte y solo tengo que truncar.

0,7d ≅ 0,10b

⑪ Uno las dos partes: 27,7 d ≅ 011011 , 10 b = 27,5
(≅ Aprox; 011011 ①; 10 ⑪)

Rta: 011011,10 ≅ 27,7 d
Ca2; 6 bits ent; 2 bits frac

2.b −19,04 $\xrightarrow{\text{bin Ca2; 6 bits ent, 2 bits frac}}$

|−19,04| = +19,04

(I) parte entera: 19d $\xrightarrow{Ca2}$

(II) parte frac.

(I) P entera: 19d $\xrightarrow{Ca2}$

19d /2 → 9, resto 1; 9/2 → 4, resto 1; 4/2 → 2, resto 0; 2/2 → 1, resto 0; 1/2 → 0, resto 1

19d = 10011b

(+)19d = 010011b (Ca2)

(II) P frac: 0,04 $\xrightarrow{Ca2}$

0,04 × 2 = [0],08

0,08 × 2 = [0],16

↳ Tengo 2 bits y solo trunco, no sigo

0,04 ≅ 0,00b = 0d

(III) Mod de mi numero → uno las dos partes

+19,04 ≅ 010011,00b = 19d

Ca2 a esto → −19,04

010011,00 flip

101100,11 +1

101101,00

Rta: −19,04d = 101101,11b (Ca2)

2 bits frac

6 bits ent

(3) Idem al anterior pero redondeando y truncando

3 A (+)29,4

(I) Parte Entera: (+)29 $\xrightarrow{Ca2 = SyM}$

29/2 → 14, resto 1; 14/2 → 7, resto 0; 7/2 → 3, resto 1; 3/2 → 1, resto 1; 1/2 → 0, resto 1

29d = 11101b

(+)29d = 011101b (Ca2)

(II) Parte fraccionaria: $0,4_d \xrightarrow{bin}$: 6bits y redondeando y truncando.)

$0,4_d \times 2 = \boxed{0},8_d$

$0,8_d \times 2 = \boxed{1},6_d$

$0,6_d \times 2 = \boxed{1},2_d$

$0,4 \underline{\sim} 0,011|0$ → redondeo (Suma 1 al bit siguiente del que corto)

$0,4 \underline{\sim} 0,100|$ → trunco ("corto")

	Trunco	redondeo y trunco
0,4	0,011	0,10
0,4	0,25	0,5

Mas cerca del 0,4 que 0,25; (Mas preciso)

$0,4 \underline{\sim} 0,106$

(III) $+29,4 = 011101,106$ ← Rta (3)

Rta: 6 bits ent

2 bits frac

(3) $-19,39872_d \xrightarrow{bin\ (Ca2)}$ → 2 bits frac, → 6 bits ent

$|-19,39872_d| = 19,39872_d \xrightarrow{a\ bin} +19,39872_d$ (I) (II)

(I) Primera: $+19_d \xrightarrow{Ca2} +19_d$

Ca2 = Sm

19d | 2
1 9 | 2
1 4 | 2
0 2 | 2
0 1 | 2
1 0

$19_d = 10011_b$

$+19_d = 010011_b$ (Ca2)

(II) P fraccionaria: $0,39872_d \xrightarrow{bin}$

$0,39872 \times 2 = \boxed{0},79744$
$0,79744 \times 2 = \boxed{1},59488$
$0,59488 \times 2 = \boxed{1},18976$

$0,39872_d \overset{N}{=} 0,0110_b$

red y trunco $0,0116$

$$\begin{array}{r} 0,0116 \\ +\quad\quad 1 \\ \hline 0,0110 \end{array}$$

$0,39872 \overset{N}{=} 0,0110$

(III) Modulo de mi numero → (I)(II) → $01011,10 \overset{N}{=} \oplus 19,39872$
↓ Ca2 $\overset{N}{=} \ominus 19,39872$

Ca2: $01011,10$ | Ca1 (Flip)

$$\begin{array}{r} 10100,01 \\ +\quad\quad\quad 1 \quad | +1\ (Ca2) \\ \hline 10100,10 \end{array}$$

RTA: $10100,10 \overset{N}{=} (-)19,39872$

(4) Realizar las siguientes operaciones utilizando el Ca2 para las restas y 12 bits (8 bits enteros, 4 fraccionarios). Representar las cifras en binario con el menor error posible.

(A) $\underbrace{71,3_d}_{(I)} - \underbrace{110,728_d}_{(II)}$

(I) $71,3_d$
(I)(I) (I)(II)

(I)(A) $71_d \xrightarrow{bin} Ca2$

71 | 2
1 35 | 2
1 17 | 2
1 8 | 2
0 4 | 2
0 2 | 2
0 1 | 2
1 0

$71_d = 1000111_b$
$\oplus 71_d = 01000111_b (Ca2)$

4a) I) i) 0,3 $\xrightarrow{bin}$:

$0,3 \times 2 = 0,6$
$0,6 \times 2 = 1,2$
$0,2 \times 2 = 0,4$
$0,4 \times 2 = 0,8$
$0,8 \times 2 = 1,6$

$0,3 \simeq 0,01001_b$

4 bits → Redondeo y trunco

$0,0100|1_b$
$+ \quad 1$
$0,0101|0$

$0,3 \simeq 0,0101_b$

4a) I) $71,3_d \simeq 01000111,0101_b$

II) $-110,728d \xrightarrow{Ca2}$

$|-110,728d| = +110,728$ (I: 110, II: 728)

4a) II) i) $110_d \xrightarrow{bin}$:

110 / 2 = 55 resto 0; 55 / 2 = 27 resto 1; 27 / 2 = 13 resto 1; 13 / 2 = 6 resto 1; 6 / 2 = 3 resto 0; 3 / 2 = 1 resto 1; 1 / 2 = 0 resto 1

$110d = 1101110_b$

$+110d = 01101110_b$ (Ca2)

4b) II) ii) $0,728\,d \xrightarrow{bin}$

$0,728 \times 2 = \boxed{1},456$
$0,456 \times 2 = \boxed{0},912$
$0,912 = \boxed{1},824$
$0,824 \times 2 = \boxed{1},648$
$0,648 \times 2 = \boxed{1},296$

$0,728d \simeq 0,10111_b$

4 bits → Red y trunc

$0,1011|1_b$
$+ \quad 1_b$
$0,1100|0_b$ → $0,10111$ red y trunc a 4 bits

$0,728 \simeq 0,1100_b$

4b) II) iii) Mod del numero → I, II → $110,728d \simeq 01101110,1100$

flip y +1 al modulo de mi numero ⟹ Ca2 num original

$01101110,1100$ ↓ flip
$10010001,0011$
$+ \quad 1$ ↓ +1

$10010001,0100_b = -110,728$

Ⓐ ① $71,3_d \triangleq 01000111,0101_6$ (Ca2)

Ⓑ Ⓐ ⑪ $-110,728 \triangleq 10010001,0100_6$ (Ca2)

$71,3_d - 110,728_d$:

$$\begin{array}{r} 01000111,0101_6 \rightarrow 71,3_d \\ + \quad 10010001,0100_6 \rightarrow \ominus 110,728_d \\ \hline 11011000,1001_6 \triangleq 71,3 - 110,728 \end{array}$$: R+A ④Ⓐ

④⑥ $\underbrace{-96,712_d}_{①}$ $\underbrace{-21,56_d}_{②}$

① $-96,712 \xrightarrow{A\,Ca2}$: $|-96,712| = \underbrace{96}_{①}\underbrace{,712}_{⑪}$

①⑪ $96_d \xrightarrow{Ca2}$:

96 | 2		
0 48 | 2		
0 24 | 2		
0 12 | 2		
0 6 | 2		
0 3 | 2		
1 1 | 2		
1 0		

$1100000_6 = 96$

01100000_6 (Ca2) $= +96$

①⑪ $0,712 \xrightarrow{A\,Ca2}$:

$0,712 \times 2 = 1,424$

$0,848 \times 2 = 1,696$

$0,696 \times 2 = 1,392$

$0,392 \times 2 = 0,784$

$0,784 \times 2 = 1,568$

$0,712_d \triangleq 0,1110_6$

Red y Trunc a 4 bits

$0,1110_{16}$

$0,1110$

$0,712 \triangleq 0,1110_6$

①⑪ Mod de mi numero: $96,712 \triangleq 01100000,1110_6$

$-96,712 \triangleq$ (Ca1) $10011111,0000_6$ | Flip

$-96,712_d \triangleq 10011111,0001_6$ | +1

⑪ $-21,56 \xrightarrow{Abs}$: $|-21,56| = 21,56$

⑪ ⊕ $\underbrace{21}_{①},\underbrace{56_d}_{⑪}$ ① $21_d \xrightarrow{Ca2}$:

21 | 2		
1 10 | 2		
0 5 | 2		
1 2 | 2		
0 1 | 2		
1 0		

$21_d = 10101_6$

$\oplus 21_d = 00010101_6$ (Ca2 8 bits)

(4)(b)(II)(II) 0,56 $\xrightarrow{bin}$:

0,56 x 2 = [1],12
0,12 x 2 = [0],24
0,24 x 2 = [0],48
0,48 x 2 = [0],96
0,96 x 2 = [1],92

0,56 ≅ 0,10001b
Red y trunc 4 bits

```
  0,1000|1b
+       |1b
  ------------
  0,1001|0b
```

0,56 ≅ 0,1001b

(II)(II) Mod de mi numero → (II)(I), (II)(II) → 00010101,1001

```
Flip | 00010101,1001 ≅ 21,56
     ↓ 11101010,0110 ≅ -21,56 (Ca1)
+1b  ↓ 11101010,0111 ≅ -21,56 (Ca2)
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(III) -96,712 - 21,56d:
(I) -96,712d ≅ 10011111,0001b
(II) -21,56 ≅ 11101010,0111b

```
  10011111,0001b → -96,712
+ 11101010,0111b → -21,56
 1|10001001,1000b ≅ -96,712 - 21,56d : RTA (4)(b)
 ↓
Carry
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(4)(c) +44,81d + 8,63d

(I) 44,81d (I)(I) 44d $\xrightarrow{Ca2}$:
(44 = (I), 81 = (II))

44 / 2 = 22 r 0
22 / 2 = 11 r 0
11 / 2 = 5 r 1
5 / 2 = 2 r 1
2 / 2 = 1 r 0
1 / 2 = 0 r 1

44d = 10 1100

(+) **44d = 00101100b (Ca2, 8 bits)**

(I)(II) 0,81d $\xrightarrow{Ca2}$

0,81 x 2 = 1,62
0,62 x 2 = 1,24
0,24 x 2 = 0,48
0,48 x 2 = 0,96
0,96 x 2 = 1,92

0,81 ≅ 0,11001
Red y Trunc 4 bits

```
  0,1100|1
+       |1
  ----------
  0,1101|0
```

0,81 ≅ 0,1101

① 44,81 ≅ 00101100, 1101b

② 8,63 (I: 8; II: 63)   ②① 8d →bin 8/2 = 4/2 = 2/2 = 1/2 = 0

8d = 1000b

+8d = 00001000b (Ca2 8 bits)

②② 0,63d →bin
0,63 × 2 = 1,26
0,26 × 2 = 0,52
0,52 × 2 = 1,04
0,04 × 2 = 0,08
0,08 = 0,16

0,63d ≅ 0,10100b
red y trunc 4 bits
0,1010|0
+ 1
0,1010|1

0,1010b ≅ 0,63d

② 8,63 ≅ 00001000, 1010

③ 44,81d + 8,63d :

00101100, 1101b → 44,81d
00001000, 1010b → 8,63d
00110101, 0111 ≅ 44,81d + 8,63d : Rta ④ⓒ

④ⓓ −101,812 + 66,66d (I: −101,812; II: 66,66d)

① −101,812 →Ca2 : |−101,812| = 101,812 (I: 101; II: 812)

①① 101d →bin : 101/2 = 50/2 = 25/2 = 12/2 = 6/2 = 3/2 = 1/2 = 0

101d = 1100101b

+101d = 01100101b (Ca2)

①② 0,812 →Ca2
0,812 × 2 = [1],624
0,624 × 2 = [1],248
0,248 × 2 = [0],496
0,496 × 2 = [0],992
0,992 × 2 = [1],984

0,812d ≅ 0,11001b
red y trunc 4 bits
0,1100|1b
1b
0,1101|0

0,812d ≅ 0,1101

Hoja 11

(4)(D) (I)(III) Modulo de mi numero → (I)$_0$, (I)$_0$ → 01100101, 1101

Ca1 ⊖ 101,812 ≅ 10011010,0010 | Ca1

Ca2 ⊖ 101,812 ≅ 10011010,0011 | +1

(II) 66,66d (II)(I) 66$_d$ $\xrightarrow{Ca2}$

66 | 2 → 33 | 2 → 16 | 2 → 8 | 2 → 4 | 2 → 2 | 2 → 1 | 2 → 0

66d = 1000010$_b$

+66d = 01000010 (Ca2)

(II)(I) 0,66d $\xrightarrow{Ca2}$

0,66d x 2 = 1,32d

0,32 x 2 = 0,64

0,64 x 2 = 1,28

0,28 x 2 = 0,56

0,56 x 2 = 1,12

0,66 ≅ 0,1010 1010$_b$

red y trunc 4 bits

0,1010 | 1010$_b$

+ 0,1010 | 1$_b$

0,1011 | 0$_b$

0,66 ≅ 0,1011

(II)(III) 66,66d ≅ (I)$_1$, (II)$_1$ → 01000010, 1011

(III) -101,812 ≅ 10011010,0011$_b$

66,66 ≅ 01000010, 1011$_b$

-101,812 + 66,66 =

10011010, 0011$_b$ → -101,812d

01000010, 1011$_b$ → 66,66

11011100, 1100$_b$ ≅ -101,812d + 66,66 RTA (4)(A)