Subject 1: operations
(Student 1: Anca Alexia Nistor)

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(Subject 3 - Option 2)

- $b_1 = 3$
- $b_2 = 16$

$x = 102201_{(3)}$
$y = 12102_{(3)}$

$z = A2C69D_{(2)}$
$f = 5_{(16)}$

$$\begin{cases} x +_{(b_1)} y_{(b_1)} = s_{(b_1)} \\ z_{(b_2)} * f_{(b_2)} = p_{(b_2)} \end{cases}$$

```
   011010
  102201(3) +
   12102(3)
  ─────────
  122010 (3)
```
$\Rightarrow 102201_{(3)} + 12102_{(3)} = 122010_{(3)} = s_{(b_1)}$

it 1: $0_{(3)} + 1_{(3)} + 2_{(3)} = 0+1+2 = 3$; 3 div 3 = 1 ; 3 mod 3 = 0
it 2: $1_{(3)} + 0_{(3)} + 0_{(3)} = 1+0+0 = 1$; 1 div 3 = 0 ; 1 mod 3 = 1
it 3: $0_{(3)} + 2_{(3)} + 1_{(3)} = 0+2+1 = 3$; 3 div 3 = 1 ; 3 mod 3 = 0
it 4: $1_{(3)} + 2_{(3)} + 2_{(3)} = 1+2+2 = 5$; 5 div 3 = 1 ; 5 mod 3 = 2
it 5: $1_{(3)} + 0_{(3)} + 1_{(3)} = 1+0+1 = 2$; 2 div 3 = 0 ; 2 mod 3 = 2
it 6: $0_{(3)} + 1_{(3)} = 0+1 = 1$

```
  3 032340
  A2C69D(16) *
      5(16)
  ──────────
  32DE111(16)
```
$\Rightarrow A2C69D_{(16)} * 5_{(16)} = 32DE111_{(16)} = p_{(b2)}$

it 1: $0_{(16)} + D_{(16)} * 5_{(16)} = 0 + 13*5 = 65$
  65 div 16 = 4 ; 65 mod 16 = 1
it 2: $4_{(16)} + 9_{(16)} * 5_{(16)} = 4 + 45 = 49$
  49 div 16 = 3 ; 49 mod 16 = 1
it 3: $3_{(16)} + 6_{(16)} * 5_{(16)} = 3 + 30 = 33$
  33 div 16 = 2 ; 33 mod 16 = 1
it 4: $2_{(16)} + C_{(16)} * 5_{(16)} = 2 + 12 \cdot 5 = 62$
  62 div 16 = 3 ; 62 mod 16 = 14 = E_{(16)}
it 5: $3_{(16)} + 2_{(16)} * 5_{(16)} = 3 + 10 = 13$
  13 div 16 = 0 ; 13 mod 16 = 13 = D_{(16)}
it 6: $0_{(16)} + A_{(16)} * 5_{(16)} = 0 + 10 \cdot 5 = 50$
  50 div 16 = 3 ; 50 mod 16 = 2

Subject 1 : operations

(student 2 : Onodi Bianca)

$S_{(3)} = 122010_{(3)}$

$Y_{(3)} = 12102_{(3)}$

$S_{(3)} - Y_{(3)} = 122010_{(3)} - 12102_{(3)} = 102201_{(3)}$

$$
\begin{array}{r}
\small 6.0-1-10-10 \\
1\ 2\ 2\ 0\ 1\ 0\ _{(3)} - \\
1\ 2\ 1\ 0\ 2\ _{(3)} \\
\hline
1\ 0\ 2\ 2\ 0\ 1\ _{(3)}
\end{array}
$$

it 1: $0_{(3)} + 0_{(3)} - 2_{(3)} = -2 < 0$

$\Rightarrow -2 + 3 = 1$

it 2: $(-1)_{(3)} + 1_{(3)} - 0_{(3)} = 0$

it 3: $0_{(3)} + 0_{(3)} - 1_{(3)} = -1 < 0$

$\Rightarrow -1 + 3 = 2$

it 4: $(-1)_{(3)} + 2_{(3)} - 2_{(3)} = -1 < 0$

$\Rightarrow -1 + 3 = 2$

it 5: $(-1)_{(3)} + 2_{(3)} - 1_{(3)} = 0$

it 6: $0_{(3)} + 1_{(3)} - 0_{(3)} = 1$

$P_{(16)} = 32DE111_{(16)}$

$g_{(16)} = 5_{(16)}$

$P_{(16)} : g_{(16)} = 32DE111_{(16)} : 5_{(16)} =$

$\begin{array}{c|l} 032DE111_{(16)} & 5_{(16)} \\ \hline 32 & 0A2C69D \\ \diagup \\ 0D \\ \diagup \\ 3E \\ \diagup \\ 21 \\ \diagup \\ 31 \\ \diagup \\ 41 \\ \diagup \\ 0_{(16)} - n \end{array}$

$m = 6, \quad 5_{(16)} = 5$

• $i = 6, \; t_6 = 0, \; 0 * 16 + 3_{(16)} = 0 + 3 = 3$

$c'_6 = \lfloor 3/5 \rfloor = 0, \; c_6 = 0_{(16)}, \; t_5 = 3 - 5 * 0 = 3$

• $i = 5, \; t_5 = 3, \; 3 * 16 + 2_{(16)} = 48 + 2 = 50$

$c'_5 = \lfloor 50/5 \rfloor = 10, \; c_5 = A_{(16)}, \; t_4 = 50 - 5 * 10 = 0$

• $i = 4, \; t_4 = 0, \; 0 * 16 + D_{(16)} = 0 + 13 = 13$

$c'_4 = \lfloor 13/5 \rfloor = 2, \; c_4 = 2_{(16)}, \; t_3 = 13 - 5 * 2 = 3$

• $i = 3, \; t_3 = 3, \; 3 * 16 + E_{(16)} = 48 + 14 = 62$

$c'_3 = \lfloor 62/5 \rfloor = 12, \; c_3 = C_{(16)}, \; t_2 = 62 - 5 * 12 = 2$

• $i = 2, \; t_2 = 2, \; 2 * 16 + 1_{(16)} = 32 + 1 = 33$

$c'_2 = \lfloor 33/5 \rfloor = 6, \; c_2 = 6_{(16)}, \; t_1 = 33 - 6 * 5 = 3$

• $i = 1, \; t_1 = 3, \; 3 * 16 + 1_{(16)} = 48 + 1 = 49$

$c'_1 = \lfloor 49/5 \rfloor = 9, \; c_1 = 9_{(16)}, \; t_0 = 49 - 5 * 9 = 4$

• $i = 0, \; t_0 = 4, \; 4 * 16 + 1_{(16)} = 64 + 1 = 65$

$c'_0 = \lfloor 65/5 \rfloor = 13, \; c_0 = D_{(16)}, \; t_{-1} = 65 - 13 * 5 = 0$

$\Rightarrow n = 0$

Subject 2 : conversions of real numbers choosing the appropriate methods

(student 2: Onodi Bianca)

$b = 2$

$h = 3$

$X(2) = 10011 , 100 (2)$

$1(2) = 1(3), \quad 0(2) = 0(3) \quad , 2 = 2(3)$

$X(3) = 1(3) * 2(3)^4 + 0(3) * 2(3)^3 + 0(3) * 2(3)^2 + 1(3) * 2(3)^1$

$\quad + 1(3) * 2(3)^0 + 1(3) * 2(3)^{-1} + 0(3) * 2(3)^{-2} * 0(3) * 2(3)^{-3}$

$\quad = 121(3) + 0(3) + 0(3) + 2(3) + 1(3) + 0,111 (3) + 0(3) + 0(3) = 00201,11 (3)$

c:
```
  1 0        0 0        1 1 0
  2 *        1 1 *      2 2 *
  2          2          2
 ---        ---        -----
  1 1        2 2        1 2 1
```

$2(3) * 2(3) = 11 (3), \quad 2 * 2 = 4 , \quad 4 \text{ div } 3 = 1 , \quad 4 \% 3 = 1$

$11 (3) * 2(3) = 22(3), \quad 1 * 3^1 + 1 * 3^0 = 4, \quad 4 * 2 = 8, \quad 8 \text{ div } 3 = 2, \quad 8 \bmod 3 = 2$

$22(3) * 2(3) = 121(3), \quad 2 * 3^1 + 2 * 3^0 = 6 + 2 = 8, \quad 8 * 2 = 16, \quad 16 \text{ div } 3 = 5, \quad 16 \% 3 = 1,$

$\qquad\qquad\qquad 5 \text{ div } 3 = 1, \quad 5 \% 3 = 2$

```
1,00 (3)  |  : 2 (3)
 10       |  0,11   - periodicity
 10
```

$10(3) = 1 * 3^1 + 0 * 3^0 = 3, \quad 3 \text{ div } 2 = 1, \quad 3 \bmod 2 = 1$

$10 (3) = 1 * 3^1 + 0 * 3^0 = 3 , \quad 3 \text{ div } 2 = 1, \quad 3 \bmod 2 = 1$

Carries:
```
  0 0 1 1 0   0 0 0
  0 0 1 2 1 , 0 0 0 +
  0 0 0 0 2 , 0 0 0 +
  0 0 0 0 1 , 0 0 0 +
          0 , 1 1
 ----------------
  0 0 2 0 1 , 1 1
```

Subject 2: student 1: Amca Alexia Nistor

From student 2:

$y(8) = 201,111(3)$

$l_2 = 2$

$3 > 2$ (the source is greater than the destination)

⇒ We use the method of successive divisions/multiplication

Conversion of the integer part:

①

$201 \overline{|2(3)}$
$\;\;\;\;100 \to$ quotient
$\overline{0|} \to$
$\overline{0|}$
$\overline{01}$ remainder
$\boxed{11} \uparrow$

it 1: $02_{(3)} = 0 * 3^1 + 2 * 3^0 = 2$
2 div 2 = 1
2 mod 2 = 0

it 2: $0_{(3)} = 0$
0 div 2 = 0
0 mod 2 = 0

it 3: $1_{(3)} = 1$
1 div 2 = 0
1 mod 2 = 1

③ $11_{(3)} \overline{|2(3)}$
$\;\;\;\;02 \to$ quotient
$\overline{11}$
$\overline{0} \to$ remainder
$\boxed{0}$

it1: $1_{(3)} = 1$
1 div 2 = 0
1 mod 2 = 1

it2: $11_{(3)} = 1*3^1 + 1*3^0 = 3+1 = 4$
4 div 2 = 2
4 mod 2 = 0

⇒ $201_{(3)} = \boxed{10011}_{(2)}$

② $100 \overline{|2(3)}$
$\;\;_{(3)}\overline{011} \to$
$\overline{10}$ quotient
$\overline{10}$ remainder
$\boxed{11} \uparrow$

it 1: $1_{(3)} = 1$
1 div 2 = 0
1 mod 2 = 1

it 2: $10_{(3)} = 1·3 + 0 = 3$
3 div 2 = 1
3 mod 2 = 1

it 3: $10_{(3)} = 3$
3 div 2 = 1
3 mod 2 = 1

④ $2_{(3)} \overline{|2(3)}$
$\;\;\;\; \to$ quotient
$\boxed{0} \to$ remainder

it1: $2_{(3)} = 2$
2 div 2 = 1
2 mod 2 = 0

⑤ $1_{(3)} \overline{|2(3)}$
$\;\;\;\;\overline{0} \to$ quotient
$\boxed{1} \to$ remainder

it 1: $1_{(3)} = 1$
1 div 2 = 0
1 mod 2 = 1

Conversion of the fractional part: (calculations in base 3)

$$\overset{0}{0},\overset{0}{1}\overset{00}{11} *$$
$$2$$
$$\overline{[0,222]}$$

it 1: $0_{(3)} + 1_{(3)} * 2_{(3)} = 0 + 1 \cdot 2 = 2$
   2 div 3 = 0
   2 mod 3 = $\boxed{2}$

it 2: $0_{(3)} + 1\overset{*}{_{(3)}} 2_{(3)} = 0 + 1 \cdot 2 = 2$
   2 div 3 = 0
   2 mod 3 = $\boxed{2}$

it 3: $0_{(3)} + 1_{(3)} * 2_{(3)} = 0 + 1 \cdot 2 = 2$
   2 div 3 = 0
   2 mod 3 = $\boxed{2}$

it 4: $0_{(3)} + 0_{(3)} * 0_{(3)} = 0$
   0 div 3 = 0
   0 mod 3 = $\boxed{0}$

$$\overset{0}{0},\overset{1}{2}\overset{1}{2}\overset{0}{2} *$$
$$2$$
$$\overline{[1,221]}$$

it 1: $0_{(3)} + 2_{(3)} * 2_{(3)} = 0 + 4 = 4$; 4 div 3 = 1; 4 mod 3 = $\boxed{1}$
it 2: $1_{(3)} + 2_{(3)} * 2_{(3)} = 1 + 2 \cdot 2 = 5$; 5 div 3 = 1; 5 mod 3 = $\boxed{2}$
it 3: $1_{(3)} + 2_{(3)} * 2_{(3)} = 5$; 5 div 3 = 1; 5 mod 3 = $\boxed{2}$
it 4: $1_{(3)} + 0_{(3)} * 2_{(3)} = 1 + 0 \cdot 2 = 1$; 1 div 3 = 0; 1 mod 3 = $\boxed{1}$

$$1,221 *$$
$$2$$
$$\overline{[0,212]}$$

it 1: $0_{(3)} + 1_{(3)} * 2_{(3)} = 0 + 1 \cdot 2 = 2$; 2 div 3 = 0; 2 mod 3 = $\boxed{2}$
it 2: $0_{(3)} + 2_{(3)} * 2_{(3)} = 4$; 4 div 3 = 1; 4 mod 3 = $\boxed{1}$
it 3: $1_{(3)} + 2_{(3)} * 2_{(3)} = 1 + 4 = 5$; 5 div 3 = 1; 5 mod 3 = $\boxed{2}$
it 4: $2_{(3)} + 1_{(3)} * 2_{(3)} = 1 + 2 = 3$; 3 div 3 = 1; 3 mod 3 = $\boxed{0}$
it 5: $1_{(3)} + 0_{(3)} * 2_{(3)} = \boxed{1}$

$\Rightarrow 0,111(3) \cong 0,0110 (2)$

$\Rightarrow 201, 111 (3) \cong 100,11,011(2)$

Student 1: Amca Assaia Nintan

$x < y < z$ $m = 16$ bits
$x = 0,1573$
$y = 0,20516$
$z = 0,371$

$x = 0.1573 = 0.2844(16) = 0.\,0010\ 1000\ 0100\ 0100\,(2)$

$0.1573 * 16 = 2.5168$	$2(16) = 2 = 0010\,(2)$
$0.5168 * 16 = 8.2688$	$8(16) = 8 = 1000\,(2)$
$0.2688 * 16 = 4.3008$	$4(16) = 4 = 0100\,(2)$
$0.3008 * 16 = 4.8128$	

POSITIONS:	S15	14	13	12	11	10	9	8	7	6	5	4	3	2	1	0
$[0.1573]$dir = $[0.1573]$uns = $[0.1573]$compl	0	0	0	1	0	1	0	0	0	0	1	0	0	0	1	0
$[-0.1573]$dir	1	0	0	1	0	1	0	0	0	0	1	0	0	0	1	0
$[-0.1573]$uns	1	1	1	0	1	0	1	1	1	1	1	0	1	1	1	0	1
$[-0.1573]$compl	1	1	1	0	1	0	1	1	1	1	0	1	1	1	1	0

$y = 0.20516 = 0.3485(16) = 0.\,0011\ 0100\ 1000\ 0101\,(2)$

$0.20516 * 16 = 3.28256$	$3(16) = 3 = 0011\,(2)$
$0.28256 * 16 = 4.52096$	$4(16) = 4 = 0100\,(2)$
$0.52096 * 16 = 8.33536$	$8(16) = 8 = 1000\,(2)$
$0.33536 * 16 = 5.36576$	$5(16) = 5 = 0101\,(2)$

POSITIONS:	S15	14	13	12	11	10	9	8	7	6	5	4	3	2	1	0
$[0.20516]$dir = $[0.20516]$ = $[0.20516]$compl	0	0	0	1	1	0	1	0	0	1	0	0	0	0	1	0
$[-0.20516]$dir	1	0	0	1	1	0	1	0	0	1	0	0	0	0	1	0
$[-0.20516]$uns	1	1	1	0	0	1	0	1	1	0	1	1	1	1	0	1
$[-0.20516]$compl	1	1	1	0	0	1	0	1	1	0	1	1	1	1	1	0

$Z = 0.371 = 0.5EF9(16) = 0.\ 0101\ 1110\ 1111\ 1001\ (2)$

$0.371 * 16 = 5.936$
$0.936 * 16 = 14.976$
$0.976 * 16 = 15.616$
$0.616 * 16 = 9.856$

$5(16) = 5 = 0101\ (2)$
$14(16) = E(16) = 1110\ (2)$
$9(16) = 9 = 1001\ (2)$
$15(16) = F(16) = 1111\ (2)$

POSITIONS:	S:15	14	13	12	11	10	9	8	7	6	5	4	3	2	1	0
$[0.371]din = [0.371]ima = = [0.371]compl$	0	0	1	0	1	1	1	1	0	1	1	1	1	1	0	0
$[-0.371]din$	1	0	1	0	1	1	1	1	0	1	1	1	1	1	0	0
$[-0.371]ama$	1	1	0	1	0	0	0	0	1	0	0	0	0	0	1	1
$[-0.371]compl$	1	1	0	1	0	0	0	0	1	0	0	0	0	1	0	0

Subject 3: Option 2: addition and substraction of subunitary numbers in complementari code

(Student 2: Onodi Bianca)

$[x]$ compl = $[0.15733]$ compl = 0.00101000010001 0 (2)

$[-x]$ compl = $[-0.15733]$ compl = 111 0101111 1011110 (2)

$[y]$ compl = $[0.20516]$ compl = 0.00 1101001 0 00010 (2)

$[-y]$ compl = $[-0.20516]$ compl = 11 1 00 1011 011110 (2)

$[z]$ compl = $[0.371]$ compl = 0.0101111.01111 100 (2)

$[-z]$ compl = $[-0.371]$ compl = 1101000010000100

$[x+y]$ compl = $[x]$ compl $\oplus$ $[y]$ compl =
```
S₁
0|001010000100010  ⊕
0|00110100100010
0|010011001 10010 0
```

$[x-y]$ compl = $|[x]$ compl $\oplus$ $[-y]$ compl =
```
S₁
0|0010100001000 10  ⊕
111 1001011011110
11 111100111100000
```

$[z-x]$ compl = $|[z]$ compl $\oplus$ $[-x]$ compl =
```
S₁
0|01011110 1111100  ⊕
1111010111011110
1 0100110110101 1010
```

$[-z-x]$ compl = $|[-z]$ compl $\oplus$ $[-x]$ compl =
```
S₁
1|10 100001000010 0  ⊕
11110101110111 0
10 1111000110001 0
```

$[x+y]_{compl}$ $(2) = 0,0100110011001100$ (2)

$= 0*2^0 + 0*2^{(-1)} + 1*2^{(-2)} + 0*2^{(-3)}$

$+ 0*2^{(-4)} + 1*2^{(-5)} + 1*2^{(-6)} + 0*2^{(-7)}$

$+ 0*2^{(-8)} + 1*2^{(-9)} + 1*2^{(-10)} + 0*2^{(-11)}$

$+ 0*2^{(-12)} + 1*2^{(-13)} + 0*2^{(-14)} + 0*2^{(-15)}$ (10)

$= 2^{(-2)} + 2^{(-5)} + 2^{(-6)} + 2^{(-9)} + 2^{(-10)}$

$+ 2^{(-13)}$ (10)

$= 0,25 + 0,03125 + 0,015625 + 0,001953125$

$+ 0,0009765625 + 0,0001220703125$ (10)

$= 0,2999267578125$ (10)

Carrie: 0 0 0 2 2 1 0 1 0 0 0 0 0 0

    0,25   +
    0,03125   +
    0,015625   +
    0,001953125   +
    0,0009765625   +
    0,0001220703125
   _____
    0,2999267578125

$[x-y]_{complb}$ 1, 1111001111 00000 (2)

$= (-1) * [1*2^{(-1)} + 1*2^{(-2)} + 1*2^{(-3)} +$

$+ 1*2^{(-4)} + 0*2^{(-5)} + 0*2^{(-6)} +$

$+ 1*2^{(-7)} + 1*2^{(-8)} + 1*2^{(-9)} +$

$+ 1*2^{(-10)} + 0*2^{(-11)} + 0*2^{(-12)} +$

$+ 0*2^{(-13)} + 0*2^{(-14)} + 0*2^{(-15)}]_{(10)}$

$= (-1)[2^{(-1)} + 2^{(-2)} + 2^{(-3)} + 2^{(-4)} +$

$2^{(-7)} + 2^{(-8)} + 2^{(-9)} + 2^{(-10)}]_{(10)}$

$= (-1)*[0.5 + 0.25 + 0.125 + 0.0625$

$+ 0.0078125 + 0.00390625 + 0.001953125$

$+ 0.0009765625]_{(10)}$

$= -0.952148375_{(10)}$

Carrie: 0 1 2 4 1 1 1 1 0 0 0

0,5	+
0,25	+
0,125	+
0,0625	+
0,0078125	+
0,00390625	+
0,001953125	+
0,0009765625	
0,952148375	

$[Z-X]compl = 0.00110110.1011010$ (2)

$= 0*2^{(-1)} + 0*2^{(-2)} + 1*2^{(-3)} + 1*2^{(-4)}$

$+ 0*2^{(-5)} + 1*2^{(-6)} + 1*2^{(-7)} + 0*2^{(-8)}$

$+ 1*2^{(-9)} + 0*2^{(-10)} + 1*2^{(-11)} +$

$+ 1*2^{(-12)} + 0*2^{(-13)} + 1*2^{(-14)} + 0*2^{(-15)}$ (10)

$= 2^{(-3)} + 2^{(-4)} + 2^{(-6)} + 2^{(-7)} + 2^{(-9)}$

$+ 2^{(-11)} + 2^{(-12)}$ (10)

$= 0.125 + 0.0625 + 0.015625 + 0.0078125$

$+ 0.001953125 + 0.000048828125$

$+ 0.000244140625$ (10)

$= 0.213623046875$ (10)

Carrie: 0 1 2 3 2 2.1100000
 0.125
 0.0625
 0.015625
 0.0078125
 0.001953 1.25
 0.00048828125
 0.000244140625
 _____
 0.21361362304 6875 (10)

$[-Z-x]$ compl $= 1.0111100011000010$ (2)

$= 0*2^{(-1)} + 1*2^{(-2)} + 1*2^{(-3)} + 1*2^{(-4)} +$

$+ 1*2^{(-5)} + 0*2^{(-6)} + 0*2^{(-7)} + 0*2^{(-8)} +$

$+ 1*2^{(-9)} + 1*2^{(-10)} + 0*2^{(-11)} +$

$+ 0*2^{(-12)} + 0*2^{(-13)} + 1*2^{(-14)}$

$+ 0*2^{(-15)}$ (10)

$= 2^{(-2)} + 2^{(-3)} + 2^{(-4)} + 2^{(-5)} +$

$+ 2^{(-9)} + 2^{(-10)} + 2^{(-14)}$ (10)

$= 0.25 + 0.125 + 0.0625 + 0.03125 +$

$+ 0.001953125 + 0.0009765625$

$+ 0.00006103515625$ (10)

$= 0.4717407226565625$ (10)

Carrie: 0 1 1 2 2 1 0 1 1 0 00000

```
        0.25                        +
        0.125                       +
        0.0625                      +
        0.03125                     +
        0.001953125                 +
        0.0009765625
        0.00006103515625            +
      _____      +
```

0.47174072265625625 (10)

Margin left notes:
$2^{(-4)}$
$2^{(-8)}$
1
$0*2^{(-15)}$
(-9)
8125