Homework - team of 2 students

Subject I - Student I - Măierean Mircea

I have chosen the following values: $b_1 = 9$

$b_2 = 16$

$x = 171025$

$y = 18376$

$Z = 340976$

$f = C$

$x_{(b_1)} + y_{(b_1)} = \Delta_{(b_1)}$

$171025_{(9)} +$

$\quad 18376_{(9)}$

$200412_{(9)}$

Steps: We take the digits one by one, and we add them

① $5+6 = 11_{(10)}$

$11 \% 9 = 2$

$11 / 9 = 1$

We will carry 1 for the next addition.

② $2+7+1 = 10_{(10)}$

$10 \% 9 = 1$

$10 / 9 = 1$

We will carry 1 for the next addition.

③ $0+3+1 = 4_{(10)}$

$4 \% 9 = 4$

$4 / 9 = 0$

We do not have anything to carry.

④ $1+8 = 9_{(10)}$

$9 \% 9 = 0$

$9 / 9 = 1$

We will carry 1 for the next addition.

⑤ $7+1+1 = 9_{(10)}$

$9 \% 9 = 0$

$9 / 9 = 1$

We will carry 1 for the next addition.

⑥ $1+1 = 2_{(10)}$

$2 \% 9 = 2$

$2 / 9 = 0$

We will have at the end $\Delta_{(b_1)} = 200412_{(9)}$.

$Z_{(b1)} \cdot f_{(b2)} = P_{(b2)}$

$340976_{(16)} \cdot$

$\underline{\quad\quad C_{(16)}}$

$2707188_{(16)}$

Steps: We will multiply each digit that Z has with C.
If we have a xcorried value, we will add it to our initial result

① $6_{(16)} \cdot C_{(16)} = 6 \cdot 12 = 72$

$72 \% 16 = 8$

$72 / 16 = 4$

We will add 4 to our next multiplication.

② $7_{(16)} \cdot C_{(16)} = 7 \cdot 12 = 84$

$84 + 4 = 88$

$88 \% 16 = 8$

$88 / 16 = 5$

We will add 5 to our next multiplication.

③ $9_{(16)} \cdot E_{(16)} = 9 \cdot 12 = 108$

$108 + 5 = 113$

$113 \% 16 = 1$

$113 / 16 = 7$

We will add 7 to our next multiplication.

④ $0_{(16)} \cdot C_{(16)} = 0 \cdot 12 = 0$

$0 + 7 = 7$

$7 \% 16 = 7$

$7 / 16 = 0$

⑤ $4_{(16)} \cdot C_{(16)} = 4 \cdot 12 = 48$

$48 \% 16 = 0$

$48 / 16 = 3$

We will add 3 to our next multiplication

⑥ $3_{(16)} \cdot C_{(16)} = 3 \cdot 12 = 36$

$36 + 3 = 39$

$39 \% 16 = 7$

$39 / 16 = 2$

We will put 2 in front of our result

Finally, we get $P_{(b2)} = 2707188_{(16)}$.

R.: $D = 200412$
$P = 2707188$

Homework

Student 2 : Manea Robert - Petrisor

Subject I

$b_1 = 9$

$b_2 = 16$

$x = 171025$

$y = 18376$

$z = 340976$

$f = C$

$\Delta_{(b1)} = 200412$

$\rho(b_2) = 270188$

$\Delta(b_1) - y(b_1) = 200412_{(9)} - 18376_{(9)} = 171025_{(9)}$

-1 -1 0 -1 -1 0

$200412_{(9)}$ −

$18376_{(9)}$

171025

i_0: $0+2-6 = -4 < 0$

$\rightarrow -4+9 = 5$

$\rightarrow b = -1$

i_1: $-1+1-7 = -7 < 0$

$\rightarrow -7+9 = 2$

$\rightarrow b = -1$

i_2: $-1+4-3 = 0$

$\rightarrow b = 0$

i_3: $0+0-8 = -8 < 0$

$\rightarrow -8+9 = 1$

$\rightarrow b = -1$

~~i_4: $0+0-8 = -8 < 0$~~

~~$\rightarrow -8+9 =$~~

i_4: $-1+0-1 = -2 < 0$

→ $-2+9 = 7$

→ $b = -1$

i_5: $-1+2 = 1$

$P(b_2): f(b_2) = ?_{(b_2)} \Leftrightarrow 2707188_{(16)} : C_{(16)} = 340976_{(16)}$

Steps: We have to divide f to p, the division starts from left to right.

$2707188_{(16)} \mid \frac{C_{(16)}}{03}$

1 / 27 / 1 / 30 / 1 / 7 / 1 / 71 / 1 / 58 / 1 / 48 / 1 / 0

i_6; $t_6 = 0$

$0*16 + 2_{(16)} = 2$

$2/12 = 0$

$2\%12 = 2$

i_5; $t_5 = 2$

$2*16 + 7_{(16)} = 32+7 = 39$

$39/12 = 3$

$39\%12 = 3$

i_4; $t_4 = 3$

$3*16+0 = 48$

$48/12 = 4$

$48\%12 = 0$

i_3; $t_3 = 0$

$0*16 + 7 = 7$

$7/12 = 0$

$7\%12 = 7$

i_2; $t_2 = 7$

$7*16+1 = 112+1 = 113$

$113/12 = 9$

$113\%12 = 5$

i_1 ; $t_1 = 5$

$5 * 16 + 8 = 80 + 8 = 88$

$88 / 12 = 7$

$88 \% 12 = 4$

i_0 ; $t_0 = 4$

$4 * 16 + 8 = 64 + 8 = 72$

$72 / 12 = 6$

$72 \% 12 = 0$

Subject 2: conversions of real numbers choosing the appropriate methods

Student 2: Manea Robert - Petrisor

b (source base) will be 8 and R (destination base) will be 16

$X_{(b)} = 53627,341_{(8)}$

For converting $53627,341_{(8)}$ to base 16 I will be using the substion method because this method is recommended for $b < R$ ($8 < 16$)

Steps:

- all the digits from the source representation are converted into the destination base

$5_{(8)} = 5_{(16)}$; $3_{(8)} = 3_{(16)}$; $6_{(8)} = 6_{(16)}$; $2_{(8)} = 2_{(16)}$;

$7_{(8)} = 7_{(16)}$; $4_{(8)} = 4_{(16)}$; $1_{(8)} = 1_{(16)}$;

- the base b is converted into base R: $8_{(8)} = 8_{(16)}$

- we calculate in base 16 the following sum:

$$53627,341_{(8)} = 5_{(16)} \cdot 8_{(16)}^{4} + 3_{(16)} \cdot 8_{(16)}^{3} + 6_{(16)} \cdot 8_{(16)}^{2} + 2_{(16)} \cdot 8_{(16)}^{1} + 7_{(16)} \cdot 8_{(16)}^{0} + 3_{(16)} \cdot 8_{(16)}^{-1} + 4_{(16)} \cdot 8_{(16)}^{-2} + 1_{(16)} \cdot 8_{(16)}^{-3}$$

$7_{(16)} \cdot 8^{0}_{(16)} = 7_{(16)} \cdot 1_{(16)} = 7_{(16)}$

$2_{(16)} \cdot 8^{1}_{(16)} = 2_{(16)} \cdot 8_{(16)} = 10_{(16)}$

$2 \cdot 8 = 16_{(10)}$
$16/16 = 1$ rest 0

$6_{(16)} \cdot 8^{2}_{(16)} = 6_{(16)} \cdot 40_{(16)} = 180_{(16)}$
$8^{2} = 64_{(10)}$
$64/16 = 4$ rest 0

$40_{(16)}$
$6_{(16)}$
$180_{(10)}$

$3_{(16)} \cdot 8^{3}_{(16)} = 3_{(16)} \cdot 200_{(16)} = 600_{(16)}$

$8^{3}_{(16)} = 40_{(16)} \cdot 8_{(16)} = 200_{(16)}$

$5_{(16)} 8^{4}_{(16)} = 5_{(16)} \cdot 1000_{(16)} = 5000_{(16)}$

$8^{4}_{(16)} = 200_{(16)} \cdot 8_{(16)} = 1000_{(16)}$

$3_{(16)} \cdot 8^{-1}_{(16)} = 3_{(16)} : 8_{(16)}$

$3{,}000_{(16)} : 8_{(16)}$, this division is used to get 3 digits at the fractional part

$3{,}000_{(16)} / 8_{(16)} = 0{,}600$

1
30
1
0
1
0

$i_0, t_0 = 0$
$03 = 0 * 16 + 3 = 3$
$3/8 = 0$
$3 \% 8 = 3$
$i_1, t_1 = 3$
$30 = 3 * 16 + 0 = 48$
$48/8 = 6$
$48 \% 8 = 0$

$i_2, t_2 = 0$

$0/8 = 0$

$0\%8 = 0$

$i_3, t_3 = 0$

$0/8 = 0$

$0\%8 = 0$

$4_{(16)} \cdot 8_{(16)}^{-2} = (4_{(16)} : 8_{(16)}) : 8_{(16)}$

$4,000_{(16)} \mid 8_{(16)}$

$1 \quad \mid 0,800$

40

1

0

1

0

$i_0, t_0 = 0$

$04 = 0 * 16 + 4 = 4$

$4/8 = 0$

$4\%8 = 4$

$i_1, t_1 = 4$

$40 = 4 * 16 + 0 = 64$

$64/8 = 8$

$64\%8 = 0$

$i_2, t_2 = 0$

$0/8 = 0$

$0\%8 = 0$

$i_3, t_3 = 0$

$0/8 = 0$

$0\%8 = 0$

Now we have to divide $0,800_{(16)}$ by $8_{(16)}$

$0,800_{(16)} \mid 8_{(16)}$

$1 \quad \mid 0,100$

08

1

0

1

0

$i_0, t_0 = 0$

$0/8 = 0$

$0\%8 = 0$

$i_1, t_1 = 0$

$08 = 0 * 16 + 8 = 8$

$8/8 = 1$

$8\%8 = 0$

$i_2, t_2 = 0$

$0/8 = 0$

$0\%8 = 0$

$i_3, t_3 = 0$

$0/8 = 0$

$0\%8 = 0$

$1_{(16)} \cdot 8^{-3}_{(16)} = [(1 : 8_{(16)}) : 8_{(16)}] : 8_{(16)}$

$1,000_{(16)} \mid 8_{(16)}$

$1 \quad\quad 0,2$

10

1

0

$i_0, t_0 = 0$

$01 = 0 * 16 + 1 = 1$

$1/8 = 0$

$1\%8 = 1$

$i_1, t_1 = 1$

$10 = 1 * 16 + 0 = 16$

$16/8 = 2$

$16\%8 = 0$

$i_2, t_2 = 0$

$0/8 = 0$

$0\%8 = 0$

=) Periodicity => $1,000_{(16)} : 8_{(16)} = 0,200$

$0,200_{(16)} \mid 8_{(16)}$

$1 \quad\quad 0,040$

02

1

20

1

0

$i_0, t_0 = 0$

$0/8 = 0$

$0\%8 = 0$

$i_1, t_1 = 0$

$02 = 0 * 16 + 2 = 2$

$2/8 = 0$

$2\%8 = 2$

$i_2, t_2 = 2$

$20 = 2 * 16 + 0 = 32$

$32 / 8 = 4$

$32 \% 8 = 0$

$i_3, t_3 = 0$

$0 / 8 = 0$

$0 \% 8 = 0$

$0,040_{(16)} \mid 8_{(16)}$

$0,008$

1

0

1

04

1

40

$i_0, t_0 = 0$

$0 / 8 = 0$

$0 \% 8 = 0$

$i_1, t_1 = 0$

$0 / 8 = 0$

$0 \% 8 = 0$

$i_2, t_2 = 0$

$04 = 0 * 16 + 4 = 4$

$4 / 8 = 0$

$4 \% 8 = 4$

$i_3, t_3 = 4$

$40 = 4 * 16 + 0 = 64$

$64 / 8 = 8$

$64 \% 8 = 0$

To obtain $y(k)$ we have to sum: $F_{(16)} + 10_{(16)} + 180,_{16)} +$

$600,_{16)} + \cancel{500_{(16)}} + 5000_{(16)} + 0,008_{(16)} + 0,100_{(16)} + 0,600_{(16)} =$

$= 5797,708_{(16)}$

Subject 2

Student I - Măieran Mircea

I have received the following values: $b = 8$

$h = 16$

$y = 5797,708$

We will use the method of successive divisions and multiplications

Computing the integer part

The integer part is divided by the destination base (in our case, the base is 8), obtaining a quotient and a remainder. The quotient is divided by the destination base, obtaining a new quotient and a new reminder. The process is repeated, until the quotient is 0. The remainders, in the reverse order of obtaining them, are the digits of the new representation in the destination base.

The fractional part is multiplied by the destination base, obtaining a number with an integer part and a fractional one. The process is continued using the new fractional part. It continues until 3 numbers of the fractional part were calculated, for our case in this specific subject. The integer parts, in the order of obtaining them are the digits of the fractional part in the destination representation.

For y, the integer part is 5797.

$5797_{(10)} \mid 8_{(16)}$

$57 \mid AF2_{(16)}$ ⑦

$79 \mid 2F$ ②

$17 \mid 15$ ⑥

$2B$ ③

$5_{(16)}$ ⑤

0

I

$5797_{(10)} \mid 8_{(16)}$

① $5_{(16)} = 5_{(10)}$

$5 \% 8 = 5 = 5_{(16)}$

$5 / 8 = 0$

② $57_{(10)} = 5 \cdot 16 + 7 = 87$

$87 \% 8 = 7$

$87 / 8 = 10$

$10 = A_{(16)}$

③ $79_{(16)} = 7 \cdot 16 + 9 = 121$

$121 / 8 = 15 = F_{(16)}$

$121 \% 8 = 1$

④ $17_{(16)} = 23_{(16+7)}$

$23 \% 8 = 7$

$23 / 8 = 2 = 2_{(16)}$

II $AF2\,18_{(16)}$

① $A_{(16)} = 10$

$10:8 = 1 = 1_{(16)}$

$10\%8 = 2$

② $2F_{(16)} = 2 \cdot 16 + 15 = 47$

$47:8 = 5_{(16)}$

$47\%8 = 7$

③ $72_{(16)} = 7 \cdot 16 + 2 = 114$

$114:8 = 14 = E_{(16)}$

$114\%8 = 2$

III $15E:8$

① $1_{(16)} = 1$

$1:8 = 0$

$1\%8 = 1$

② $15_{(16)} = 1 \cdot 16 + 5 = 21$

$21:8 = 2 = 2_{(16)}$

$21\%8 = 5$

③ $5E_{(16)} = 5 \cdot 16 + 14 = 94$

$94:8 = 11 = B_{(16)}$

$94\%8 = 6$

IV $2B:8$

① $2_{(16)} = 2$

$2:8 = 0$

$2\%8 = 2$

② $2B_{(16)} = 2 \cdot 16 + 11 = 43$

$43:8 = 5 = 5_{(16)}$

$43\%8 = 3$

V $5:8$

$5_{(16)} = 5$

$5:8 = 0$

$5\%8 = 5$

The integer part is equal to $53627_{(8)}$

The fractional part of y is equal to 0,708

Step I: $0,708_{(16)} \cdot 8_{(16)} = 3,840_{(16)} = 3,84_{(16)}$

① $8_{(16)} \cdot 8_{(16)} = 8 \cdot 8 = 64$

$64\%16 = 0 = 0_{(16)}$

$64:16 = 4 = 4_{(16)}$

We will add 4 in the next multiplication

② $0_{(16)} \cdot 8_{(16)} = 0 \cdot 8 = 0$

$0 + 4 = 4$

$4\%16 = 4 = 4_{(16)}$

$4:16 = 0$

③ $7_{(16)} \cdot 8_{(16)} = 7 \cdot 8 = 56$

$56\%16 = 8 = 8_{(16)}$

$56:16 = 3_{(16)}$

③ is the value of the integer part

Step II : $0,84_{(16)} \cdot 8_{(16)} = 4,2_{(16)}$

① $4_{(16)} \cdot 8_{(16)} = 4 \cdot 8 = 32$

$32 \% 16 = 0 = 0_{(16)}$

$32 / 16 = 2 = 2_{(16)}$

We will add 2 in the next multiplication

② $8_{(16)} \cdot 8_{(16)} = 8 \cdot 8 = 64$

$64 + 2 = 66$

$66 \% 16 = 2 = 2_{(16)}$

$66 / 16 = 4$

④ is the value of the integer part

Step III : $0,2_{(16)} \cdot 8_{(16)} = 1,0_{(16)}$

① $2_{(16)} \cdot 8_{(16)} = 2 \cdot 8 = 16$

$16 \% 16 = 0 = 0_{(16)}$

$16 / 16 = 1 = 1_{(16)}$

① is the value of the integer part

The fractional part is equal to 0,341

The final result is 53627,341

R: y = 53627,341

Subject 3 - Option 3

Student I - Maierean Mircea

I have chosen $x = 31821,14$

$i = 15$

$F = 16$

The number will be represented on $n = 32$ bits

The most significant bit (S), position $n-1$ (31), is the sign bit with the values:

a) 0, if the number is positive

b) 1, if the number is negative

x is greater than 0, so S will have the value 0

The decimal point has a fixed position, a virtual one, separating the integer part from the fractional one

The integer part (i bits)

- memorizes (aligned to the right, relative to the virtual position of the decimal point) the digits of the absolute integer value of the number converted into binary
- if i > the number of digits of the binary representation of the absolute value of the number, the remaining bits of the number to the left are filled with 0
- if i < the number of digits of the binary representation of the absolute value of the number, then the most significant digits of the integer part are lost

For x, the integer part is 31821. We'll convert it into binary

$$31821 = 16384 + 8192 + 4096 + 2048 + 1024 + 64 + 8 + 4 + 1 =$$

$$= 2^{14} + 2^{13} + 2^{12} + 2^{11} + 2^{10} + 2^6 + 2^3 + 2^2 + 2^0 =$$

$$= 1\,1\,1\,1\,1\,0\,0\,0\,1\,0\,0\,1\,1\,0\,1_{(2)}$$

The ~~fractional part~~ (F bits)

- memorizes (aligned to the left, relative to the virtual position of the decimal point) the digits of the fractional part
- if F > the number of binary digits of the fractional part, then the remaining digits to the right are filled with 0
- if F < the number of binary digits of the fractional part, then the least significant digits of the fractional part are lost

For x, the fractional part is 0,14

We will perform successive multiplications for 16 times by the destination base 2

① $0,14 \cdot 2 = \underline{0},28$ ② $0,28 \cdot 2 = \underline{0},56$ ③ $0,56 \cdot 2 = \underline{1},12$ ④ $0,12 \cdot 2 = \underline{0},24$

⑤ $0,24 \cdot 2 = \underline{0},48$ ⑥ $0,48 \cdot 2 = \underline{0},96$ ⑦ $0,96 \cdot 2 = \underline{1},92$ ⑧ $0,92 \cdot 2 = \underline{1},84$

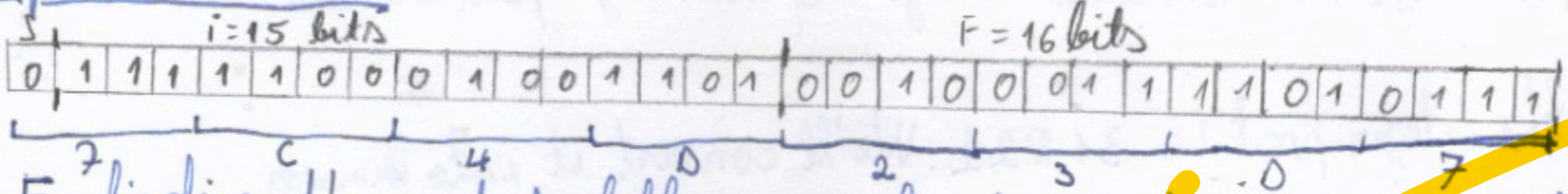
⑨ $0,84 \cdot 2 = \underline{1},68$ ⑩ $0,68 \cdot 2 = \underline{1},36$ ⑪ $0,36 \cdot 2 = \underline{0},72$ ⑫ $0,72 \cdot 2 = \underline{1},44$

⑬ $0,44 \cdot 2 = \underline{0},88$ ⑭ $0,88 \cdot 2 = \underline{1},76$ ⑮ $0,76 \cdot 2 = \underline{1},52$ ⑯ $0,52 \cdot 2 = \underline{1},04$

$0,14 = 0,00\ 1000\ 1111\ 0101\ 11_{(2)}$

So, $x = 1111\ 1000\ 1001\ 101,00\ 1000\ 1111\ 0101\ 111_{(2)}$

Representation



For finding the content of the memory location in hexadecimal, we will convert using the rapid conversions table

10	0	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15
2	0	1	10	11	100	101	110	111	1000	1001	1010	1011	1100	1101	1110	1111
16	0	1	2	3	4	5	6	7	8	9	A	B	C	D	E	F

Using this, we group the digits from right to left by 4. We will obtain

$M = 7C4D\ 23D7_{(16)}$

Subject 3
Option 3

$M_{(16)} = 7C4\Delta23\Delta7$

$I = 15$

$F = 16$

I have to find the real number x having $M_{(16)} = 7C4\Delta23\Delta7$ as its fixed-point representation on 32 bits with $I = 15$ and $F = 16$

$n = I + F + 1 = 32$

The most significant bit(S), position $n-1$, is the sign bit with the values: 0 for positive numbers and 1 for negative numbers;

The decimal point has a fixed position, a virtual one, separating the integer part from the fractional one;

The integer part (I bits)

- memorizes the digits of the absolute integer value of the number converted into binary
- if $I >$ the number of digits of the binary repres. of the absolute integer value of the number, the remaining bits to the left are filled with 0.

- if I < the number of digits of the binary repres. of the ~~asbo~~ absolute value of the number, the the most significant digits of the integer part are lost

The fractional part (F bits)

- memorizes the digits of the fractional part
- if F > the number of binary digits of the fractional part then the remaining digits to the right are filled with 0
- if F < the number of binary digits of the fractional part then the least significant digits of the fractional part are lost.

7C4D23A7 transformed into binary using rapid conversion will be

$7_{(16)} = 0111_{(2)}$

$C_{(16)} = 1100_{(2)}$

$4_{(16)} = 0100_{(2)}$

$D_{(16)} = 1101_{(2)}$

$2_{(16)} = 0010_{(2)}$

$3_{(16)} = 0011_{(2)}$

S	I = 15 bits	F = 16 bits
0	111 1100 0100 1101	0010 0011 1101 0111

7 C 4 D 2 3 D 7

$$X = 2^0 + 2^2 + 2^3 + 2^6 + 2^{10} + 2^{11} + 2^{12} + 2^{13} + 2^{14} + 2^{-3} + 2^{-7} + 2^{-8} + 2^{-9} + 2^{-10} + 2^{-12} + 2^{-13} + 2^{-14} + 2^{-15}$$

$$= 1 + 4 + 8 + 64 + 1024 + 2048 + 4096 + 8192 + 16384 + \frac{1}{8} + \frac{1}{128} + \frac{1}{256} + \frac{1}{512} + \frac{1}{1024} + \frac{1}{4096} + \frac{1}{16384} + \frac{1}{32768} + \frac{1}{65536}$$

$$= \frac{1042715115}{32768} + \frac{1}{65536} = \frac{2085430231}{65536} \simeq 31821,14$$