Lupea 6.11

Computational Logic – Homework – FÎNTÎNĂ OLIVIA

Student 1 – Fîntînă + Herța

Subject 1: operations – First Part: FÎNTÎNĂ OLIVIA

Let $\begin{cases} b_1 = 5 \\ b_2 = 16 \end{cases}$ and $\begin{cases} x = 123412_{(5)} \\ y = 41231_{(5)} \\ z = 121578_{(16)} \\ f = 4_{(16)} \end{cases}$, and the following operations:

(i) $x_{(b_1)} + y_{(b_1)} = s_{(b_1)}$ (addition)

(ii) $z_{(b_2)} * f_{(b_2)} = p_{(b_2)}$ (multiplication)

(i) $123412_{(5)} + 41231_{(5)} =$

$$\begin{array}{r} \overset{+1+1}{123402} + \\ 41231_{(5)} \\ \hline 220143_{(5)} \end{array}$$

$1 + 2 = 3 \quad / 5 = 0$ (1)
$3 \ \% \ 5 = 3$

$1 + 3 = 4 \quad / 5 = 0$ (2)
$4 \ \% \ 5 = 4$

$4 + 2 = 6 \quad / 5 = 1$ (carry) (3)
$6 \ \% \ 5 = 1$

$3 + 1 = 4 + 1$(carry) $= 5 \ / 5 = 1$ (carry) (4)
$5 \ \% \ 5 = 0$

$2 + 4 = 6 + 1$(carry) $= 7 \ / 5 = 1$ (carry) (5)
$7 \ \% \ 5 = 2$

$1 + 1$(carry) $= 2 \ / 5 = 0$ (6)
$2 \ \% \ 5 = 2$

As we chose base 5 to represent the numeric values, a number $n = d_1 d_2 \dots d_n$ must have all its digits $d_{\overline{1,2,\dots,n}} < b$, where b = base. In the case of operations (3), (4) and (5), where the result of the addition surpassed that of the base, the digit of the given order n was equal to the [result] MOD [base] operation. The order of the surpassing digit (result > 5 => result = 5 + result MOD 5) is equal to [result] DIV [base] and added to the digit of order $n+1$, as a "carry".

$$\begin{array}{r} \scriptstyle n+2 \\ 6\,5\,4\,3\,2\,1 \\ 121578 \\ 4 \\ \hline 4855E0 \\ 5\,4\,3\,2\,1\,0 \end{array} \leftarrow \text{order}$$

(ii) $z = 121578_{(16)}$

$f = 4_{(16)}$

$z * f = 121578_{(16)} * 4_{(16)} =$

$d_1: \; 8 \cdot 4 = 32 \;/\; 16 = 2$ (carry)
$32 \,\%\, 16 = 0$

$d_2: \; 2 + 7 \cdot 4 = 30 \;/\; 16 = 1$ (carry)
$30 \,\%\, 16 = 14 \; (=E)$

$d_3: \; 1 + 5 \cdot 4 = 21 \;/\; 16 = 1$ (carry)
$21 \,\%\, 16 = 5$

$d_4: \; 1 + 1 \cdot 4 = 5 \;/\; 16 = 0$
$5 \,\%\, 16 = 5$

$d_5: \; 2 \cdot 4 = 8 \;/\; 16 = 0$
$8 \,\%\, 16 = 8$

$d_6: \; 1 \cdot 4 = 4 \;/\; 16 = 0$
$4 \,\%\, 16 = 4$

In the case of multiplication, each digit of n-th order is multiplied by $f_{(16)}$, following the same algorhythm as in the case of addition: the result of the simple multiplication

$$d_n \cdot f = [\text{result}],$$

where the result may or may not surpass the base and, subsequently, the order of the digit. Therefore, the [result] gets divided by the [base], the result being added as a "carry" to the n+1 order of digit-processing. Then, [result] MOD [base] is written down as d_n in the result.

Student 2: HERȚA DIANA-LARISA

$b_1 = 5$, ~~s = 2201B~~ $s = 220143_{(5)}$ $p = 4855E0_{(16)}$

$b_2 = 16$ $y = 41231_{(5)}$ $f = 4_{(16)}$

i) substraction: $s(b_1) - y(b_1) = ?(b_1)$

ii) division: $p(b_2) : f(b_2) = ?(b_2)$

(i) $220143_{(5)} - 41231_{(5)} =$

$= \overset{543210}{220143}_{(5)} -$

$041231_{(5)}$

$123412_{(5)}$

s has 6 digits $\Rightarrow m = 5$

y has 5 digits $\Rightarrow n = 4$

$t_0 = 0$

t_i - the transport

$i=0$: $3_{(5)} + 0_{(5)} > 1_{(5)} \Rightarrow c_0 = 3_{(5)} - 1_{(5)} = 2_{(5)}$, $t_1 = 0$

$i=1$: $t_1 = 0 \Rightarrow 4_{(5)} + 0_{(5)} > 3_{(5)} \Rightarrow c_1 = 4_{(5)} - 3_{(5)} = 1_{(5)}$, $t_2 = 0$

$i=2, t_2=0$: $1_{(5)} + (0)_{(5)} < 2_{(5)} \Rightarrow$ we borrow an unit from the immediately higher order digit which becomes $10_{(5)}$ at the level of the current position $\Rightarrow t_3 = -1$

$1_{(5)} + 0_{(5)} + 10_{(5)} - 2_{(5)} = 1_{(10)} + 0_{(10)} + 5^1 \cdot 1_{(10)} - 2_{(10)} =$

$= 4_{(10)} = 4_{(5)} \Rightarrow c_2 = 4_{(5)}$

$i=3, t_3=-1$: $0_{(5)} + (-1)_{(5)} < 1_{(5)} \Rightarrow$ we borrow an unit $\Rightarrow 0_{(5)} + (-1)_{(5)} + 10_{(5)} - 1_{(5)} =$

$= 0_{(10)} - 1_{(10)} + 5_{(10)} - 1_{(10)} = 3_{(10)} = 3_{(5)}$, $t_4 = -1$

$\Rightarrow c_3 = 3_{(5)}$

$i=4, t_4=-1$: $2_{(5)} + (-1)_{(5)} < 4_{(5)} \Rightarrow$ we borrow an unit $\Rightarrow t_5 = -1$; $2_{(5)} + (-1)_{(5)} + 10_{(5)} - 4_{(5)} =$

$= 2_{(10)} + (-1)_{(10)} + 5_{(10)} - 4_{(10)} = 6_{(10)} - 4_{(10)} = 2_{(10)} =$

$= 2_{(5)} \Rightarrow c_4 = 2_{(5)}$

$i=5, t_5=-1$: $2_{(5)} + (-1)_{(5)} > 0_{(5)} \Rightarrow c_5 = 2_{(5)} - 1_{(5)}$

$c_5 = 1_{(5)}$

(ii) $p(b_2) : f(b_2) = 4855E0_{(16)} : 4_{(16)}$ p has 6 digits $\Rightarrow m = 5$

$4_{(16)} = 4_{(10)}$

$\overset{543210}{4855E0}_{(16)} \mid 4_{(10)}$

$| 121578_{(16)}$

1
8
1
5
4
= 15
14
= 1E
= 20
= 0 ~~rest~~

the remainder is 0

$i=5, t_5=0$: $0 \cdot 16 + 4_{(16)} = 4_{(10)}$

$c'_5 = [4/4] = 1_{(10)} \Rightarrow c_5 = 1_{(16)}$, $t_4 = 4 - 4 \cdot 1 = 0$

$i=4, t_4=0$: $0 \cdot 16 + 8_{(16)} = 8_{(10)}$

$c'_4 = [8/4] = 2_{(10)} \Rightarrow c_4 = 2_{(16)}$ $t_3 = 8 - 4 \cdot 2 = 0$

$i=3, t_3=0$: $0 \cdot 16 + 5_{(16)} = 5_{(10)}$

$c'_3 = [5/4] = 1 \Rightarrow c_3 = 1_{(16)}$ $t_2 = 5 - 4 \cdot 1 = 1$

$i=2, t_2=1$: $1 \cdot 16 + 5_{(16)} = 16 + 5 = 21_{(10)}$

$c'_2 = [21/4] = 5_{(10)}$, $c_2 = 5_{(16)}$ $t_1 = 21 - 4 \cdot 5 = 1$

$\underline{i=1, t_1=1:}$ $1 \cdot 16+E=16+14=30$

$c'_1=[30/4]=7 \quad c_1=7_{(16)} \Rightarrow t_0=30-4 \cdot 7=2$

$\underline{i=0, t_0=2:}$ $2 \cdot 16+0=32$

$c'_0=32/4=8 \quad c_0=8_{(16)} \Rightarrow t_{-1}=32-4 \cdot 8$

$t_{-1}=0_{(16)}=r$

Explanation for substraction:

The substraction is done starting with the units digits (from the index 0) from right to left. We filled the second number with $m-n=1$ 0s (zeros). We will substract, therefore, each digit from the second number from each digit from the first number. If the first digit is lower than the second one, one will be borrowed from the higher digit, which means we will borrow with the value of the base, performing the operation

$\underbrace{a_0+p-b_0}$, where a_0 - first digit
b_0 - digit from the second number
p - value p of the base

The borrow can be considered to be a transport figure (t_i) that can take the value 0 or -1.

Explanation for division:

The division is carried out starting with the most significant digit (index m) from left to right, the process being repetitive with a number of $m+1$ iterations.

At each iteration, a value obtained as the sum of the current digit is calculated with the product of the carry digit from the previous ~~operation~~ iteration and the base p, after they have been converted to decimal.

The calculated value provides 2 digits:

- the transport figure used in the next iteration is the remainder of the division
- the positionally corresponding figure is the quotient of dividing the computed value
- the quotiem will have +1 digits and the possible digit 0 from the most significant position will be removed

In the end, the carriage figure corresponding to the last iteration will represent the remainder r.

SUBJECT 2

Student 2: HERȚA DIANA-LARISA

Let $b=8$ and $h=16$

$x_{(8)} = 65713,221$ Using the Substitution Method we convert each digit of x from base 8 to base 16

$6_{(8)} = 6_{(16)}$
$5_{(8)} = 5_{(16)}$
$7_{(8)} = 7_{(16)}$
$1_{(8)} = 1_{(16)}$
$3_{(8)} = 3_{(16)}$
$2_{(8)} = 2_{(16)}$
$1_{(8)} = 1_{(16)}$

$\Rightarrow$ Since the destination base is greater than the source base, the digits stay the same. $\Rightarrow \overset{4}{6}\overset{3}{5}\overset{2}{7}\overset{1}{1}\overset{0}{3},221 = \underbrace{6571}_{I=\text{integer}} + \underbrace{0,221}_{F=\text{fractional}}$

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

$F = 2_{(16)} \cdot 8^{-1}_{(16)} + 2_{(16)} \cdot 8^{-2}_{(16)} + 1_{(16)} \cdot 8$

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

$8^1_{(16)} = 8_{(16)}$

$8^2_{(16)} = 8_{(16)} \cdot 8_{(16)} = 40_{(16)}$; $8 \cdot 8 = 64$ DIV $16 = 4$, MOD $16 = 0$

$8^3_{(16)} = 8_{(16)} \cdot 8^2_{(16)} = 200_{(16)}$; $40 \cdot 8 = 320$ DIV $16 = 20$, MOD $16 = 0$

$8^4_{(16)} = 8_{(16)} \cdot 8^3_{(16)} = 1000_{(16)}$; $200 \cdot 8 = 1600$ DIV $16 = 100$, MOD $16 = 0$

$6_{(16)} \cdot 8^4_{(16)} = 6 \cdot 1000 = 6000_{(16)}$

$5_{(16)} \cdot 8^3_{(16)} = 5 \cdot 200 = A00_{(16)}$ $\qquad$ $200_{(16)} \cdot 5 = A00$ $\quad 10_{(10)} = A_{(16)}$

$7_{(16)} \cdot 8^2_{(16)} = 7 \cdot 40 = 1C0_{(16)}$ $\qquad$ $40_{(16)} \cdot 7 = 1C0$ $\quad 4 \cdot 7 = 28$ DIV $16 = 1$ the carry, MOD $16 = 12 = C_{(16)}$

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

$3_{(16)} \cdot 8^0_{(16)} = 3 \cdot 1 = 3_{(16)}$

$\oplus$

$I = 6000 + A00 + 1C0 + 8 + 3$

$I = 6A00 + 1C0 + 8 + 3$

$6A00 + 1C0 = 6BC0$

$6BC0 + 8 = 6BC8$

$6BC8 + 3 = 6BCB_{(16)}$ (I)

(1) $8^{-1}_{(16)} = \frac{1_{(16)}}{8_{(16)}} = 0,2_{(16)}$ $1_{(16)} : 8_{(16)} = 0,2_{(16)}$ $10_{(16)} = 16^1 \cdot 1 + 0 \cdot 16^0 = 16$

$\frac{0}{10}$ $16 : 8 = 2 = 2_{(16)}$

(2) $8^{-2}{}_{(16)} = \frac{1}{8^2{}_{(16)}} = \cancel{8_{(16)}}\ 0,04_{(16)}$ $0,2_{(16)} : 8_{(16)} = 0,04.$ $20_{(16)} = 2 \cdot 16 + 0 \cdot 16^0 = 32$

$\frac{0}{=2}$ $32 : 8 = 4 = 4_{(16)}$

$\frac{0}{20}$

(3) $8^{-3}_{(16)} = \frac{1}{8^3_{(16)}} = \frac{1}{8^2_{(16)}} \cdot \frac{1}{8_{(16)}} = 0,008_{(16)}$ $0,04_{(16)} : 8_{(16)} = 0,008_{(16)}$

$\frac{0}{=0}$ $40_{(16)} = 4 \cdot 16 + 0 \cdot 16^0 = 64$

$\frac{0}{=4}$ $64 : 8 = 8$

$\frac{8}{40}$

$2_{(16)} \cdot 8^{-1}_{(16)} = 2 \cdot 0,2 = 0,4_{(16)}$

$2_{(16)} \cdot 8^{-2}_{(16)} = 2 \cdot 0,04 = 0,08_{(16)}$

$1_{(16)} \cdot 8^{-3}_{(16)} = 0,008_{(16)}$ $\oplus$

$F = 0,4_{(16)} + 0,08_{(16)} + 0,008_{(16)}$

$F = 0,488$ (II)

$(I - II) \Rightarrow 6BCB + 0,488 = 6BCB,488_{(16)}$

Subject 2: Conversions of real numbers

$y_{(16)} = 6BCB,488 \longrightarrow ?_{(8)}$

Since the destination base is lesser than the source base, the method used for converting y to base 8 is that of successive multiplications and divisions.

$y = 6BCB,488 = \underbrace{6BCB}_{I} + \underbrace{0,488}_{F}$ I - integer part
F - fractional part

In order to convert the integer part (I) to the destination base, we need to successively divide y by the [destination base]$_{\text{(source base)}}$, until we reach 0. By taking the remainders in reverse order of achieving, (the remainder of the first division is going to be the last digit), we get the integer part converted to the destination base. $[\, 8 < 16 \Rightarrow 8_{(16)} \,]$

$6BCB_{(16)} : 8_{(16)} = 0D79$

$\overline{0}$
$6B$
$\overline{=3C}$
$\overline{=4B}$
$=\boxed{3}$ → first remainder, last digit

(I) $6B = 6 \cdot 16^1 + B \cdot 16^0 = 96 + 11 = 107 : 8 = 13 = D$; $\;8,\; =27,\; 24,\; =3$

(II) $3C = 16^1 \cdot 3 + C \cdot 16^0 = 48 + 12 = 60$; $\;60 : 8 = 7,\; 56,\; =4$

(III) $4B = 4 \cdot 16^1 + B \cdot 16^0 = 64 + 11 = 75$; $\;75 : 8 = 9,\; 72,\; =3$

$D79_{(16)} : 8_{(16)} = 1A7$

8
57
$\overline{=79}$
$=\boxed{1}$ → second remainder, second to last digit

(I) $D_{(16)} = 13 : 8 = 1$; $\;8,\; =5$

(II) $57_{(16)} = 5 \cdot 16^1 + 7 \cdot 16^0 = 80 + 7 = 87$; $\;87 : 8 = 10 = A$; $\;80,\; =7$

(III) $79_{(16)} = 7 \cdot 16^1 + 9 \cdot 16^0 = 112 + 9 = 121 : 8 = 15 = F$; $\;120,\; =1$

$$\begin{array}{l|l} 1AF_{(16)} & 8_{(16)} \\ \hline \underline{0} & 035 \\ 1A & \\ \overline{=2F} & \\ \overline{=\boxed{7}} & \end{array}$$

(I) $1A = 1\cdot16^1 + A\cdot16^0 = 16+10 = 26 : 8 = 3$

$\underline{24}$

$=2$

(II) $2F = 2\cdot16^1 + F\cdot16^0 = 32+15 = 47 : 8 = 5$

$\underline{40}$

$=7$

$=\boxed{7}$ → third remainder,...

$$\begin{array}{l|l} 35_{(16)} & 8_{(16)} \\ \hline \underline{0} & 06 \\ 35 & \\ \overline{=\boxed{5}} & \end{array}$$

(I) $35 = 3\cdot16^1 + 5\cdot16^0 = 48+5 = 53 : 8 = 6$

$\underline{48}$

$=5$

$=\boxed{5}$ → fourth remainder

$$\begin{array}{l|l} 6_{(16)} & 8_{(16)} \\ \hline \underline{0} & 0 \\ \boxed{6} & \end{array}$$

→ last remainder, first digit =>

$6BCB = 65713$

In order to convert the fractional part (F) to the destination base, we need to succesively multiply it by [destination base]$_{(\text{source base})}$. The first integer part of the result is going to be the first digit of the fractional part of the result. Again, we take the fractional part of the result and multiply it by [destination base]$_{(\text{source base})}$. We repeat this process as many times as the desired number of digits of the result.

$F = 0,488$

$0,488_{(16)} \cdot 8_{(16)} = \underline{2},44_{(16)}$ → first digit

$0,44_{(16)} \cdot 8_{(16)} = \underline{2},2_{(16)}$ → second digit

$0,2_{(16)} \cdot 8_{(16)} = \underline{1},0$ → third digit

$\Rightarrow 0,488_{(16)} = 0,221_{(8)}$

(I) $4\cdot8 = 32 \;/\; 16 = 2$

$32 \,\%\, 16 = 0$

$8\cdot8 = 64 \;/\; 16 = 4$

$64 \,\%\, 16 = 0$

$8\cdot8 = 64 \;/\; 16 = 4$

$64 \,\%\, 16 = 0$

(+)

(II) $4\cdot8 = 32$ (...)

(III) $2\cdot8 = 16 \;/\; 16 = 1$

$16 \,\%\, 16 = 0$

$I + F \Rightarrow 6BCB,488_{(16)} = 65713,221_{(8)}$

Subject 3: representations

Option 4: floating-point representation of real numbers, with mantissa >1

$x = \overbrace{21123}^{I},37_{(10)} \longrightarrow ?_{(8)}$

$n = 32$ bits

$$
\begin{array}{l}
21123 : 8 = 2640 \text{ rest } 3 \\
2640 : 8 = 330 \text{ rest } 0 \\
330 : 8 = 41 \text{ rest } 2 \\
41 : 8 = 5 \text{ rest } 1 \\
5 : 8 = 0 \text{ rest } 5
\end{array}
$$

$21123_{(10)} = 51203_{(8)} =$

$\frac{101}{5}\ \frac{001}{1}\ \frac{010}{2}\ \frac{000}{0}\ \frac{011}{3}$

↳ using the rapid conversions table, each octal digit equals a group of three binary digits

$101\ 001\ 010\ 000\ 011 = 1,01\ 001\ 010\ 000\ 011_{(2)} \cdot 2^{14}$ (I)

mantissa >1

$e = 14 \Rightarrow c = 127 + 14 = 141$

1 hidden bit (mantissa >1)

$c = 141_{(10)} = 2^7 + 2^3 + 2^2 + 2^0 = 10001101$ (II)

↳ There are 14 digits in the mantissa from the integer part ⇒ in a 32-bit representation, we need $23 - 14 = 9$ more binary digits obtained from the fractional part

$0,37 \cdot 8 = 2,96$
$0,96 \cdot 8 = 7,68$
$0,68 \cdot 8 = 5,44$
$0,44 \cdot 8 = 3,52$

$0,37_{(10)} = 0,275_{(8)} = 0,\underset{2}{010}\ \underset{7}{111}\ \underset{5}{101}$ (III)

↳ using the rapid conversions table, each octal digit equals a group of three binary digits

$$21123,37_{(10)} = 1,0100\ 1010\ 0000\ 1101\ 0111\ 101_{(2)} \cdot 2^{14}$$

Representation

S	31	30	29	28	27	26	25	24	23	22	21	20	19	18	17	16	15	14	13	12	11	10	9	8	7	6	5	4	3	2	1
0	1	0	0	0	1	1	0	1	0	1	0	0	1	0	1	0	0	0	0	0	1	1	0	1	0	1	1	1	1	0	1
4				6				A				5				0				6				B				D			

S	c (8bits)								m (23 bits)																						
S	31	30	29	28	27	26	25	24	23	22	21	20	19	18	17	16	15	14	13	12	11	10	9	8	7	6	5	4	3	2	1
0	1	0	0	0	1	1	0	1	0	1	0	0	1	0	1	0	0	0	0	0	1	1	0	1	0	1	1	1	1	0	1
4				6				A				5				0				6				B				D			

$M_{(16)} = 46A506BD_{(16)}$, floating point, $m>1$

the content of the memory location

Sub 3 - Student 2 : HERTA DIANA LARISA

$M_{(16)} = 46A506BD_{(16)}$, floating point , $m > 1$

Using the rapid conversion table

$46A506BA_{(16)} =$

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

$6_{(16)} = 0110_{(2)}$

$A_{(16)} = 1010_{(2)}$

$5_{(16)} = 0101_{(2)}$

$0_{(16)} = 0000_{(2)}$

$6_{(16)} = 0110_{(2)}$

$B_{(16)} = 1011_{(2)}$

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

$= \underbrace{0100}_{4}\underbrace{0110}_{6}\underbrace{1010}_{A}\underbrace{0101}_{5}\underbrace{0000}_{0}\underbrace{1101}_{6}\underbrace{0111}_{B}\underbrace{1101}_{D}{}_{(2)}$

$SP \Rightarrow n = 32$ bits $\Rightarrow$ representation:

$\boxed{S \mid \overset{8\ bits}{c = e + 127} \mid \overset{23\ bits}{m}}$

$\Rightarrow$ Sign bit | c - 8 bits | m - 23 bits

0 | 1000 1101 | $\underline{01001010000011010111101}$

$x = 0,m \cdot b^{e}$

m - mantissa

b - numeration base

e - exponent

$c = 1000\ 1101_{(2)} = 2^7 + 2^3 + 2^2 + 2^0 = 128 + 8 + 4 + 1 = 141$

$c = 127 + e \Rightarrow e = c - 127 \Rightarrow e = 141 - 127 \Rightarrow e = 14$

$\Rightarrow$ 14 digits in mantissa from the integer part ~~and~~ mantissa > 1 $\Rightarrow$ denormalisation of the floating point number

$1,\overbrace{01001010000011}^{14\ digits}010111101 \cdot 2^{14}$

We take the mantissa and the exponent and multiply with the base at the power of e

$\Rightarrow \overset{14\,13\,12\,11\,10\,9\,8\,7\,6\,5\,4\,3\,2\,1\,0\,-1\,-2\,-3\,-4\,-5\,-6\,-7\,-8\,-9}{101001010000011,010111101} =$

$= 2^{14} + 2^{12} + 2^{9} + 2^{7} + 2^{1} + \cancel{1} 2^{-2} + 2^{-4} + 2^{-5} + 2^{-6} + 2^{-7} + 2^{-9} =$

$= 2^9(2^5 + 2^3 + 1) + 128 + 2 + 1 + \frac{1}{2^2} + \frac{1}{2^4} + \frac{1}{2^5} + \frac{1}{2^6} + \frac{1}{2^7} + \frac{1}{2^9}$

$= 512 \cdot (32 + 8 + 1) + 131 + \frac{1}{4} + \frac{1}{16} + \frac{1}{32} + \frac{1}{2^6}\left(1 + \frac{1}{2} + \frac{1}{2^2}\right)$

$= 512 \cdot 41 + 131 + \frac{11}{32} + \frac{1}{64} \cdot \frac{7}{4}$

$= 20992 + 131 + \frac{11}{32} + \frac{7}{256}$

$= 21123 + \frac{88 + 7}{256} = 21123 + \frac{95}{256} = 21123 + 0,37 = 21123,37$