**Computational Logic Homework – teams**

Student 1: Adrian Astăluș

Student 2: Ana Avram

**Subject 1**

**b1** = base 16, **b2** = base 7, **x** = AF63B8, **y** = DE97A, **z** = 645126, **f** = 5

**Student 1(Adrian Astăluș):**

* x(16) + y(16) = s(16)

|  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- |
| 1 | 1 | 0 | 1 | 1 | 0 | carry |
| A | F | 6 | 3 | B | 8 | + |
| 0 | D | E | 9 | 7 | A |  |
| **B** | **D** | **4** | **D** | **3** | **2** |  |

* 0+8+A(16) = 8 + 10 = 18(10)

18/16 = 1, 18%16 = 2

* 1+B(16)+7 = 8 + 11 = 19(10)

19/16 = 1, 19%16 = 3

* 1+3+9 = 13

13/16 = 0, 13%16 = 13 = D(16)

* 0+6+E(16) = 6 + 14 = 20(10)

20/16 = 1, 20%16 = 4

* 1+F+D = 1 + 15 + 13 = 29(10)

29/16 = 1, 29%16 = 13 = D(16)

* 1+A+0 = 1 + 10 = 11(10)

11/16 = 0, 11%16 = 11 = B(16)

**Student 2(Ana Avram):**

* s(16) - y(16) = ?(16)

|  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- |
| 1 | 1 | 0 | 1 | 1 | 0 | borrows |
| B | D | 4 | D | 3 | 2 | - |
| 0 | D | E | 9 | 7 | A |  |
| **A** | **F** | **6** | **3** | **B** | **8** |  |

* 2-0-A(16) = 2 - 10 = -8(10)

d0 = -8 + 16 = 8, c1 = 1

* 3-1-7 = 3 - 8 = -5(10)

d1 = -5 + 16 = 11 = B­(16), c2 = 1

* D(16)-1-9 = 13 – 10 = 3(10)

d2 = 3, c3 = 0

* 4-0-E(16) = 4 - 14 = -10(10)

d3 = -10 + 16 = 6, c4 = 1

* D(16)-1-D(16) = 15 - 1 - 15 = -1(10)

d4 = -1 + 16 = 15 = F(16), c5 = 1

* B(16)-1-0 = 11 - 1 = 10(10)

d5 = 10 = A(16)

**Student 1(Adrian Astăluș):**

* z(7) \* f(7) = p(7)

|  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- |
| 4 | 3 | 3 | 1 | 2 | 4 | 0 | carry |
|  | 6 | 4 | 5 | 1 | 2 | 6 | + |
|  |  |  |  |  |  | 5 |  |
| **4** | **5** | **2** | **5** | **0** | **0** | **2** |  |

* 0+(6\*5)= 0 + 30 = 30(10)

30/7 = 4, 30%7 = 2

* 4+(2\*5) = 4 + 10 = 14(10)

14/7 = 2, 14%7 = 0

* 2+(1\*5) = 2 + 5 = 7(10)

7/7 = 1, 7%7 = 0

* 1+(5\*5) = 1 + 25 = 26(10)

26/7 = 3, 26%7 = 5

* 3+(4\*5) = 3 + 20 = 23(10)

23/7= 3, 23%7 = 2

* 3+(6\*5) = 3 + 30 = 33(10)

33/7 = 4, 33%7 = 5

* 4+(5\*0) = 4 + 0 = 4(10)

4/7 = 0, 4%7 = 4

**Student 2(Ana Avram):**

* p(7) : f(7) = ?(7)

   4525002(7)  | 5(7)

       /             |645126(7)

     32

       /

        35

         /

         10             

  /

           20

  /

42

  /

0 - remainder

* 4\*7 + 5 = 28 + 5 = 33(10)

33/5 = 6, 33%5 = 3

* 3\*7 + 2 = 21 + 2 = 23(10)

23/5 = 4, 23%5 = 3

* 3\*7 + 5 = 21 + 5 = 26(10)

26/5 = 5, 26%5 = 1

* 1\*7 + 0 = 7 + 0 = 7(10)

7/5 = 1, 7%5 = 2

* 2\*7 + 0 = 14 + 0 = 14(10)

14/5= 2, 14%5 = 4

* 4\*7 + 2 = 28 + 2 = 30

30/5 = 6, 30%5 = 0

**Subject 2**

**b** = base 5, **h** = base 8, **x(b)** = 22131,101, **y(h)** = 3005,153

**Student 2(Ana Avram):**

* x(b) -> y(h)

(substitution method)

2(5) = 2(8), 1(5) = 1(8), 3(5) = 3(8), 0(5) = 0(8)

5 = 5(8)

22131,101(5) = 2(8)\*(5(8))4 + 2(8)\*(5(8))3 + 1(8)\*(5(8))2 + 3(8)\*(5(8))1 + 1(8)\*(5(8))0 + 1(8)\*(5(8))-1 + 0(8)\*(5(8))-2 + 1(8)\*(5(8))-3

* (5(8))2  = 5(8) \* 5(8) = 31(8)

5\*5 = 25; 25/8 = 3, 25%8 = 1

* (5(8))3 = 31(8) \* 5(8) = 175(8)

|  |  |  |  |
| --- | --- | --- | --- |
| 1 | 0 | 0 | carry |
|  | 3 | 1 | \* |
|  |  | 5 |  |
| 1 | 7 | 5 |  |

5\*1 + 0 = 5; 5/8 = 0, 5%8 = 5

5\*3 + 0 = 15; 15/8 = 1, 15%8 = 7

5\*0 + 1 = 1; 1/8 = 0, 1%8 = 1

* (5(8))4 = 175(8) \* 5(8) = 1161(8)

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| 1 | 4 | 3 | 0 | carry |
|  | 1 | 7 | 5 | \* |
|  |  |  | 5 |  |
| 1 | 1 | 6 | 1 |  |

5\*5 + 0 = 25; 25/8 = 3, 25%8 = 1

5\*7+3 = 35+3 = 38; 38/8 = 4, 38%8 = 6

5\*1+4 = 5+4 = 9; 9/8 = 1, 9%8 =1

5\*0+1 = 1; 1/8 = 0, 1%8 = 1

**Student 1(Adrian Astăluș):**

* y(h) -> x(b)

(successive divisions & multiplications)

3005(8)|5(8)

   /       |464(8)|5(8)

   40       \_/       |75(8)|5(8)

     /          34       \_/    |14(8)|5(8)

      25       \_/        25     \_/   |2(8)|5(8)

       /           3        \_/       2    \_/  |0

       112

3\*8 + 0 = 24 + 0 = 24(10)

24/5 = 4, 24%5 = 4

4\*8 + 0 = 32 + 0 = 32(10)

32/5 = 6, 32%5 = 2

2\*8 + 5 = 16 + 5 = 21(10)

21/5 = 4, 21%5 = 1

4\*8 + 6 = 32 + 6 = 38(10)

38/5 = 7, 38%5 = 3

3\*8 + 4 = 24 + 4 = 28(10)

28/5 = 5, 28%5 = 3

7(8) = 7(10)

7/5 = 1, 7%5 = 2

2\*8 + 5 = 16 + 5 = 21(10)

21/5 = 4, 21%5 = 1

1\*8 + 4 = 8 + 4 = 12(10)

12/5 = 2, 12%5 = 2

2(8) = 2(10)

2/5 = 0, 2%5 = 2

so **3005(8) = 22131(5)**

* 2(8)\*(5(8))4 = 2342(8)

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
|  | 0 | 1 | 0 | 0 | carry |
|  | 1 | 1 | 6 | 1 | \* |
|  |  |  |  | 2 |  |
|  | 2 | 3 | 4 | 2 |  |

2\*1 + 0 = 2 + 0 = 2(10)

2/8 = 0, 2%8 = 2

2\*6 + 0 = 12 + 0 = 12(10)

12/8 = 1, 12%8 = 4

2\*1 + 1 = 2 + 1 = 3(10)

3/8 = 0, 3%8 = 3

2\*1 + 0 = 2 + 0 = 2(10)

2/8 = 0, 2%8 = 2

* 2(8)\*(5(8))3 = 372­(8)

|  |  |  |  |
| --- | --- | --- | --- |
| 1 | 1 | 0 | carry |
| 1 | 7 | 5 | \* |
|  |  | 2 |  |
| 3 | 7 | 2 |  |

2\*5 + 0 = 10 + 0 = 10(10)

10/8 = 1, 10%8 = 2

2\*7 + 1 = 14 + 1 = 15(10)

15/8 = 1, 15%8 =7

2\*1 + 1 =2 + 1 = 3(10)

3/8 =0, 3%8 = 3

* 1(8)\*(5(8))2 = 1(8) \* 31(8) = 31(8)
* 3(8)\*(5(8))1 = 3(8) \* 5(8) = 17(8)

3\*5 = 15(10); 15/8 = 1, 15%8 = 7

* 1(8)\*(5(8))0 = 1(8) \* 1(8) = 1(8)
* 0,153(8) \* 5(8) = 1,027(8)

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| 1 | 3 | 1 | 0 | carry |
| 0, | 1 | 5 | 3 | \* |
|  |  |  | 5 |  |
| 1, | 0 | 2 | 7 |  |

0 + 5\*3 = 0 + 15 = 15(10)

15/8 = 1, 15%8 = 7

1 + 5\*5 = 1 + 25 = 26(10)

26/8 = 3, 26%8 = 2

3 + 5\*1 = 3 + 5 = 8(10)

8/8 = 1, 8%8 =0

1 + 5\*0 = 1 + 0 = 1(10)

1/8 =0, 1%8 = 1

* 0,027(8) \* 5(8) = 0,163(8)

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| 0 | 1 | 4 | 0 | carry |
| 0, | 0 | 2 | 7 | \* |
|  |  |  | 5 |  |
| 0, | 1 | 6 | 3 |  |

0 + 5\*7 = 0 + 35 = 35(10)

35/8 = 4, 35%8 = 3

4 + 5\*2 = 4 + 10 = 14(10)

14/8 = 1, 14%8 = 6

1 + 5\*0 = 1 + 0 = 1(10)­

8/8 = 1, 8%8 =0

0 + 5\*0 = 0 + 0 = 0(10)

0/8 =0, 0%8 = 0

* 0,163(8) \* 5(8) = 1,077(8)

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| 1 | 3 | 1 | 0 | carry |
| 0, | 1 | 6 | 3 | \* |
|  |  |  | 5 |  |
| 1, | 0 | 7 | 7 |  |

0 + 5\*3 = 0 + 15 = 15(10)

15/8 = 1, 15%8 = 7

1 + 5\*6 = 1 + 30 = 31(10)

31/8 = 3, 31%8 = 7

3 + 5\*1 = 3 + 5 = 8(10)­

8/8 = 1, 8%8 =0

1 + 5\*0 = 1 + 0 = 1(10)

1/8 =0, 1%8 = 1

so **0,153(8) = 0,101(5)**

* 1(8)\*(5(8))-1 = 1(8) : 5(8)

1,000(8) : 5(8) = 0,146(8)

/ 1\*8 + 0 = 8(10); 8/5 = 1, 8%5 =3

30 3\*8 + 0 = 24(10); 24/5 = 4, 24%5 = 4

\_/ 4\*8 + 0 = 32(10); 32/5 =6, 32%5 = 2

40

\_/

2

* 0(8)\*(5(8))-2 = 0
* 1(8)\*(5(8))-3 = [(1(8):5(8)):5(8)]:5(8) = 0,004(8)

1(8):5(8) = 0,146(8)

0,146(8):5(8) = 0,024(8)

/ 0\*8 + 1 = 1(10); 1/5 = 0, 1%5 =1

14 1\*8 + 4 = 12(10); 12/5 = 2, 12%5 = 2

/ 2\*8 + 6 = 22(10); 22/5 = 4, 22%5 =2

26

/

2

0,024(8):5(8) = 0,004(8)

/ 0\*8 + 2 = 2(10); 2/5 =0, 2%5 = 2

24 2\*8 + 4 = 20(10); 20/5 = 4, 20%5 = 0

/

0

so **22131,101(5)** = 2342(8) + 372(8) + 31(8) + + 17(8) + 1(8) + 0,146(8) + 0,004(8) = **3005,152(8)**

6 + 4 = 10; 10%8 = 2, 10/8 = 1

2+2+1+7+1 = 13(10); 13%8 = 5, 13/8 = 1

1+4+7+3+1 = 16(10); 16%8 = 0, 16/8 = 2

2+3+3 = 8(10); 8%8 = 0, 8/8 = 1

**3005(8) = 22131(5)**

**0,153(8) = 0,101(5)**

so **3005,153(8) = 22131,101(5)**

**Explanations**

**Student 2** used the substitution method, firstly converting all the digits from the source base into the destination base. The source base is also converted. Because the destination base is bigger, all the digits remain the same. Then, the sum is calculated in the destination base(in this case 8).

**Student 1** used the method of successive divisions (for the integer part) and multiplications (for the fractional part). Both the successive divisions and the multiplications are performed by the destination base(in this case 5). The division is repeated until we get 0 as a quotient, and the multiplication is repeated until we reach the required number of digits (in this case 3).

|  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- |
| 1 | 2 | 1 | 0 |  | 0 | 1 | 0 | carry |
| 2 | 3 | 4 | 2 | , | 0 | 0 | 0 | + |
|  | 3 | 7 | 2 | , | 0 | 0 | 0 |  |
|  |  | 3 | 1 | , | 0 | 0 | 0 |  |
|  |  | 1 | 7 | , | 0 | 0 | 0 |  |
|  |  |  | 1 | , | 0 | 0 | 0 |  |
|  |  |  | 0 | , | 1 | 4 | 6 |  |
|  |  |  | 0 | , | 0 | 0 | 4 |  |
| 3 | 0 | 0 | 5 | , | 1 | 5 | 2 |  |

**Subject 3 – option 5**

**x(10)** = 78534,21

**Student 1(Adrian Astăluș):**

* represents x in floating-point notation, SP, mantissa <1
* writes the content of the memory location in hexadecimal: M(16)
* 78534(10) = 231306(8) =

= 010011001011000110(2)

78534:8 = 9816 r 6

9816:8 = 1227 r 0

1227: 8 =153 r 3

153:8 = 19 r 1

19:8 = 2 r 3

2:8 = 0 r 2

* 0,21(10) = 0,1534(8) =

= 0,001101011100(2)

0,21 \* 8 = 1,68

0,68 \* 8 = 5,44

0,44 \* 8 = 3,52

0,52 \* 8 = 4,16

* 78534,21(10) = 10011001011000110,001101011100(2)

= 0,100110010110001100011010111000(2) \* 1017

e = 17 => c = 17+127 = 144

144 = 128 + 16 = 27 + 24 = 10010000(2)

|  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| S | C = e+127 (8bits) | | | | | | | | , | mantissa (23 bits) | | | | | | | | | | | | | | | | | | | | | | |
| 0 | 1 | 0 | 0 | 1 | 0 | 0 | 0 | 0 | 1 | | 0 | 0 | 1 | 1 | 0 | 0 | 1 | 0 | 1 | 1 | 0 | 0 | 0 | 1 | 1 | 0 | 0 | 0 | 1 | 1 | 0 | 1 |
| 4 | | | | 8 | | | | 4 | | | | | C | | | | B | | | | 1 | | | | 8 | | | | D | | | |

**M(16) = 484CB18D**

**Student 2(Ana Avram):**

* receives M(16) from Student 1and finds the real decimal number having M(16) as its floating-point representation, SP, mantissa <1, to verify the correctness of the result obtained by Student 1

|  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| 4 | | | | 8 | | | | 4 | | | | C | | | | B | | | | 1 | | | | 8 | | | | D | | | |
| 0 | 1 | 0 | 0 | 1 | 0 | 0 | 0 | 0 | 1 | 0 | 0 | 1 | 1 | 0 | 0 | 1 | 0 | 1 | 1 | 0 | 0 | 0 | 1 | 1 | 0 | 0 | 0 | 1 | 1 | 0 | 1 |
| S | c ( e + 127) | | | | | | | | mantissa ( 23 bits) | | | | | | | | | | | | | | | | | | | | | | |

**M(16) = 484CB18D = 01001000010011001011000110001101(2)**

S = 0 => we have a positive number

c = 10010000(2) = 27 + 24 = 128 + 16 = 144 => e = c – 127 = 144 – 127 = 17

x(2) = (-1)S \* m \* 2e = 0,10011001011000110001101 \* 217 =

= 10011001011000110,001101(2) =

= 216 + 213 + 212 + 29 + 27 + 26 + 22 + 2 + 2-3 + 2-4 + 2-6 =

= 65536 + 8192 + 4096 + 512 + 128 + 64 + 4 + 2 + 0,125 + 0,0625 + 0,015625 =

= 78534,203125(10) ≈ **78534,21(10)**