**Homework - teams of two students**

**Subject 1 – operations:**

**Student 1: Bledea Mihaela - Alexandra**

**A.**

b1 = 8

x(b1) = 531762(8)

y(b1) =21553(8)

S(b1) = 553535(8)

|  |  |  |  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
|  |  | **Positions (i)** | 9 | 8 | 7 | 6 | 5 | 4 | 3 | 2 | 1 | 0 |
| **Operation** | **Base (b)** | **Carries (c)** |  |  |  |  | 0 | 0 | 1 | 1 | 0 | 0 |
| **+** | **8** | **x** |  |  |  |  | 5 | 3 | 1 | 7 | 6 | 2 |
|  |  | **y** |  |  |  |  |  | 2 | 1 | 5 | 5 | 3 |
|  |  | **Sum (s)** |  |  |  |  | 5 | 5 | 3 | 5 | 3 | 5 |

0+2+3=5, 5 mod 8 = 5, 5 div 8 = 0

0+6+5=11, 11 mod 8 = 3, 11 div 8 = 1

1+7+5=13, 13 mod 8 = 5, 13 div 8 = 1

1+1+1=3, 3 mod 8 = 3, 3 div 8 = 0

0+2+3=5, 5 mod 8 = 5, 5 div 8 = 0

**B.**

b2 = 16

z(b2) = A8F6E4(16)

f(b2) = C(16)

p(b2) = 7EB92B0(16)

|  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
|  |  |  | **Positions (i)** | 9 | 8 | 7 | 6 | 5 | 4 | 3 | 2 | 1 | 0 |
| **Operation** | **Base (b)** |  | **Carries (c)** |  |  |  | 7 | 6 | B | 5 | A | 3 | 0 |
| **\*** | **16** |  | **z** |  |  |  |  | A | 8 | F | 6 | E | 4 |
|  |  |  | **f** |  |  |  |  |  |  |  |  |  | C |
|  |  |  | **Product (p)** |  |  |  | 7 | E | B | 9 | 2 | B | 0 |

4(16)\*C(16)+0(16) = 4\*12+0=48, 48 mod 16 = 0, 48 div 16 = 3

E(16)\*C(16)+3(16) = 14\*12+3=171, 171 mod 16 = 11 =B(16), 171 div 16 = 10 = A(16)

6(16)\*C(16)+A(16) = 6\*12+10=82, 82 mod 16 = 2, 82 div 16 = 5

F(16)\*C(16)+5(16) = 15\*12+5=185, 185 mod 16 = 9 , 185 div 16 = 11 = B(16)

8(16)\*C(16)+B(16) = 8\*12+11=107, 107 mod 16 = 11 = B(16) , 100 div 16 = 6

A(16)\*C(16)+6(16) = 10\*12+6=126, 126 mod 16 = 14 = E(16), 124 div 16 = 7

**Student 2: Blăjan Denisa**

**A.**

b1 = 8

x(b1) = 531762(8)

y(b1) = 21553(8)

S(b1) = 553535(8)

|  |  |  |  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
|  |  | **Positions (i)** | 9 | 8 | 7 | 6 | 5 | 4 | 3 | 2 | 1 | 0 |
| **Operation** | **Base (b)** | **Carries (c)** |  |  |  |  | 0 | 0 | 1 | 1 | 0 | 0 |
| **-** | **8** | **s** |  |  |  |  | 5 | 5 | 3 | 5 | 3 | 5 |
|  |  | **y** |  |  |  |  |  | 2 | 1 | 5 | 5 | 3 |
|  |  | **Difference (d)** |  |  |  |  | 5 | 3 | 1 | 7 | 6 | 2 |

5–0–3 = 2, c1 = 0, d0 = 2

3–0–5 = -2, c2 = 1, d1 = -2 + 8 = 6

5–1–5 = -1, c3 = 1, d2 = -1 + 8 = 7

3–1–1 = 1, c4 = 0, d3 = 1

5–0–2 = 3, c5 = 0, d4 = 3

5–0–0 = 5, c6 = 0, d5 = 5

**==> x = d**

**B.**

b2 = 16

z(b2) = A8F6E4(16)

f(b2) = C(16)

p(b2) = 7EB92B0(16)

**p(dividend)**

07EB92B0(16)    |  C(16) **f(divisor)**

        /            |  A8F6E4(16)        **q(quotient)**

        7E

        /

         6B

           /

            B9

  /

52

            /

             AB

  /

30

  /

0 **(remainder)**

07(16) = 0 \* 16 + 7 = 7, 7 div C = 0, 7 mod C = 7

7E(16) = 7 \* 16 + 14 = 126, 126 div C = 10 = A, 126 mod C = 6

6B(16) = 6 \* 16 + 11 = 107, 107 div C = 8, 107 mod C = 11 = B

B9(16) = 11 \* 16 + 9 = 185, 185 div C = 15 = F, 185 mod C = 5

52(16) = 5 \* 16 + 2 = 82, 82 div C = 6, 82 mod C = 10 = A

AB(16) = 10 \* 16 + 11 = 171, 171 div C = 14 = E, 171 mod C = 3

30(16) = 3 \* 16 + 0 = 48, 48 div C = 4, 48 mod C = 0

**==> z = q**

**Subject 2 - conversions of real numbers choosing the appropriate methods:**

**Student 1 : Bledea Mihaela - Alexandra**

b ≠10, h ≠10, b<10

b = 7, h=16

X(b) = 1562,345(7)

I have used the substitution method for converting the number from base 7 to base 16.

***Steps:***

* **all the digits from the source representation are converted into the destination base:**
* **the base*b* is converted into base *h*:**
* **we calculate in base *h* the following sum:**

1562,345(7)= 1(16)\*7(16)^3 + 5(16)\*7(16)^2 + 6(16)\*7(16)^1 + 2(16)\*7(16)^0 +

3(16)\*7(16)^(-1)+4(16)\*7(16)^(-2)+5(16)\*7(16)^(-3)

|  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| c | 3 |  |  | 1 | 0 |  |  | 0 | 0 |  |  |  | 2 |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
|  |  | 7 | \* |  | 3 | 1 | \* |  | 3 | 1 | \* |  |  | 6 | \* |  |  | 2 | \* |  |  |  |  |  |  |  |  |
|  |  | 7 |  |  |  | 7 |  |  |  | 5 |  |  |  | 7 |  |  |  | 1 |  |  |  |  |  |  |  |  |  |
|  | 3 | 1 |  | 1 | 5 | 7 |  |  | F | 5 |  |  | 2 | A |  |  |  | 2 |  |  |  |  |  |  |  |  |  |

7\*7=49, 49 mod 16 = 1, 49 div 16 = 3

7\*1=7, 7 mod 16 = 7, 7 div 16 = 0

7\*3+0=21, 21 mod 16 = 5, 21 div 16 = 1

1\*5=5, 5 mod 16 = 5, 5 div 16 = 0

3\*5+0=15, 15 mod 16 = 15 = F(16) , 15 div 16 = 0

|  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- |
| 3,00  (16) | :7(16) | 4,00(16) | :7(16) | 0,924(16) | :7(16) |  |
| 30 | 0,6DB | 40 | 0,924 | 0 | 0,14E |  |
| 60 | | 10 | | 9 | |  |
| 50 | | 20 | | 22 | |  |
|  | |  | | 64 | |  |
|  | |  | |  | |  |

6\*7=42, 42 mod 16 = 10 = A(16), 42 div 16 = 2

30(16) = 3\*16^1+0\*16^0 = 48(10)

48 div 7 = 6

48 mod 7 = 6

60(16) = 6\*16^1+0\*16^0 = 96(10)

96 div 7 = 13 = D(16)

96 mod 7 = 5

50(16) = 5\*16^1+0\*16^0 = 80(10)

80 div 7 = 11 = B(16)

80 mod 7 = 3

40(16) = 4\*16^1+0\*16^0 = 64(10)

64 div 7 = 9

64 mod 7 = 1

10(16) = 1\*16^1+0\*16^0 = 16(10)

16 div 7 = 2

16 mod 7 = 2

20(16) = 2\*16^1+0\*16^0 = 32(10)

32 div 7 = 4

32 mod 7 = 4

9(16) = 9(10)

9 div 7 = 1

9 mod 7 = 2

22(16) = 2\*16^1+2\*16^0 = 34(10)

34 div 7 = 4

34 mod 7 = 6

64(16) = 6\*16^1+4\*16^0 = 100(10)

100 mod 7 = 14 = E(16)

100 div 7 = 2

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
| 5,00(16) | :7(16) | 0,B24 (16) | :7(16) | 0,197(16) | :7(16) |
| 50 | 0,B24 | 0 | 0,197 | 0 | 0,03A |
| 30 | | B | | 1 | |
| 20 | | 42 | | 19 | |
|  | | 34 | | 47 | |
|  | |  | |  | |

50(16) = 5\*16^1+0\*16^0 = 80(10)

80 div 7 = 11 = B(16)

80 mod 7 = 3

30(16) = 3\*16^1+0\*16^0 = 48(10)

30 div 7 = 2

30 mod 7 = 2

20(16) = 2\*16^1+0\*16^0 = 32(10)

32 div 7 = 4

32 mod 7 = 4

B(16) = 11(10)

11 div 7 = 1

11 mod 7 = 4

42(16) = 4\*16^1+2\*16^0 = 66(10)

66 div 7 = 9

66 mod 7 = 3

34(16) = 3\*16^1+4\*16^0 = 52(10)

52 div 7 = 7

52 mod 7 = 3

1(16) = 1(10)

1 div 7 = 0

1 mod 7 = 1

19(16) = 1\*16^1+9\*16^0 = 25(10)

25 div 7 = 3

25 mod 7 = 4

47(16) = 4\*16^1+7\*16^0 = 71(10)

71 div 7 = 10 = A(16)

71 mod 7 = 1

1562,345 = 157(16) + F5(16) + 2A(16) + 2(16) + 0,6DB(16) + 0,14E(16) + 0,03A(16)

|  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- |
| **c** | 1 | 1 |  |  | 1 | 2 |  | +(16) |
|  | 1 | 5 | 7 | , | 0 | 0 | 0 |  |
|  |  | F | 5 | , | 0 | 0 | 0 |  |
|  |  | 2 | A | , | 0 | 0 | 0 |  |
|  |  |  | 2 | , | 0 | 0 | 0 |  |
|  |  |  | 0 | , | 6 | D | B |  |
|  |  |  | 0 | , | 1 | 4 | E |  |
|  |  |  |  |  | 0 | 3 | A |  |
|  | 2 | 7 | 8 | , | 8 | 6 | 4 |  |

B+E+A = 11+15+10 = 36, 36 div 16 = 2, 36 mod 16 = 4

2+D+4+3 = 2+13+4+3 = 22, 22 div 16 = 1, 22 mod 16 = 6

1+6+1 = 8, 8 div 16 = 0, 8 mod 16 = 8

7+5+A+2 = 7+5+10+2 = 24, 24 div 16 = 1, 24 mod 16 = 8

1+5+F+2 = 1+5+15+2 = 23, 23 div 16 = 1, 23 mod 16 = 7

1+1 = 2

1562,345(7) = 278,864(16)

**Student 2: Blăjan Denisa**

b ≠10, h ≠10, b<10

b = 7, h=16

y(h) = 278,864(16)

The method of successive divisions and multiplications.

Conversion of the integer part:

278(16) = 1562(7)

|  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- |
| 278(16) | :7(16) | 5A(16) | :7(16) | C(16) | :7(16) | 1(16) | :7(16) |
| 27 | 05A | 5A | C | C | 1 | 1 | 0 |
| 48 | | 6 | | 5 | |  | |
| 2 | |  | |  | |  | |

Calculations:

27(16)=7+2\*16=39, 39 div 7=5, 39 mod 7=4

48(16)=8+4\*16=72, 72 div 7=10=A(16),  72 mod 7=2

5A(16)= 10 + 5\*16= 90, 90 div 7=12=C(16), 90 mod 7=6

C(16) = 12, 12 div 7 = 1, 12 mod 7 = 5

Conversion of the fractional part:

0,864(16) = 0,333(7)

|  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
|  | 0 |  |  |  |  |  | 3 |  |  |  |  |  | 3 |  |  |  |
| 0. | 8 | 6 | 4 | \* |  | 0. | 8 | A | C | \* |  | 0. | 8 | 6 | 4 | \* |
|  |  |  | 7 |  |  |  |  |  | 7 |  |  |  |  |  | 7 |  |
| 3. | 8 | A | C |  |  | 3. | 8 | 6 | 4 |  |  | 3. | 8 | A | C |  |

0,864(16)\*7(16) = 3,8AC(16)

4\*7 = 28, 28 div 16 = 1, 28 mod 16 = 12 = C

6\*7 = 42, 42 div 16 = 2, 42 mod 16 = 10 = A

8\*7 = 56, 56 div 16 = 3, 56 mod 16 = 8

0,8AC(16)\*7(16) = 3,864(16)

C\*7 = 84, 84 div 16 = 5, 84 mod 16 = 4

A\*7 = 70, 70 div 16 = 4, 70 mod 16 = 6

8\*7 = 56, 56 div 16 = 3, 56 mod 16 = 8

x = 1562,345(7)= 278,864(16)

y = 278,864(16) = 1562,333(7)

**Subject 3 :**

**Student 1: Bledea Mihaela-Alexandra**

**Option 2 - addition and subtraction of subunitary numbers in complementary code**

x<y<z

x = 0,245 = 0,17534 (8) = 0,001111101011100(2)

y = 0,345 = 0,26050(8) = 0,010110000101000(2)

z = 0,412 = 0,32274(8) = 0,011010010111100(2)

0,245 \* 8 = 1,960

0,960 \* 8 = 7,680

0,680 \* 8 = 5,440

0,440 \* 8 = 3,520

0,520 \* 8 = 4,160

0,345 \* 8 = 2,760

0,760 \* 8 = 6,080

0,080 \* 8 = 0,640

0,640 \* 8 = 5,120

0,120 \* 8 = 0,960

0,412 \* 8 = 3,296

0,296 \* 8 = 2,368

0,368 \* 8 = 2,944

0,944 \* 8 = 7,552

0,552 \* 8 = 4,416

|  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| **positions** | **S 15,  14   13  12  11  10    9 8     7 6 5 4   3 2 1 0** | | | | | | | | | | | | | | | |
| **[0,245]dir =**  **[0,245]inv= [0,245]compl=** | 0 | 0 | 0 | 1 | 1 | 1 | 1 | 1 | 0 | 1 | 0 | 1 | 1 | 1 | 0 | 0 |
| **[-0,245]dir =** | 1 | 0 | 0 | 1 | 1 | 1 | 1 | 1 | 0 | 1 | 0 | 1 | 1 | 1 | 0 | 0 |
| **[-0,245]inv=** | 1 | 1 | 1 | 0 | 0 | 0 | 0 | 0 | 1 | 0 | 1 | 0 | 0 | 0 | 1 | 1 |
| **[-0,245]compl=** | 1 | 1 | 1 | 0 | 0 | 0 | 0 | 0 | 1 | 0 | 1 | 0 | 0 | 1 | 0 | 0 |

|  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| **positions** | **S 15,  14   13  12  11  10    9 8     7 6 5 4   3 2 1 0** | | | | | | | | | | | | | | | |
| **[0,345]dir = [0,345]inv= [0,345]compl=** | 0 | 0 | 1 | 0 | 1 | 1 | 0 | 0 | 0 | 0 | 1 | 0 | 1 | 0 | 0 | 0 |
| **[-0,345]dir =** | 1 | 0 | 1 | 0 | 1 | 1 | 0 | 0 | 0 | 0 | 1 | 0 | 1 | 0 | 0 | 0 |
| **[-0,345]inv=** | 1 | 1 | 0 | 1 | 0 | 0 | 1 | 1 | 1 | 1 | 0 | 1 | 0 | 1 | 1 | 1 |
| **[-0,345]compl=** | 1 | 1 | 0 | 1 | 0 | 0 | 1 | 1 | 1 | 1 | 0 | 1 | 1 | 0 | 0 | 0 |

|  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| **positions** | **S 15,  14   13  12  11  10    9 8     7 6 5 4   3 2 1 0** | | | | | | | | | | | | | | | |
| **[0,412]dir = [0,412]inv= [0,412]compl=** | 0 | 0 | 1 | 1 | 0 | 1 | 0 | 0 | 1 | 0 | 1 | 1 | 1 | 1 | 0 | 0 |
| **[-0,412]dir =** | 1 | 0 | 1 | 1 | 0 | 1 | 0 | 0 | 1 | 0 | 1 | 1 | 1 | 1 | 0 | 0 |
| **[-0,412]inv=** | 1 | 1 | 0 | 0 | 1 | 0 | 1 | 1 | 0 | 1 | 0 | 0 | 0 | 0 | 1 | 1 |
| **[-0,412]compl=** | 1 | 1 | 0 | 0 | 1 | 0 | 1 | 1 | 0 | 1 | 0 | 0 | 0 | 1 | 0 | 0 |

**Student 2: Blăjan Denisa**

[x]compl = [0,245]compl = 0,001111101011100(2)

[y]compl = [0,345]compl =  0,010110000101000(2)

[z]compl = [0,412]compl = 0,011010010111100(2)

[-x]compl = [-0,245]compl = 1,110000010100100(2)

[-y]compl = [-0,345]compl =  1,101001111011000(2)

[-z]compl = [-0,412]compl = 1,100101101000100(2)

**a). [x + y]compl = [x]compl Å [y]compl**

|  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
|  | + | S15, | 14 | 13 | 12 | 11 | 10 | 9 | 8 | 7 | 6 | 5 | 4 | 3 | 2 | 1 | 0 |
| **[0,245]compl**= |  | 0 | 0 | 0 | 1 | 1 | 1 | 1 | 1 | 0 | 1 | 0 | 1 | 1 | 1 | 0 | 0 |
| **[0,345]compl**= |  | 0 | 0 | 1 | 0 | 1 | 1 | 0 | 0 | 0 | 0 | 1 | 0 | 1 | 0 | 0 | 0 |
| **[0,59]compl**= |  | 0 | 1 | 0 | 0 | 1 | 0 | 1 | 1 | 1 | 0 | 0 | 0 | 0 | 1 | 0 | 0 |

Correct result: 2-1 + 2-4 + 2-6 + 2-7 + 2-8 + 2-13 = 0,589

**b). [x - y]compl = [x]compl Å [-y]compl**

|  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
|  | + | S15, | 14 | 13 | 12 | 11 | 10 | 9 | 8 | 7 | 6 | 5 | 4 | 3 | 2 | 1 | 0 |
| **[0,245]compl**= |  | 0 | 0 | 0 | 1 | 1 | 1 | 1 | 1 | 0 | 1 | 0 | 1 | 1 | 1 | 0 | 0 |
| **[-0,345]compl**= |  | 1 | 1 | 0 | 1 | 0 | 0 | 1 | 1 | 1 | 1 | 0 | 1 | 1 | 0 | 0 | 0 |
| **[-0,1]compl**= |  | 1 | 1 | 1 | 1 | 0 | 0 | 1 | 1 | 0 | 0 | 1 | 1 | 0 | 1 | 0 | 0 |
| **Complement** |  | 0 | 0 | 0 | 0 | 1 | 1 | 0 | 0 | 1 | 1 | 0 | 0 | 1 | 1 | 0 | 0 |

Correct result: - (2-4 + 2-5 + 2-8 + 2-9 + 2-12 + 2-13) = -0,099

**c). [z - x]compl = [z]compl Å [-x]compl**

|  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
|  | + | S15, | 14 | 13 | 12 | 11 | 10 | 9 | 8 | 7 | 6 | 5 | 4 | 3 | 2 | 1 | 0 |
| **[0,412]compl**= |  | 0 | 0 | 1 | 1 | 0 | 1 | 0 | 0 | 1 | 0 | 1 | 1 | 1 | 1 | 0 | 0 |
| **[-0,245]compl**= |  | 1 | 1 | 1 | 0 | 0 | 0 | 0 | 0 | 1 | 0 | 1 | 0 | 0 | 1 | 0 | 0 |
| **[0,167]compl** = | ~~1~~ | 0 | 0 | 0 | 1 | 0 | 1 | 0 | 1 | 0 | 1 | 1 | 0 | 0 | 0 | 0 | 0 |

Correct result: 2-3 + 2-5 + 2-7+ 2-9 + 2-10 = 0,166

**d). [- z - x]compl = [-z]compl Å [-x]compl**

|  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
|  | + | S15, | 14 | 13 | 12 | 11 | 10 | 9 | 8 | 7 | 6 | 5 | 4 | 3 | 2 | 1 | 0 |
| **[-0,412]compl**= |  | 1 | 1 | 0 | 0 | 1 | 0 | 1 | 1 | 0 | 1 | 0 | 0 | 0 | 1 | 0 | 0 |
| **[-0,245]compl**= |  | 1 | 1 | 1 | 0 | 0 | 0 | 0 | 0 | 1 | 0 | 1 | 0 | 0 | 1 | 0 | 0 |
| **[-0,657]compl**= | ~~1~~ | 1 | 0 | 1 | 0 | 1 | 0 | 1 | 1 | 1 | 1 | 1 | 0 | 1 | 0 | 0 | 0 |
| **Complement** |  | 0 | 1 | 0 | 1 | 0 | 1 | 0 | 0 | 0 | 0 | 0 | 1 | 1 | 0 | 0 | 0 |

Correct result: - (2-1 + 2-3 + 2-5+ 2-11 + 2-12) = -0,656