Seminar II + III

Substitution method (continued)

$3251,53_{(6)} = ?_{(16)}$

$h < v$

$3251,53_{(6)} = 3 \cdot 6_{16}^{3} + 2 \cdot 6_{16}^{2} + 5 \cdot 6_{16}^{1} + 1$
$+ 5 \cdot 6_{16}^{-1} + 3 \cdot 6_{16}^{-2}$

$= 1 +$

$5 \cdot$
6_{16}

$5 \cdot 6 = 30 \text{ MOD } 16 = 14$
$\text{DIV } 16 = 1$

$A = 10$

$\ldots = 2EF,EAA$

3. Succesive divisions and multiplications

$b > h$

INTEGER PART
↳ division

FRACTIONAL PART
↳ multiplication

8 decimals

$4527{,}65_{(8)} = ?_{(5)} = 111202{,}403_{(5)}$

$0{,}65_8 \cdot 5_5 = 4{,}11_8$
$0{,}11_8 \cdot 5_8 = 0{,}55$
$0{,}55_8 \cdot 5_8 = 3{,}41$

$0{,}65_8 \cdot 5_5$
$= 4{,}11$

$0{,}55_8 \cdot 5_8$
$= 4{,}41$

$4527_8 \mid 5_8$
$1421_{(18)}$

$25_8 = 21_{10}$

25 DIV 8 = 3
MOD 8 = 1

21 DIV 5 = 4
MOD 5 = 1

33 DIV 8 = 4
MOD 8 = 1

$12_8 = 10_{10}$

10 DIV 5 = 2
MOD 5 = 0

29 DIV 8 = 3
MOD 8 = 4

$\Rightarrow 4527_8 =$
$= 111202_5$

$14_8 = 12$ DIV 5 = 2
MOD 5 = 2

$22_8 = 18$ DIV 5 = 3
MOD 5 = 3

$31_8 = 25$

$23_8 = 19_{10}$ DIV 5 = 3
MOD 5 = 4

$40_8 = 32$ DIV 5 = 6
MOD 5 = 2

$36_8 = 24 + 6 = 30$

30 DIV 5 = 6
MOD 5 = 0

D) D2A1,F6$_{(16)}$ -> ?$_{(7)}$ = 313130,650

D2A1 | 7$_{(16)}$

1E17 | 7 → 44C

62, 04, 31 → (0)

1E, 21, 57 → (3)

$62_{16} = 96+2 = 98$ DIV 7 = 14 = E
MOD 7 = 0

$31_{16} = 49$ DIV 7 = 7
MOD 7 = 0

$1E_{16} = 30$ DIV 7 = 4
MOD 7 = 2

$21_{16} = 33_{10}$ DIV 7 = 4
MOD 7 = 5

$57_{16} = 87$ DIV 7 = 12 = C
MOD 7 = 3

44C | 7

5D | 7 → 16

44, 5C → (1)

2D → (3)

$44_{16} = 64+4 = 68$ DIV 7 = 9
MOD 7 = 5

$5C_{16} = 80+13 = 93$ DIV 7 = 13 = D
MOD 7 = 2

$2D_{16} = 32+13 = 45$ DIV 7 = 6
MOD 7 = 3

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16 | 7 → (3)

(1)

$16_{16} = 16+6 = 22$ DIV 7 = 3
MOD 7 = 1

0,F6 · 7

6,BA

0,BA · 7

$6 \cdot 7 = 42$ DIV 16 = 2
MOD 16 = 10 = A

$7 \cdot F = 7 \cdot 15 = 107$ DIV 16 = 6
MOD 16 = 11 = B

$A \cdot 7 = 70_{10}$ DIV 16 = 4
MOD 16 = 6

0,F6 · 7 = 6,BA

0,BA · 7 = 5,16

0,16 · 7 = 0,BA

$$\begin{array}{r} 0,B4 \\ \cdot\ 7 \\ \hline 5,16 \end{array}$$

$7 \cdot 11 + 4 = 81$ DIV $16 = 5$

MOD $16 = 1$

$$\begin{array}{r} 0,16 \\ \cdot\ 7 \\ \hline 0,B4 \end{array}$$

42 DIV $16 = 2$

MOD $16 = 10$

REPRESENTATIONS (CODES) – INTEGERS

Ex 1: $x = 58$

$y = 83$

$n = 8$ bits

$[x]_{dir, inv, c}$	$[y]\ldots$	$[x+y]_c$
$[-x]_{dir, inv, c}$	$[-y]\ldots$	$[x-y]_c$, $[y-x]_c$

$x = 111010_{(2)}$

	S_7	6	5	4	3	2	1	0	
$[x]_d$	0	0	1	1	1	0	1	0	$= [x]_i = [x]_c$
$[-x]_d$	1	0	1	1	1	0	1	0	
$[x]_i$	1	1	0	0	0	1	0	1	
$[-x]_c$	1	1	0	0	0	1	1	0	

$y = 83 = 64 + 16 + 2 + 1$

$= 1010011_{(2)}$

	S_7	6	5	4	3	2	1	0
$[y]_d$	0	1	0	1	0	0	1	1
$[-y]_d$	1	1	0	1	0	0	1	1
$[y]_i$	1	0	1	0	1	1	0	0
$[-y]_c$	1	0	1	0	1	1	0	1

$[x+y]_c = [x]_c \oplus [y]_c$

	S_7	6	5	4	3	2	1	0	
$[x]_c$	0	0	1	1	1	0	1	0	$\oplus$
$[y]_c$	0	1	0	1	0	0	1	1	
	(1)	0	0	0	1	1	0	1	

x, y positive, result is negative $\Rightarrow$ given $R_i \Rightarrow$ overflow

$[y-x]_c = [y] \oplus [-x]_c$

	S_7	6	5	4	3	2	1	0	
$[7]_C =$	0	1	0	1	0	0	1	1	
$[-x]_C =$	1	1	0	0	0	1	1	0	
	(1)	0	0	0	1	1	0	0	1	$= [25]_C$

the bit is discarded as per $R_{\overline{1}}$

$$[x-7]_C = [x]_C \oplus [-7]_C$$

	S_7	6	5	4	3	2	1	0	
$[x]_C =$	0	0	1	1	1	0	1	0	
$[-7]_C =$	1	0	1	0	1	1	0	1	
	1	1	1	0	0	1	1	1	$= [-25]_C$

complement: $00011001 = 1+8+16 = 25$

D2A1,F6$_{(16)}$ → ?$_{(7)}$ = 301030,64$_{(7)}$

We will use the repeated division and multiplication method since our input base is smaller than our destination base, allowing us to do operation with one digit only.

D2A1$_{16}$ | 7$_{16}$ → 1E17
62$_{16}$ = 98 DIV 7 = 14 = E, MOD 7 = 0
31$_{16}$ = 49 DIV 7 = 7, MOD 7 = 0

1E17 | 7 → 44C, remainder 3
1E$_{16}$ = 30
44C | 7 → 9D, remainder 0
9D | 7 → 16, remainder 1
16 | 7 → 3, remainder 0
3 | 7 → 0, remainder 3

0,F6$_{16}$ · 7$_{16}$ = 6, B6
0,B6 · 7$_{16}$ = 4, F6

6·7 = 42 DIV 16 = 2, MOD 16 = 6
15·7+2 = 107 DIV 16 = 6, MOD 16 = 11 = B
11·7+2 = 79 DIV 16 = 4, MOD = 15 = F