

# Lab 4

## Restoring Division

A

Q

11

01

10

01

10

110

cat=6

Restoring division		A		Q	
CNT					
000	-	0010 1101	1110	111	0
		0111 0101			
		1011 1000			
		0111 0101			
		0010 1101			
		0101 1011	1101 1100		
001	-	0111 0101			
		1110 0110			
		0111 0101			
		0101 1011	1011 1100		
010	-	0111 0101			
		1000 0010			
		1000 0101	0111 0010		
011	-	0111 0101			
		0001 0000			
		0010 0000	1110 0011		
100	-	0111 0101			
		1010 1011			
		0111 0101			
		0010 0000			

$$X = 7217$$

$$Y = 197$$

$$X = 00001110010110001$$

$$Y = 011000101$$

CNT	A								Q								
000	0	0	0	0	1	1	1	0	0	0	0	1	1	0	0	0	1
	0	0	0	1	1	1	0	0	0	0	1	1	0	0	0	1	0



# Restoring division

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dcti 1966

CNT	A	Q
000	00001 1100	0011 0001
	0 0011 1000	0110 0010
	0 1100 0101	
	1 0111 0011	
	0 1100 0101	
	0 0011 1000	
	0 0111 0000	1100 0100
001	0 1100 0101	
	1 1010 1011	
	0 1100 0101	
	0 0111 0000	
	0 1110 0001	1000 1000
	0 1100 0101	
010	0 0001 1100	
	0 0011 1001	0001 0010
011	0 1100 0101	
	1 0111 0100	
	+Y	

$$X = 0001 1100 0011 0001$$

$$Y = 01 100 0101$$

$$X = 7217$$

$$Y = 197$$

$$\begin{array}{r} 128 \\ - 69 \\ \hline 64 \\ \hline 5 \end{array}$$

$$\begin{array}{r} 0047 \\ - 32 \\ \hline 17 \\ - 16 \\ \hline 1 \end{array}$$

011	0011 1001	0001 0010
100	0110 0010	1
	1101 0110	1
	0 110 0010	1
	0 0111 0010	
	0 1110 0100	0100 1000
	0 1100 0101	
101	0 0001 1111	
	0 0011 1110	1001 0010
	0 1100 0101	
110	1 0111 1001	
	0 1100 0101	
	0 0011 1110	
	0 0111 1101	0010 0100
	0 1100 0101	
111	1 1011 1000	
	0 1100 0101	
	0 0111 1101	0010 0100

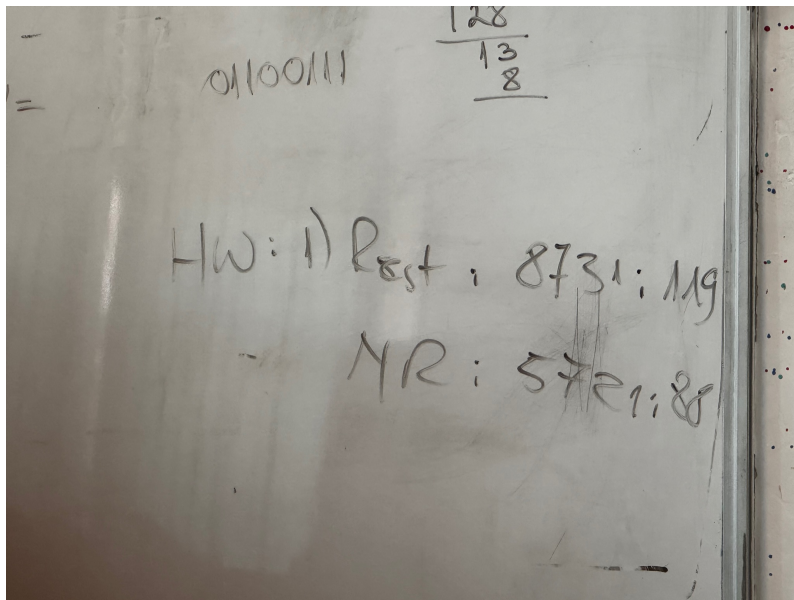
$$\begin{array}{r} 197 \\ 36 \\ \hline 1782 \\ 591 \\ \hline 7092 \\ + \\ 125 \\ \hline 7217 \end{array}$$

## Non Restoring

Asul :  $x_i = (2x_i - m) + m$   
 $x_{i+1} = 2(x_i \text{ if } A[i] = 1) - m$

$\left\{ \begin{array}{l} \text{if } A[i] = 0 \quad x_{i+1} = 2x_i - m \\ \text{if } A[i] = 1 \quad x_{i+1} = 2x_i + m \end{array} \right.$

CORR. if  $A[i] = 1 \rightarrow A = A + m$





# Non Restoring division

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$$x = 3725$$

$$y = 103$$

$$X = 3725 - 2048 = 1677 - 1024$$

$$y = \frac{653}{512} = \frac{128}{138}$$

$$HW: 1) R_{est} : 8731:119$$

$$NR: 5721:88$$

CNT	S	A	Q
000	0	0001 1101	0001 1010
	0	0110 0111	0001 1010
	1	1011 0110	0011 0100
		0110 1100	
001 + 0	0	0110 0111	0011 0100
	1	1101 0011	0110 1000
		1010 0110	
010 + 0	0	0110 0111	0110 1001
	0	0000 1101	1101 0010
		0001 1010	
011 - 0	0	0110 0111	1101 0010
	1	1011 0011	1010 0100
		0110 0111	
100 + 0	0	0110 0111	1010 0100
	1	1100 1110	0100 1000
		1001 1101	

	A
0101 + 0	0 1001 1101
	0 0110 0111
	0 0000 0100
	0 0000 1000
110 - 0	0 0110 0111
	1 1010 0001
	0100 0011
111 + 0	0 0110 0111
	1 1010 1010
001 + 0	0 0110 0111
	0001 0001
	0010 0100
	17 rest
	36 cat
	3708 + 17 = 3725

RA

$x = 8731$

$y = 119$

8731-

8192

539

512

027

16

11

8

3

2

1

 $2^{13}$ 

9

2

2

2

3

2

2

2

2

2

$X = 0010001000011011$

119-

64

55

32

23

16

7

4

3

2

 $2^6$ 

$Y = 01110111$

CNT	A	Q
000	$  \begin{array}{r}  01000100 \\  - 01110111 \\  \hline  (1)1001101 \\  + 01110111 \\  \hline  01000100 \\  10001000  \end{array}  $	$  \begin{array}{r}  00110110 \\  011011010  \end{array}  $
001	$  \begin{array}{r}  - 01110111 \\  \hline  00010001 \\  00100010  \end{array}  $	$  \begin{array}{r}  01101101 \\  11011010  \end{array}  $
010	$  \begin{array}{r}  - 01110111 \\  \hline  10101011 \\  + 01110111 \\  \hline  00100010 \\  01000101  \end{array}  $	$  \begin{array}{r}  10110100  \end{array}  $
011	$  \begin{array}{r}  - 01110111 \\  \hline  11001110 \\  + 01110111 \\  \hline  01000101 \\  10001011  \end{array}  $	$  \begin{array}{r}  01101000  \end{array}  $

CNT	A	Q
100	$  \begin{array}{r}  1000 \quad 1011 \\  -0111 \quad 0111 \\  \hline  0001 \quad 0100 \\  0010 \quad 1000  \end{array}  $	$  \begin{array}{r}  0110 \quad 1000 \\  0110 \quad 1001 \\  1101 \quad 0010  \end{array}  $
101	$  \begin{array}{r}  -0111 \quad 0111 \\  \hline  1011 \quad 0001 \\  +0111 \quad 0111 \\  \hline  0010 \quad 1000 \\  0101 \quad 0001  \end{array}  $	$10100100$
110	$  \begin{array}{r}  -0111 \quad 0111 \\  \hline  1101 \quad 1010 \\  +0111 \quad 0111 \\  \hline  0101 \quad 0001 \\  1010 \quad 0011  \end{array}  $	$01001000$
111	$  \begin{array}{r}  -0111 \quad 0111 \\  \hline  0010 \quad 1100 \\  \hline  \text{rest } 44  \end{array}  $ <div style="margin-top: 20px;"> <math display="block">  \begin{array}{r}  8731 \mid 119 \\  833 \phantom{00} \\  \hline  0401 \phantom{00} \\  357 \phantom{00} \\  \hline  044  \end{array}  </math> </div>	$  \begin{array}{r}  01001001 \\  \hline  \text{rest } 73  \end{array}  $

NR

$$X = 5721$$

$$Y = 88$$

5721

4096

1625

1024

0601

512

089

64

25

16

9

6

3

1

 $2^{12}$  $2^{10}$  $2^9$  $2^6$  $2^5$  $2^4$  $2^3$  $2^2$ 

$$X = 0001011001011001$$

88

64

24

16

8

 $2^6$ 

$$Y = 01011000$$

CNT	S	A	Q
000	0	0 0 1 0 1 1 0 0	1 0 1 1 0 0 1 0
	0	0 1 0 1 1 0 0 0	
	1	1 1 0 1 0 1 0 0	
	1	1 0 1 0 1 0 0 1	0 1 1 0 0 1 0 0
001	0	0 1 0 1 1 0 0 0	
	0	0 0 0 0 0 0 0 1	
	0	0 0 0 0 0 0 1 1	1 1 0 0 1 0 1 0
010	0	0 1 0 1 1 0 0 0	
	1	1 0 1 0 1 0 1 1	
	1	0 1 0 1 0 1 1 1	1 0 0 1 0 1 0 0
011	0	0 1 0 1 1 0 0 0	
	1	1 0 1 0 1 1 1 1	
	1	0 1 0 1 1 1 1 1	0 0 1 0 1 0 1 0
100	0	0 1 0 1 1 0 0 0	
	1	1 0 1 1 0 1 1 1	
	1	0 1 1 0 1 1 1 0	0 1 0 1 0 1 0 0
101	0	0 1 0 1 1 0 0 0	
	1	1 1 0 0 0 1 1 0	
	1	1 0 0 0 1 1 0 0	1 0 1 0 1 0 0 0



CNT	S	A				Q			
110	1	1	0	0	0	1	1	0	0
	+ 0	0	1	0	1	1	0	0	0
	<u>1</u>	1	1	1	0	0	1	0	0
	1	1	1	0	0	1	0	0	1
111	+ 0	0	1	0	1	1	0	0	0
	<u>0</u>	0	0	1	0	0	0	0	1