

# Lab 4

## Restoring Division

$$\begin{array}{r}
 \overbrace{A}^{\sim} \quad \overbrace{Q}^{\sim} \\
 \begin{array}{r}
 11 \\
 - 10 \\
 \hline
 01
 \end{array} \quad \begin{array}{r}
 1 \\
 - 0 \\
 \hline
 1
 \end{array} \\
 \hline
 \begin{array}{r}
 10 \\
 - 110 \\
 \hline
 \end{array} \\
 \text{cnt = 6}
 \end{array}$$

Restoring division	
CNT	A
000	00101101 - 01110101 ----- 10111000 + 01110101 ----- 00101101 01011011
001	01110101 - 1100110 ----- 01110101 + 01011011 ----- 1011011110111000
010	01110101 - 10000101 ----- 01110010
011	01110101 - 00100000 ----- 00100000
100	01110101 - 10101011 ----- 01110101 00100000

$\begin{array}{r}
 0 \\
 0 \\
 + 1 \\
 \hline
 1
 \end{array}$   
 $\begin{array}{r}
 1 \\
 - 0 \\
 \hline
 1
 \end{array}$   
 $\begin{array}{r}
 0 \\
 1 \\
 \hline
 1
 \end{array}$   
 $\begin{array}{r}
 1 \\
 - 0 \\
 \hline
 1
 \end{array}$   
 $\begin{array}{r}
 0 \\
 1 \\
 \hline
 1
 \end{array}$   
 $\begin{array}{r}
 A \\
 Q
 \end{array}$

test = 1

$$x = 7217$$

$$y = 197$$

~~x = 00001110000110001~~

~~y = 011000101~~

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CNT	A	Q
000	00001110000110001	00110001
000	0001110000110001	01100010

Restoring division

DUTI-PUBLIC

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X = 7217

0001

$$X = 0001 \ 1100 \ 0011 \ 0001$$

A

Q

CNT

000	00001	1100	0011	0001
	00011	1000	0110	0010
	0 1100	0101		
	1 0111	0011		
	0 1100	0101		
	0 0011	1000		
001	00111	0000	1100	01010
	0 1100	0101		
	1 1010	1011		
	0 1100	0101		
	0 0111	0000		
	0 1110	0001	1000	10010
	0 1100	0101		
010	0 0001	1100		
	0 0011	1001	0001	0010
011	0 1100	0101		
	1 0111	0100		
	+Y			

Y = 797 -

$$\begin{array}{r} 128 \\ - 69 \\ \hline 59 \end{array}$$

$$\begin{array}{r} 64 \\ \hline 5 \end{array}$$

011

$$\begin{array}{r} 0011 \ 1001 \ 0001 \ 00100 \\ 0110 \ 0010 \ 1 \\ \hline 1101 \ 0110 \ 1 \end{array}$$

1100

$$\begin{array}{r} 0 110 \ 0010 \\ 0 110 \ 0010 \\ \hline 0 0111 \ 0010 \end{array}$$

101

$$\begin{array}{r} 0 1100 \ 0101 \\ 0 1100 \ 0101 \\ \hline 0 0001 \ 1111 \end{array}$$

797

110

$$\begin{array}{r} 0 0011 \ 1110 \ 1001 \ 0010 \\ 0 1100 \ 0101 \ 0010 \ 0010 \\ \hline 1 0111 \ 1001 \ 0010 \ 0010 \end{array}$$

36

$$\begin{array}{r} 1182 \\ - 591 \\ \hline 591 \end{array}$$

$$\begin{array}{r} 7092 \\ + 125 \\ \hline 7217 \end{array}$$

111

$$\begin{array}{r} 0 0011 \ 1110 \ 1001 \ 0010 \\ 0 1100 \ 0101 \ 0010 \ 0010 \\ \hline 0 0111 \ 1101 \ 0010 \ 0010 \end{array}$$

$$\begin{array}{r} 7217 \\ - 125 \\ \hline 7217 \end{array}$$

$$\begin{array}{r} 0 1100 \ 0101 \\ 0 1100 \ 0101 \\ \hline 0 0111 \ 1101 \end{array}$$

$$\begin{array}{r} 1 1011 \ 1000 \\ 0 1100 \ 0101 \\ \hline 0 0111 \ 1101 \end{array}$$

$$\begin{array}{r} 0 1100 \ 0101 \\ 0 1100 \ 0101 \\ \hline 0 0111 \ 1101 \end{array}$$

$$\begin{array}{r} 0 0111 \ 1101 \\ + 0 0111 \ 1101 \\ \hline 0 0110 \ 0000 \end{array}$$

$$\begin{array}{r} 0 0111 \ 1101 \\ + 0 0111 \ 1101 \\ \hline 0 0110 \ 0000 \end{array}$$

$$\begin{array}{r} 0 0111 \ 1101 \\ + 0 0111 \ 1101 \\ \hline 0 0110 \ 0000 \end{array}$$

$$\begin{array}{r} 0 0111 \ 1101 \\ + 0 0111 \ 1101 \\ \hline 0 0110 \ 0000 \end{array}$$

$$\begin{array}{r} 0 0111 \ 1101 \\ + 0 0111 \ 1101 \\ \hline 0 0110 \ 0000 \end{array}$$

## Non Restoring

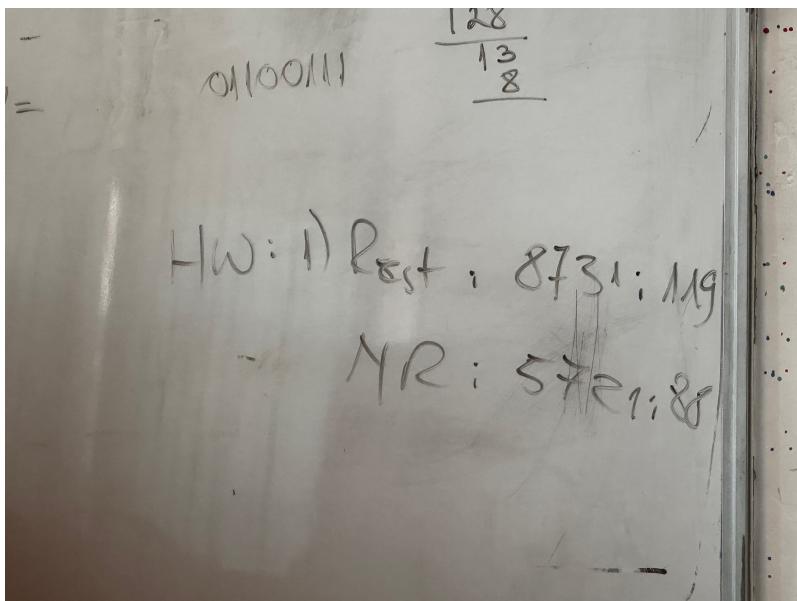
$$\text{Pascal: } x_i = (2x_i - m) + m$$

$$x_{i+1} = 2(x_i + m) - m$$

if  $A\{7\} = 1$

$$\begin{cases} \text{if } A\{7\} = 0 & x_{i+1} = 2x_i - m \\ \text{if } A\{7\} = 1 & , x_{i+1} = 2x_i + m \end{cases}$$

CORR. if  $A\{7\} = 1 \rightarrow A = A + m$





RD

X = 01110111

Y = 110

$$\begin{array}{r}
 8731 - \\
 8192 \\
 \hline
 539 \\
 512 \\
 \hline
 027 \\
 16 \\
 \hline
 71 \\
 8 \\
 \hline
 3 \\
 2 \\
 \hline
 1 \\
 2 \\
 \hline
 0
 \end{array}$$

$$\begin{array}{r}
 X = 0010001000011011 \\
 \hline
 119 - \\
 64 \\
 \hline
 55 \\
 32 \\
 \hline
 23 \\
 16 \\
 \hline
 7 \\
 4 \\
 \hline
 3 \\
 2 \\
 \hline
 1
 \end{array}$$

CNT	A	Q
000	$  \begin{array}{r}  01000100 \\  01110111 \\  \hline  01001101  \end{array}  $ $  \begin{array}{r}  01000100 \\  + 01110111 \\  \hline  10001000  \end{array}  $ $  \begin{array}{r}  10001000 \\  + 01001101 \\  \hline  10100101  \end{array}  $	$  \begin{array}{r}  00110110 \\  01101101 \\  \hline  01101101  \end{array}  $
001	$  \begin{array}{r}  - 01110111 \\  \hline  00010001  \end{array}  $ $  \begin{array}{r}  00100010 \\  + 01110111 \\  \hline  11011010  \end{array}  $	$  \begin{array}{r}  01101101 \\  11011010 \\  \hline  11011010  \end{array}  $
010	$  \begin{array}{r}  - 01110111 \\  \hline  10101011  \end{array}  $ $  \begin{array}{r}  00100010 \\  + 10101011 \\  \hline  10111011  \end{array}  $ $  \begin{array}{r}  00100010 \\  + 01111011 \\  \hline  01000101  \end{array}  $	$  \begin{array}{r}  10110100 \\  10110100 \\  \hline  10110100  \end{array}  $
011	$  \begin{array}{r}  - 01110111 \\  \hline  11001110  \end{array}  $ $  \begin{array}{r}  01000101 \\  + 11001110 \\  \hline  01000101  \end{array}  $ $  \begin{array}{r}  10001011 \\  + 01000101 \\  \hline  10001011  \end{array}  $	$  \begin{array}{r}  01101000 \\  01101000 \\  \hline  01101000  \end{array}  $

CNT	A	Q
100	$  \begin{array}{r}  10000 \quad 1011 \\  -0111 \quad 0111 \\  \hline  0001 \quad 0100 \\  00101 \quad 000  \end{array}  $	$  \begin{array}{r}  0110 \quad 1000 \\  0110 \quad 1001 \\  1101 \quad 0010  \end{array}  $
101	$  \begin{array}{r}  -01110111 \\  \hline  101100001 \\  +01110111 \\  \hline  00101000 \\  01010001  \end{array}  $	10100100
110	$  \begin{array}{r}  -01110111 \\  \hline  11011010 \\  +01110111 \\  \hline  01010001 \\  10100011  \end{array}  $	01001000
111	$  \begin{array}{r}  -01110111 \\  \hline  00101100  \end{array}  $ <p style="text-align: center;">  <span style="margin-right: 20px;">rest 44</span> </p>	$  \begin{array}{r}  01001001 \\  \hline  \text{cat } 73  \end{array}  $
	$  \begin{array}{r l}  8731 & 119 \\  833 & \hline  \hline  0401 & 73 \\  357 & \\  \hline  044 &  \end{array}  $ <p style="text-align: center;"><u>W</u></p>	

NR

X = 5721

Y = 88

5721

4096

1625

1024

601

512

089

64

25

16

9

8

 $2^{12}$  $2^{10}$  $2^9$  $2^6$  $2^4$  $2^2$  $2^1$  $2^0$ 

X = 0001011001011001

Y = 01011000

88

64

24

16

8

CNT	S	A	Q
000	0	001011000	10110010
-	0	010110000	
	0	110101000	
	1	101010001	011001010
001	0	010110000	
	0	000000000	
	0	000000001	11001010
010	0	010110000	
	1	101010101	
	1	010101011	10010100
011	0	010110000	
	1	101011111	
	1	010111111	00101010
100	0	010110000	
	1	101101111	
	1	011011110	01010100
101	0	010110000	
	1	110001110	
	1	100011100	10101000

