

Sports: HMC CS Prof. qualifies for Olympics in new Spam-eating event.

In the News Today

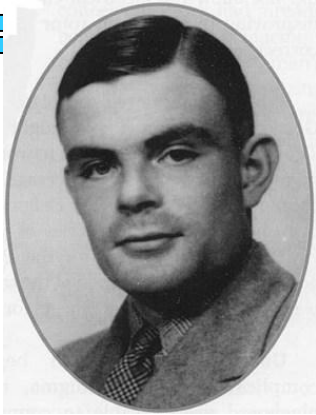
News Briefs

County fair serves up average food, but the price may be too high. What's fair fare for fair fair fare? (p.42)

Spam-Based Computer Hailed as Technological Marvel

(Pasadena, AP): A team of computer science professors at the Pasadena Institute of Technology (P.I.T.) has unveiled a new computer that operates on pureed Spam rather than on electricity. "It's a work of genius that will undoubtedly revolutionize the way we think about Spam," said an enthusiastic spokesman of the canned meat products industry. However, a vegetarian alternative, operating on minced tofu, is also expected to be announced soon and this technology is less likely to smell considerably better. Industry analysts believe, however, that a chocolate pudding based computer being developed at Harvey Mudd College shows the greatest promise.

True Story: Alan Turing



Alan Turing
1912-1954



1938 Princeton Ph.D.
thesis on uncomputability

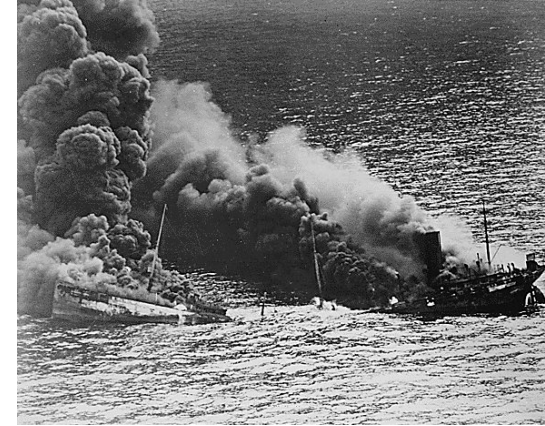
Alan Turing



Bletchley Park



German WWII U-Boat



Allied Tanker hit by
U-Boat Torpedo



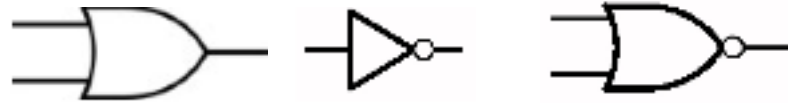
Enigma



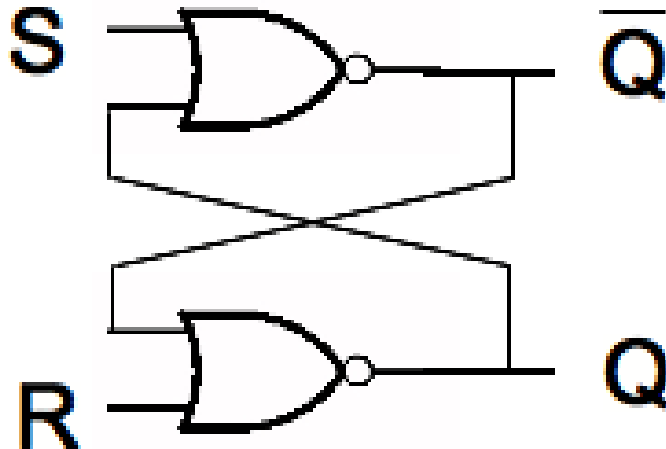
A 1-bit Memory



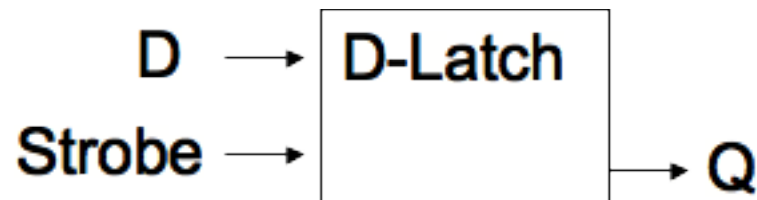
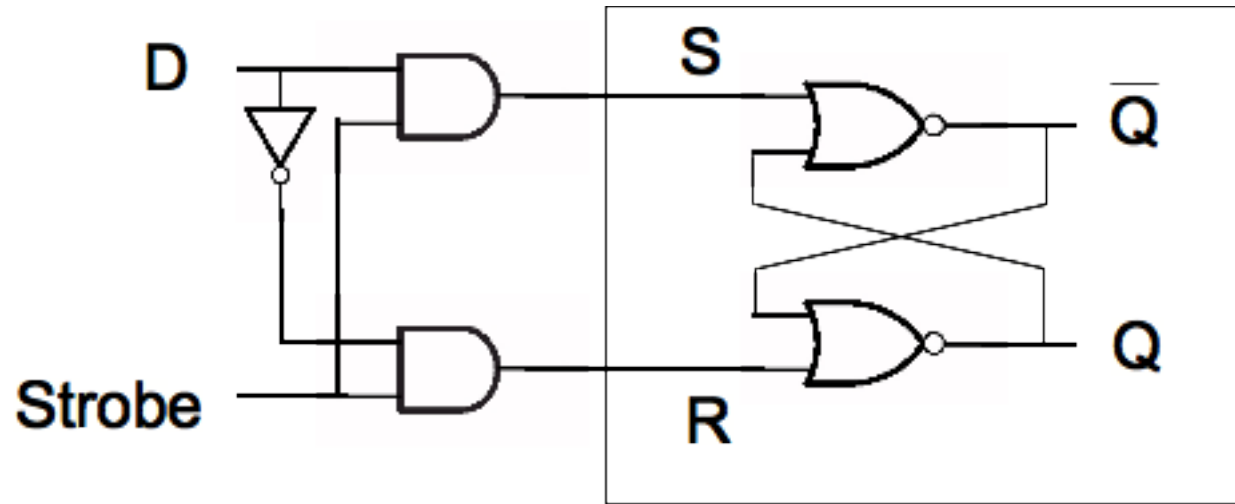
This stuff is truly
unforgettable!



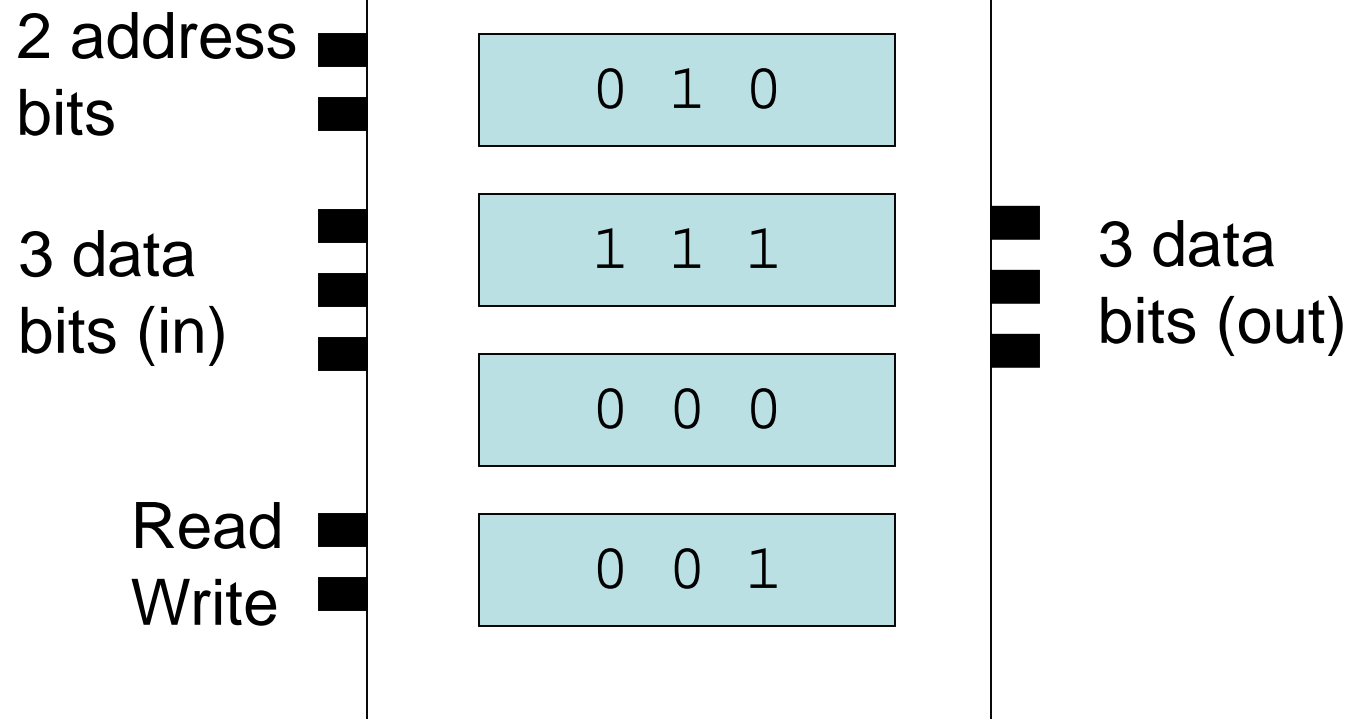
OR + NOT = NOR



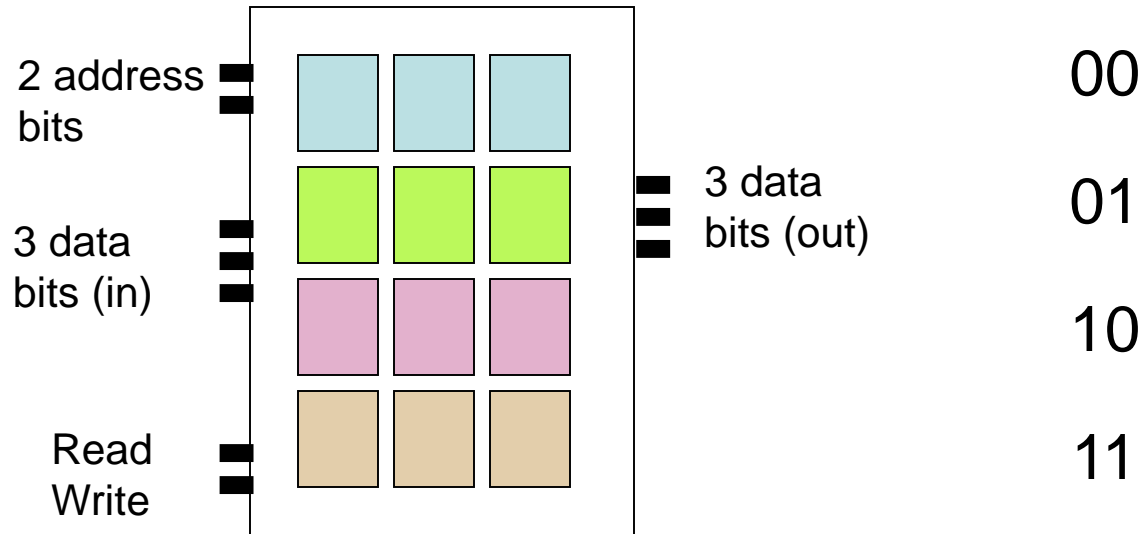
From S-R Latches to D-Latches



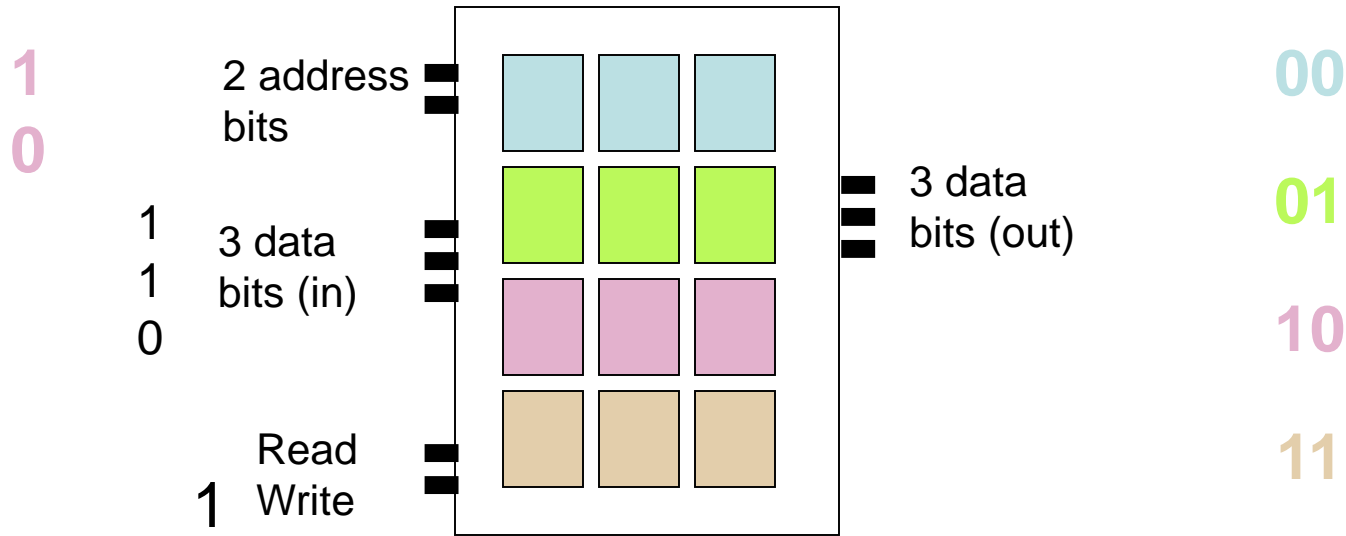
small! Random Access Memory (RAM)



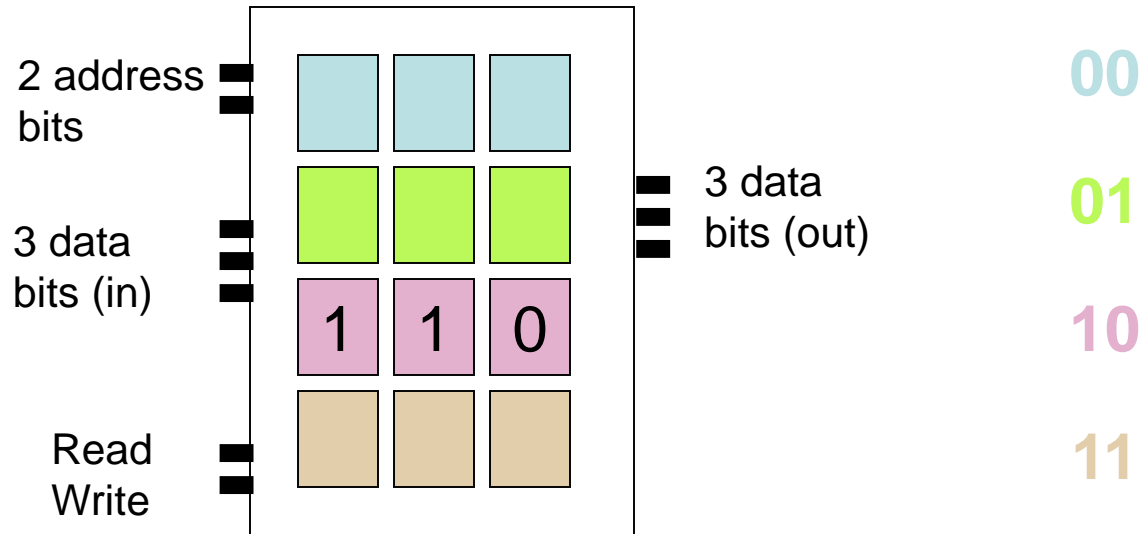
A Random Access Memory (RAM)



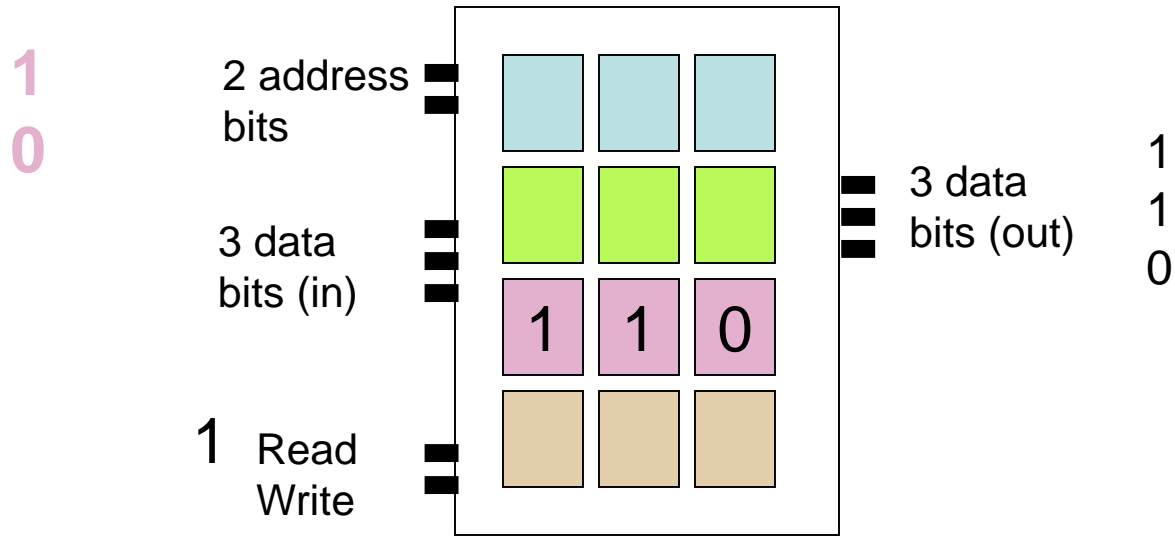
A Random Access Memory (RAM)



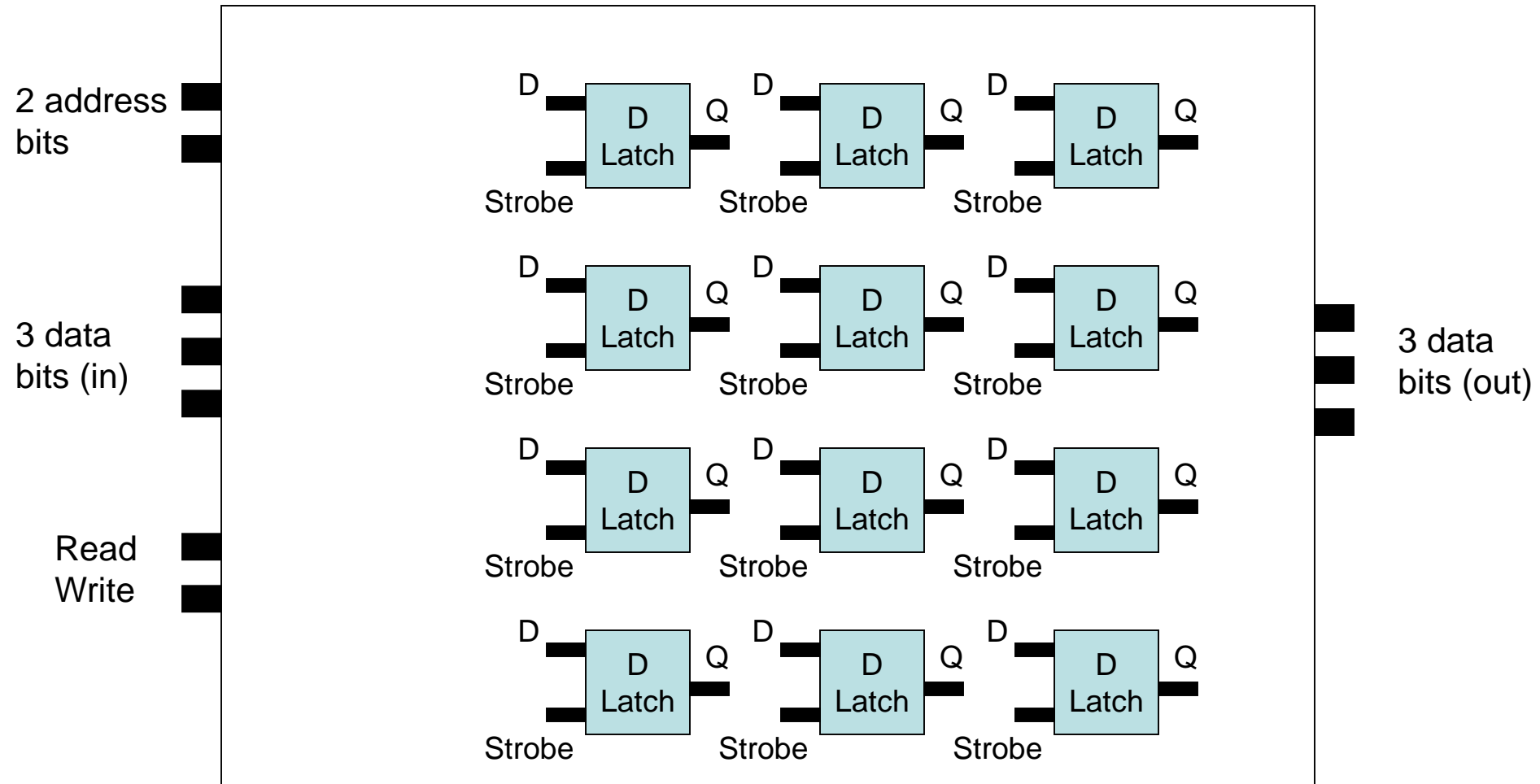
A Random Access Memory (RAM)



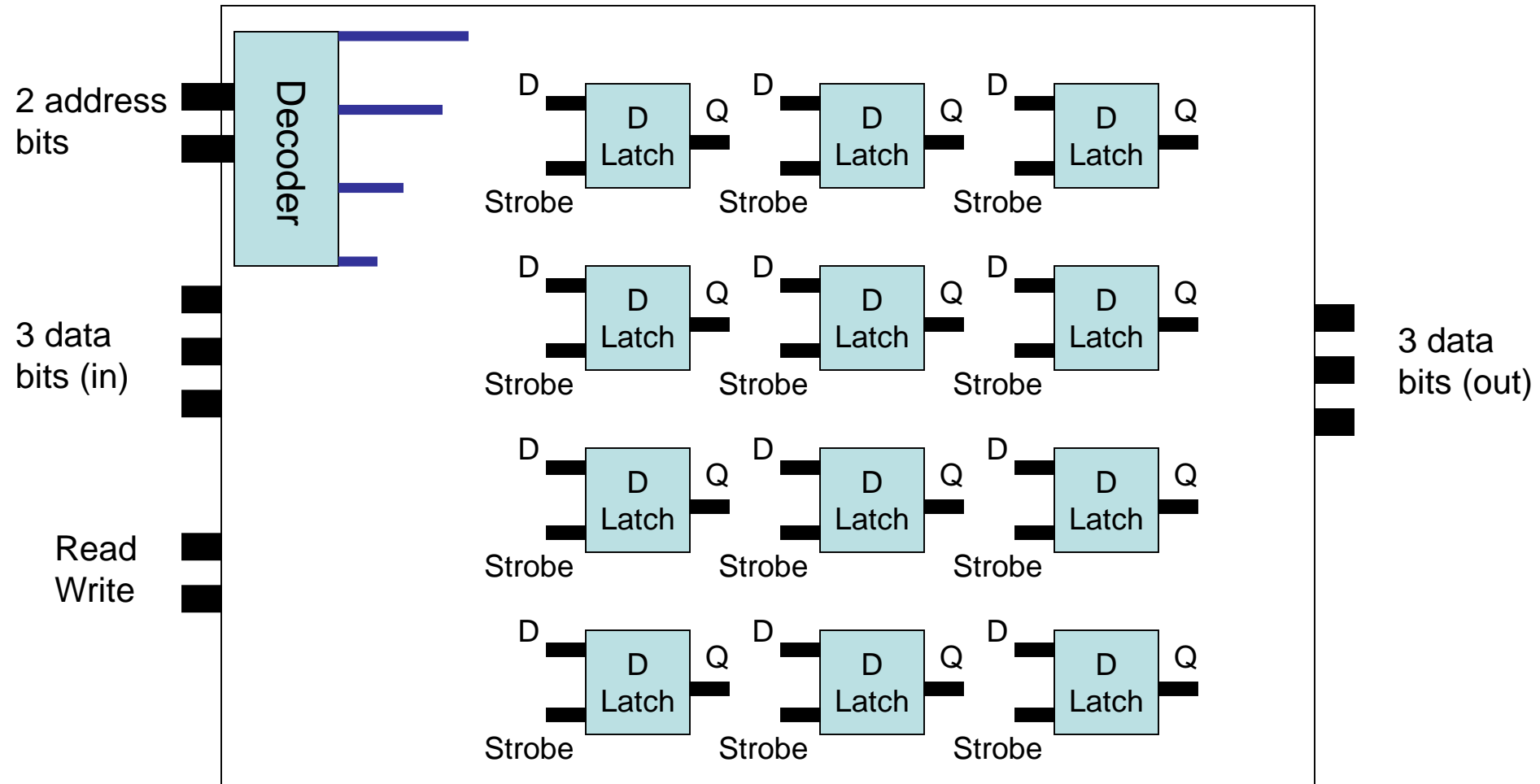
A Random Access Memory (RAM)



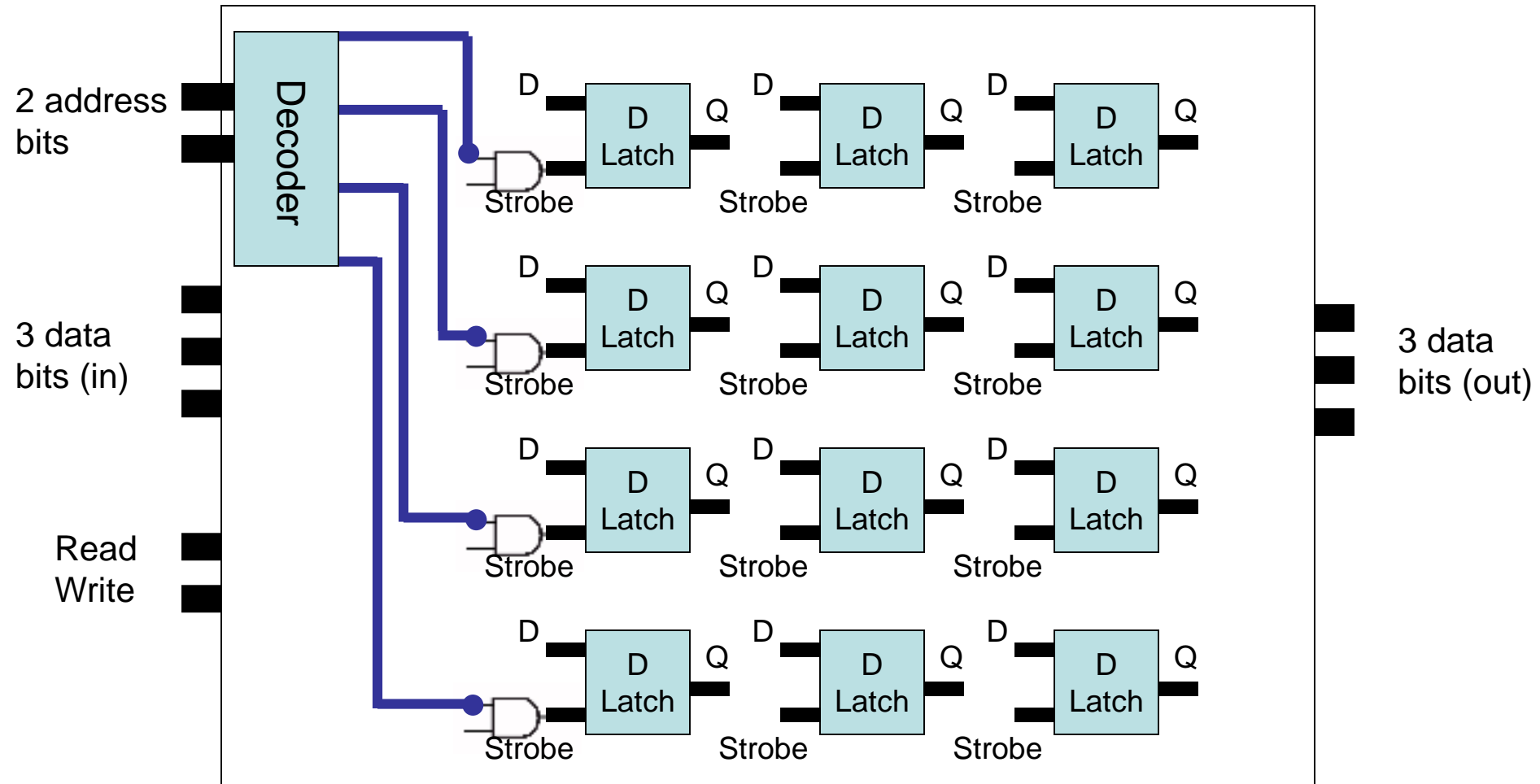
A Random Access Memory (RAM)



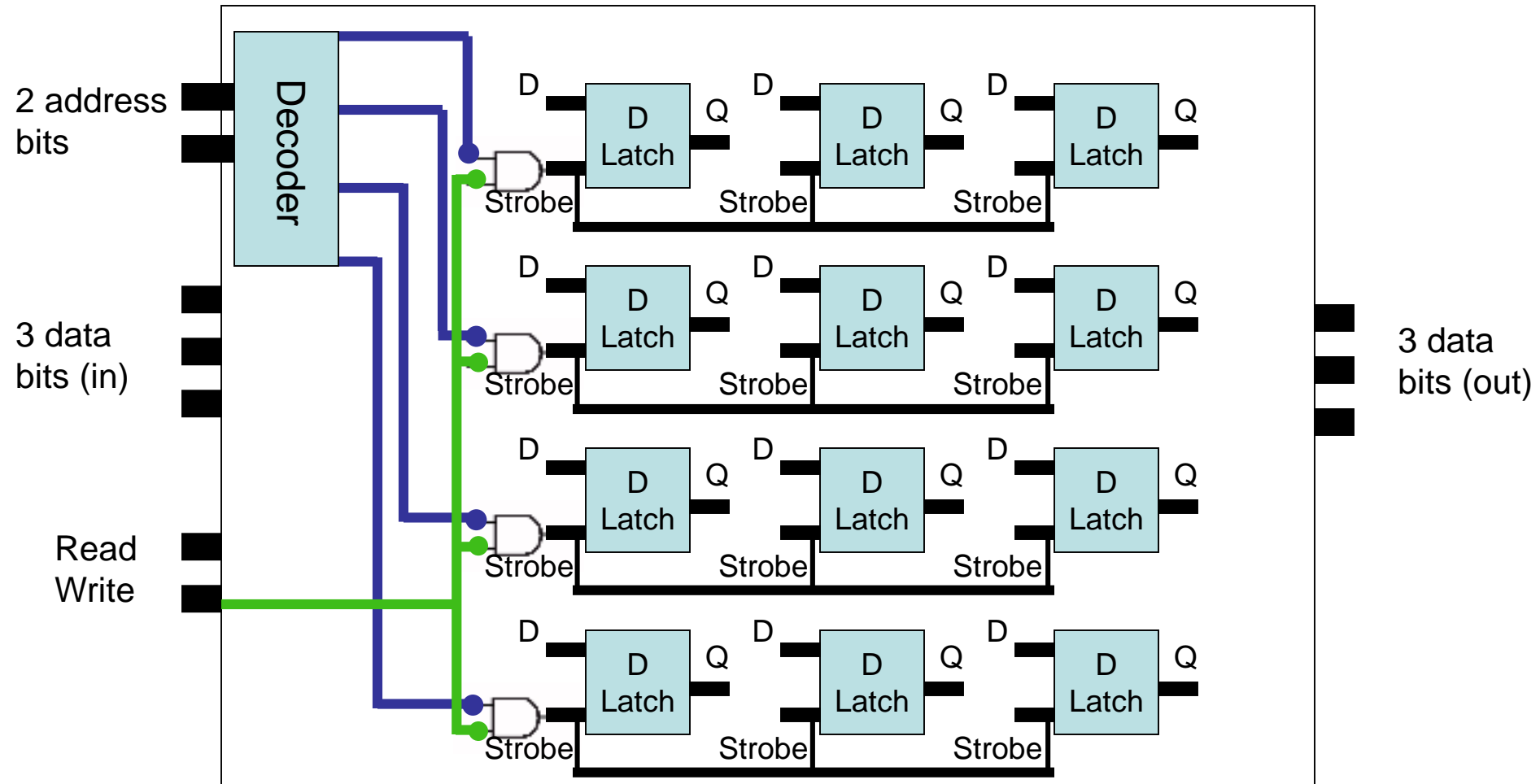
A Random Access Memory (RAM)



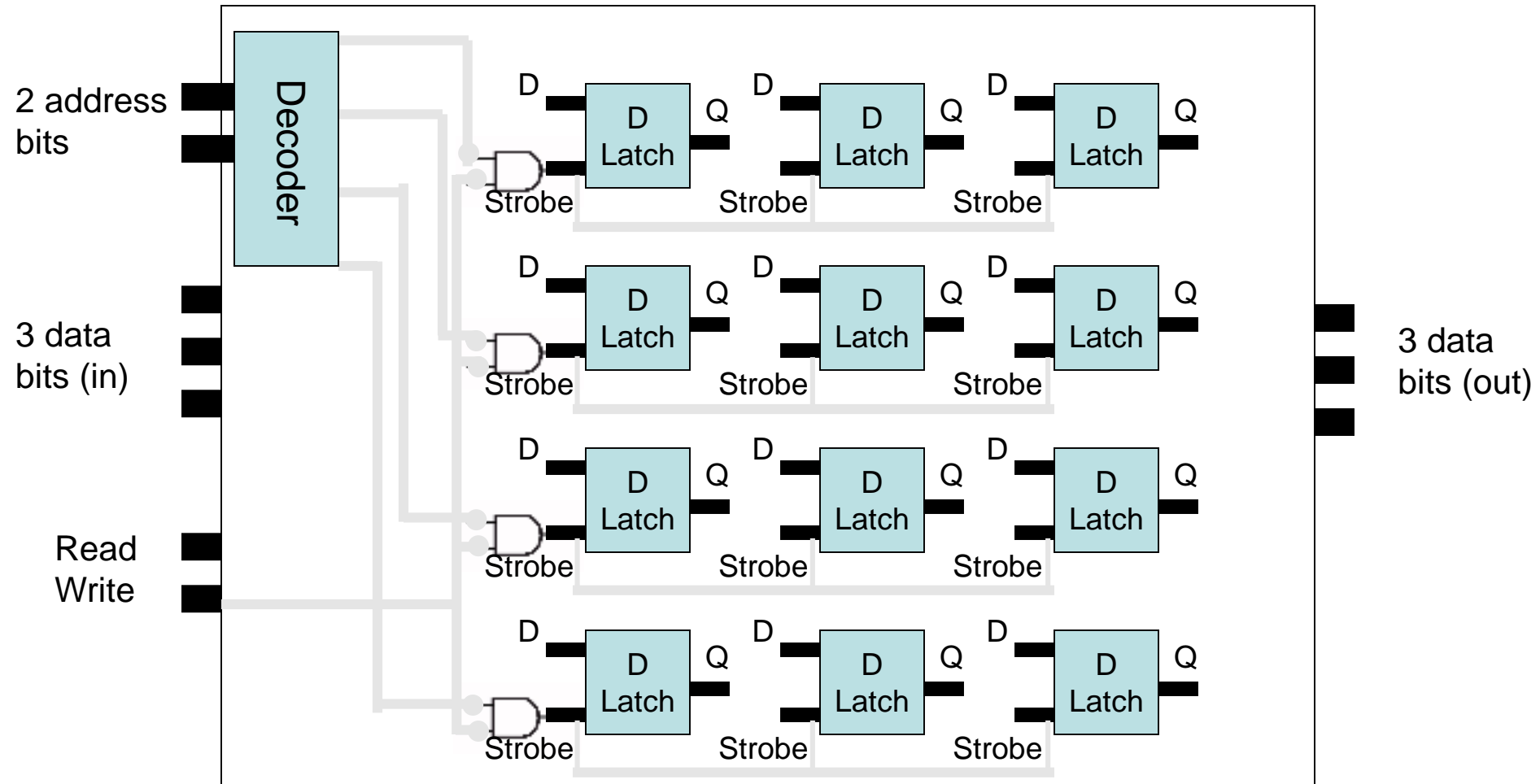
A Random Access Memory (RAM)



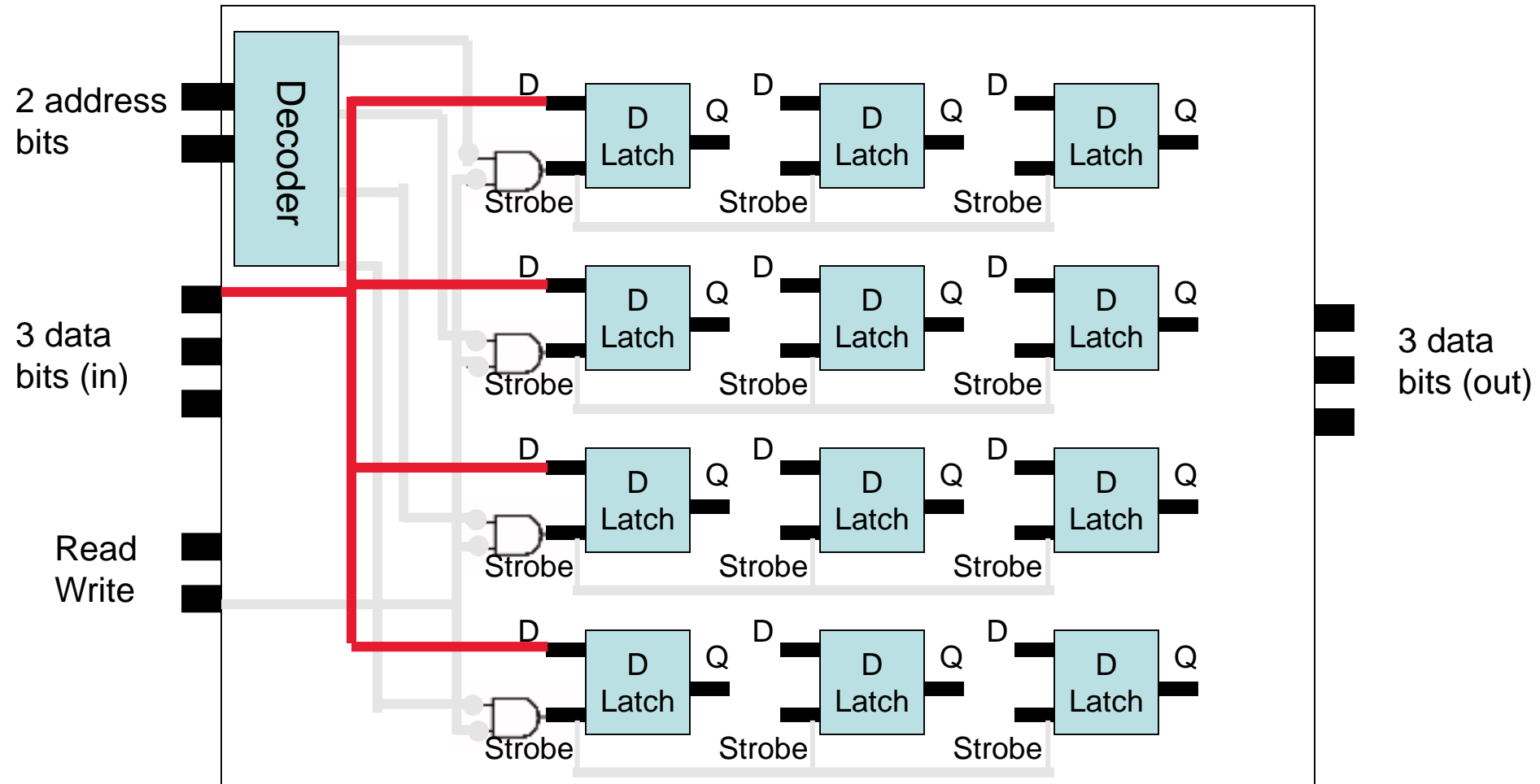
A Random Access Memory (RAM)



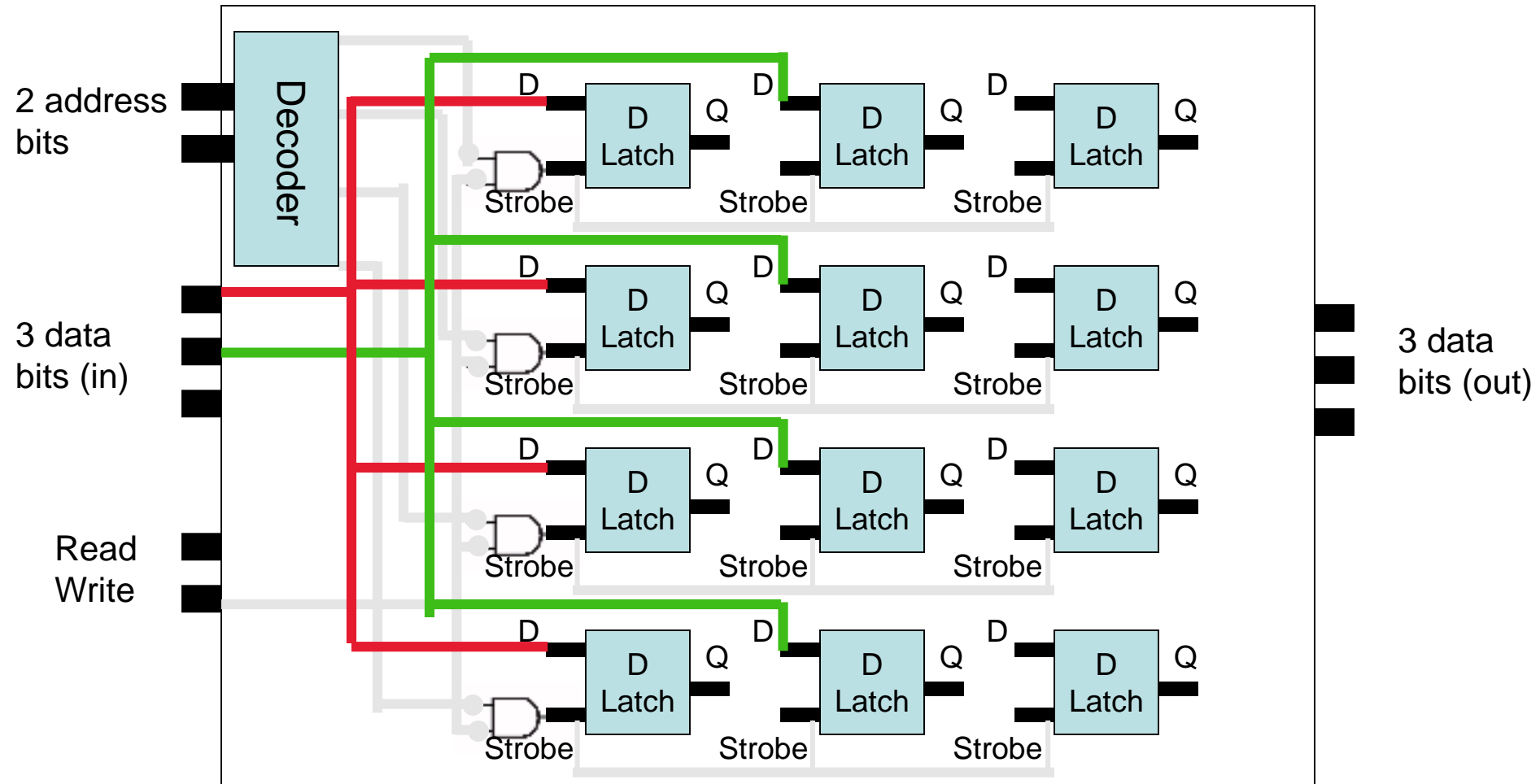
A Random Access Memory (RAM)



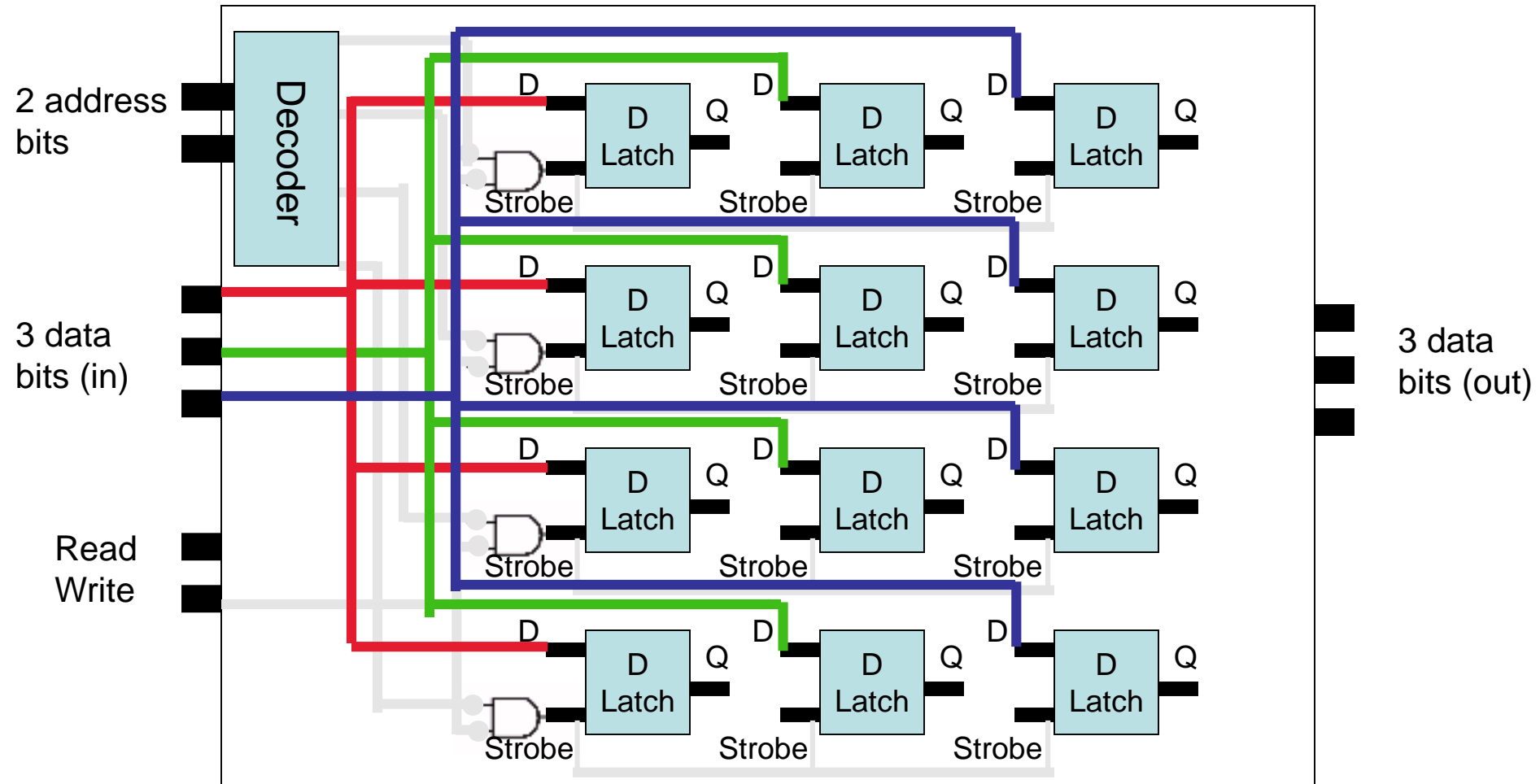
A Random Access Memory (RAM)



A Random Access Memory (RAM)



A Random Access Memory (RAM)

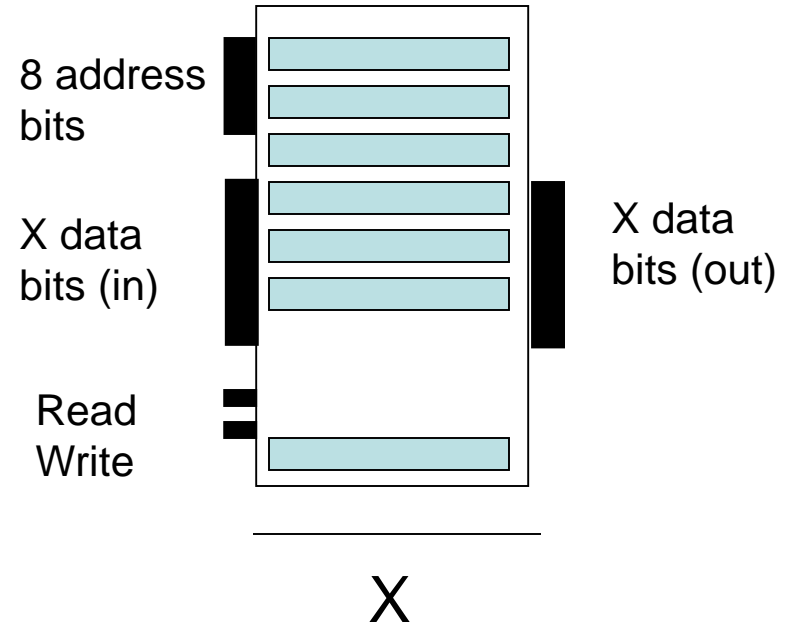
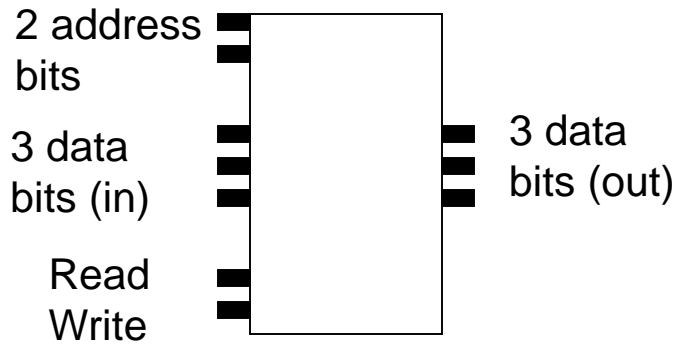


A Random Access Memory (RAM)



A 512K RAM
(About 4.2 million bits)

Small memory, “big” memory...



A “Calculator”

Instruction Register

Load 5 into Register 0

Register 0

0

Register 1

0

Register 2

0

Register 3

0

A “Calculator”

Instruction Register

Load 5 into Register 0

Register 0

5

Register 1

0

Register 2

0

Register 3

0

A “Calculator”

Instruction Register

Register2=Register0+Register1

Register 0

5

Register 1

0

Register 2

0

Register 3

0

A “Calculator”

Instruction Register

Register2=Register0+Register1

Register 0

5

Register 1

0

Register 2

5

Register 3

0

A “Calculator”

Instruction Register

Register2=Register0+Register2

Register 0

5

Register 1

0

Register 2

5

Register 3

0

A “Calculator”

Instruction Register

Register2=Register0+Register2

Register 0

5

Register 1

0

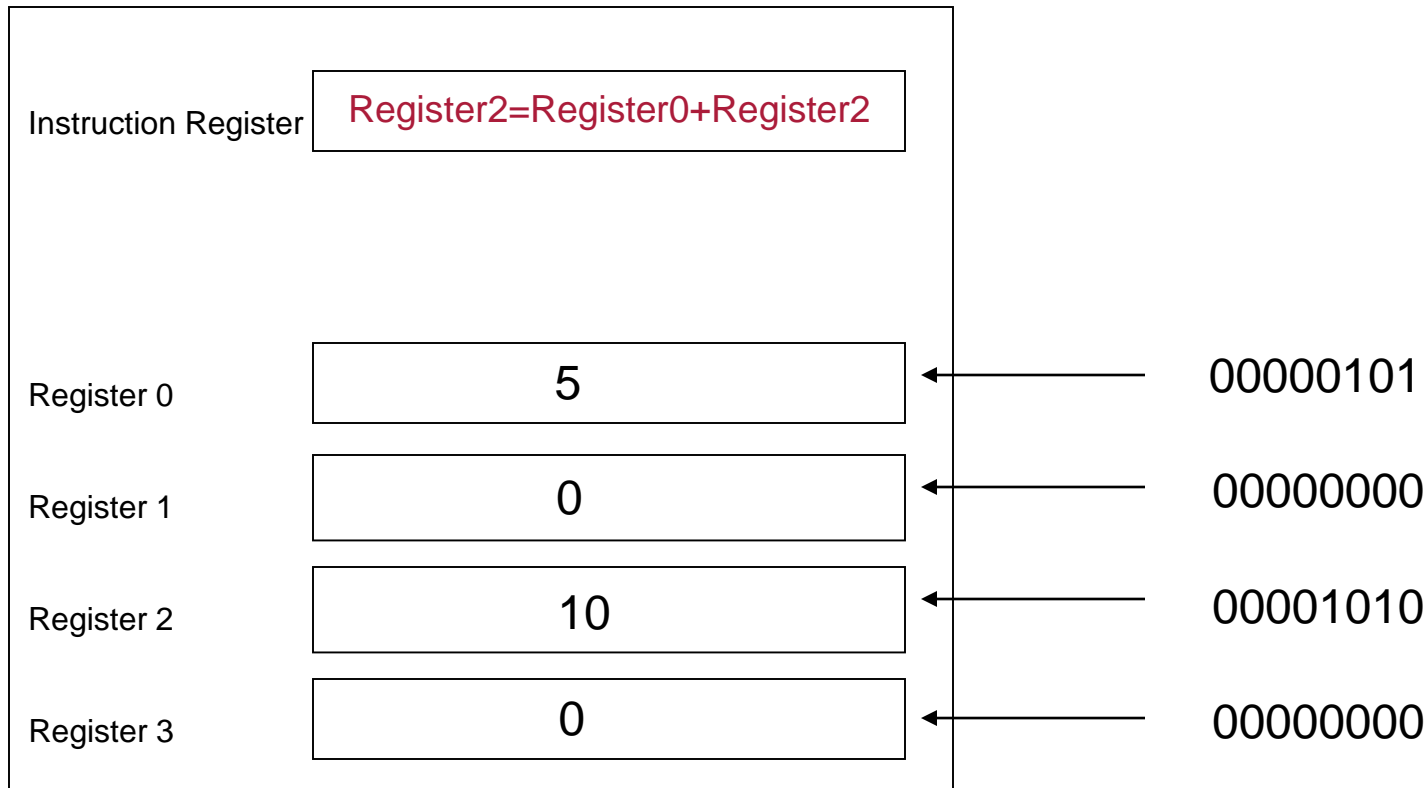
Register 2

10

Register 3

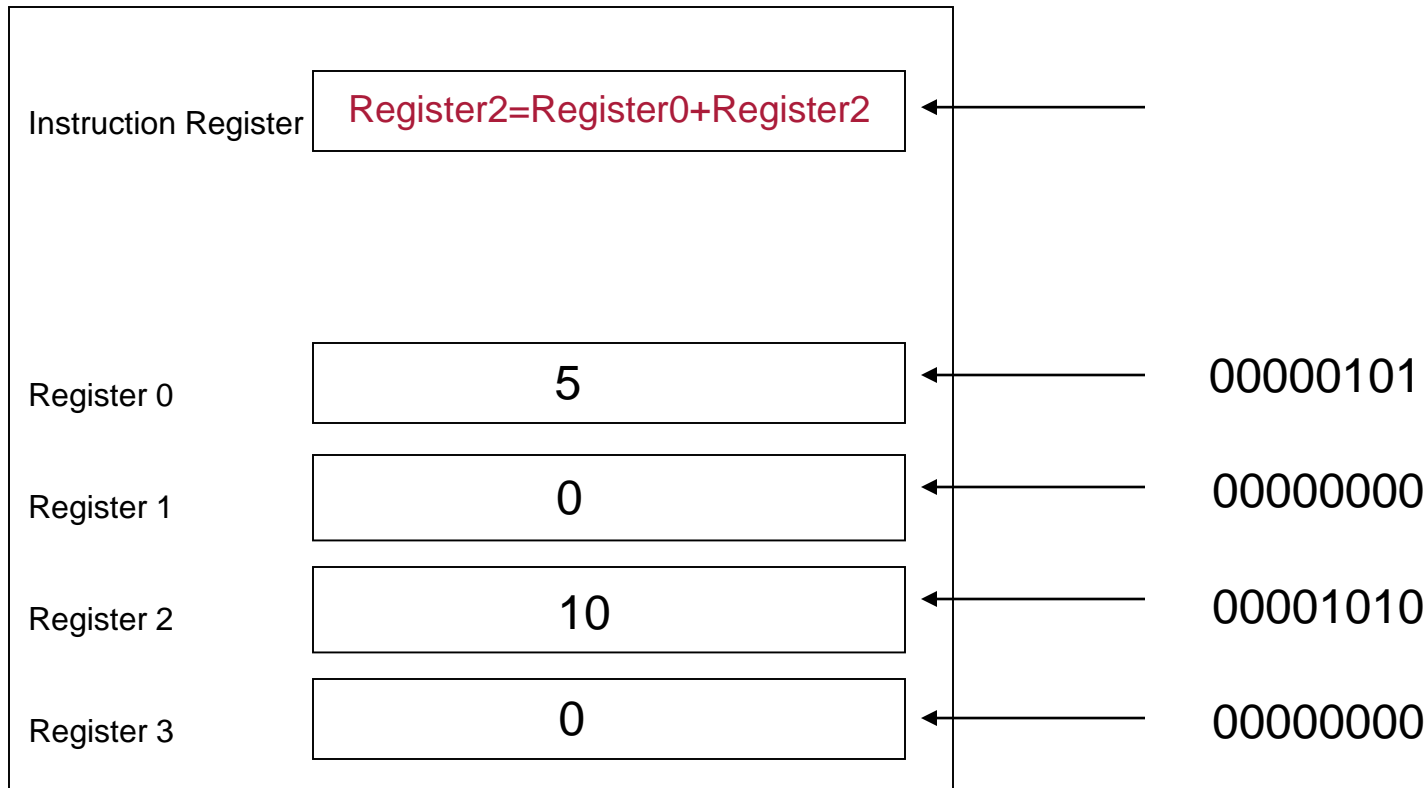
0

A “Calculator”



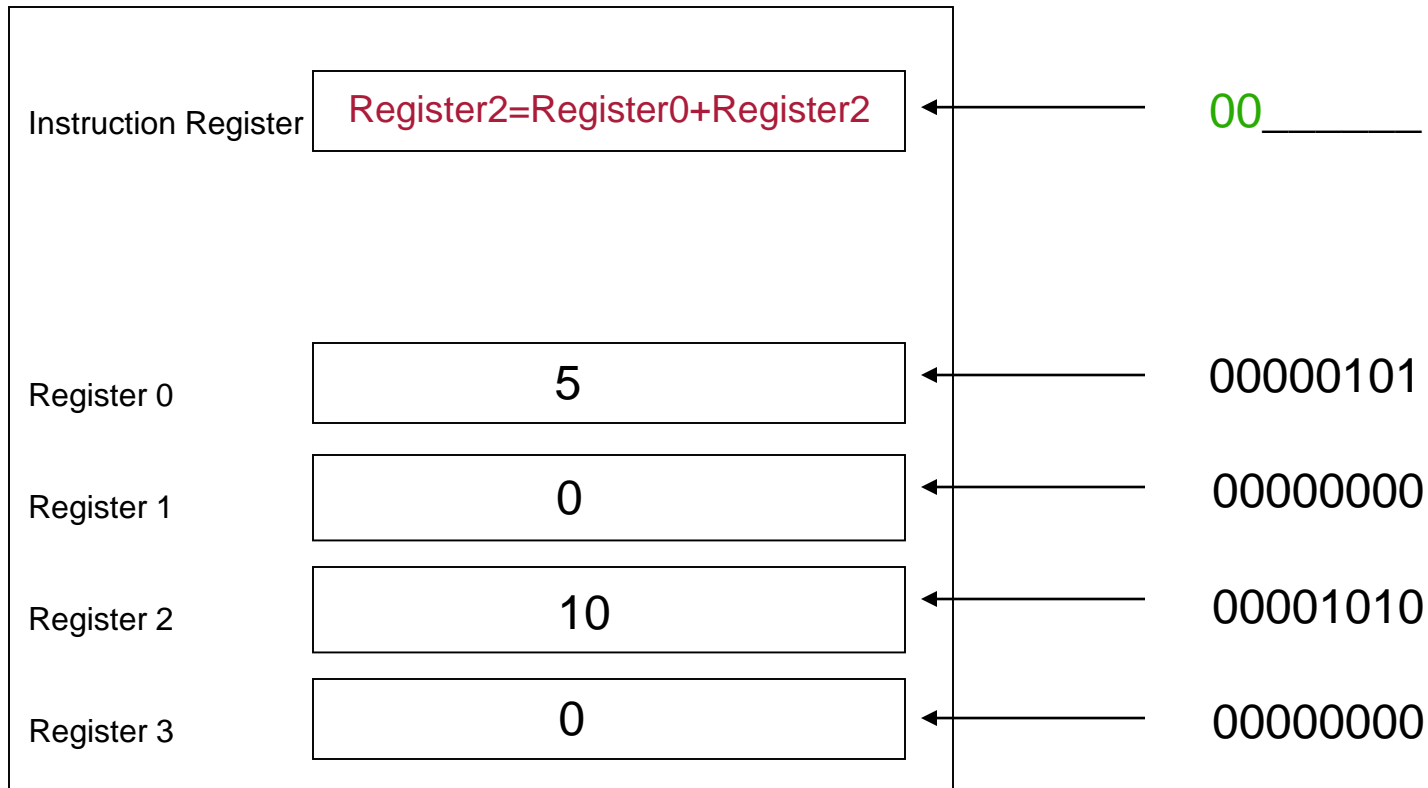
A “Calculator”

00 add
01 subtract
10 multiply
11 divide



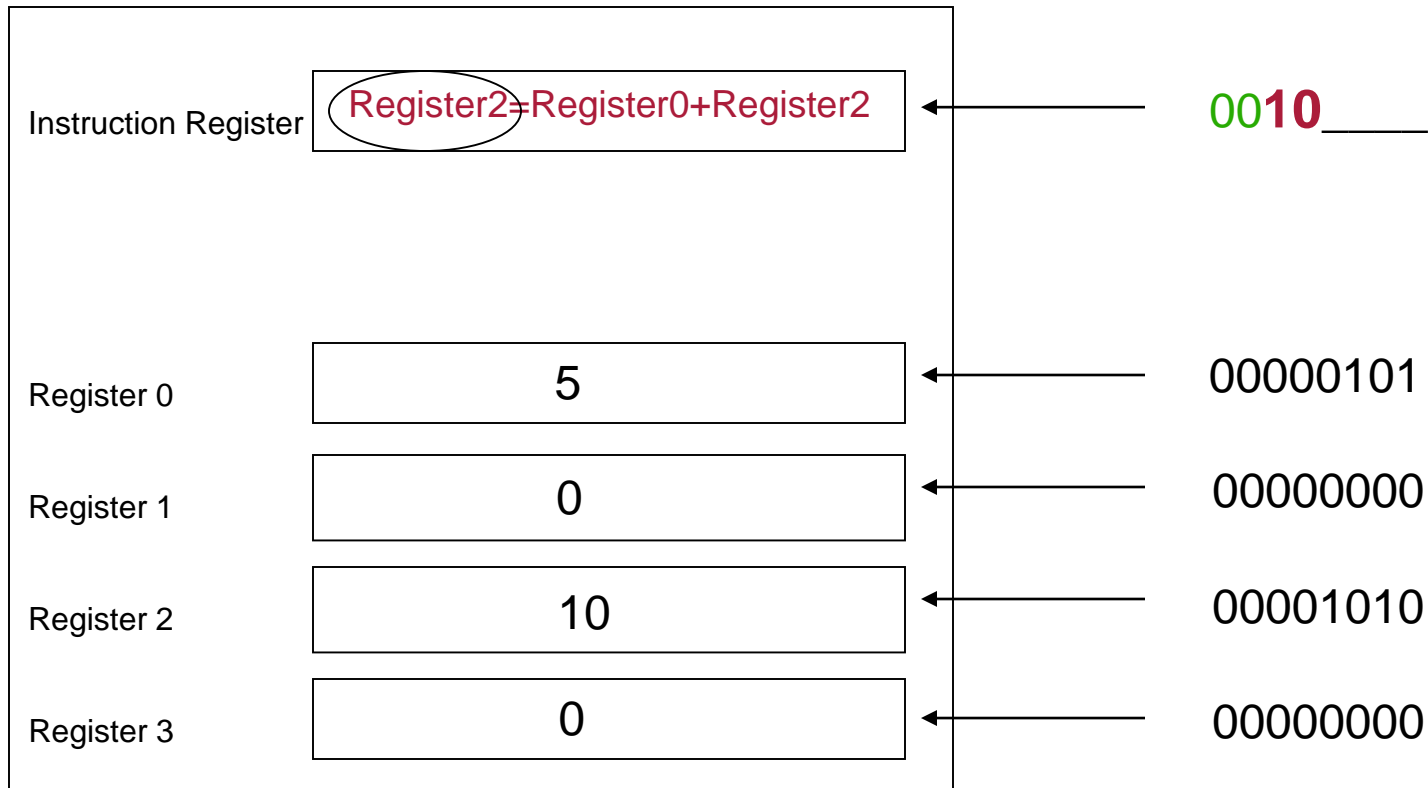
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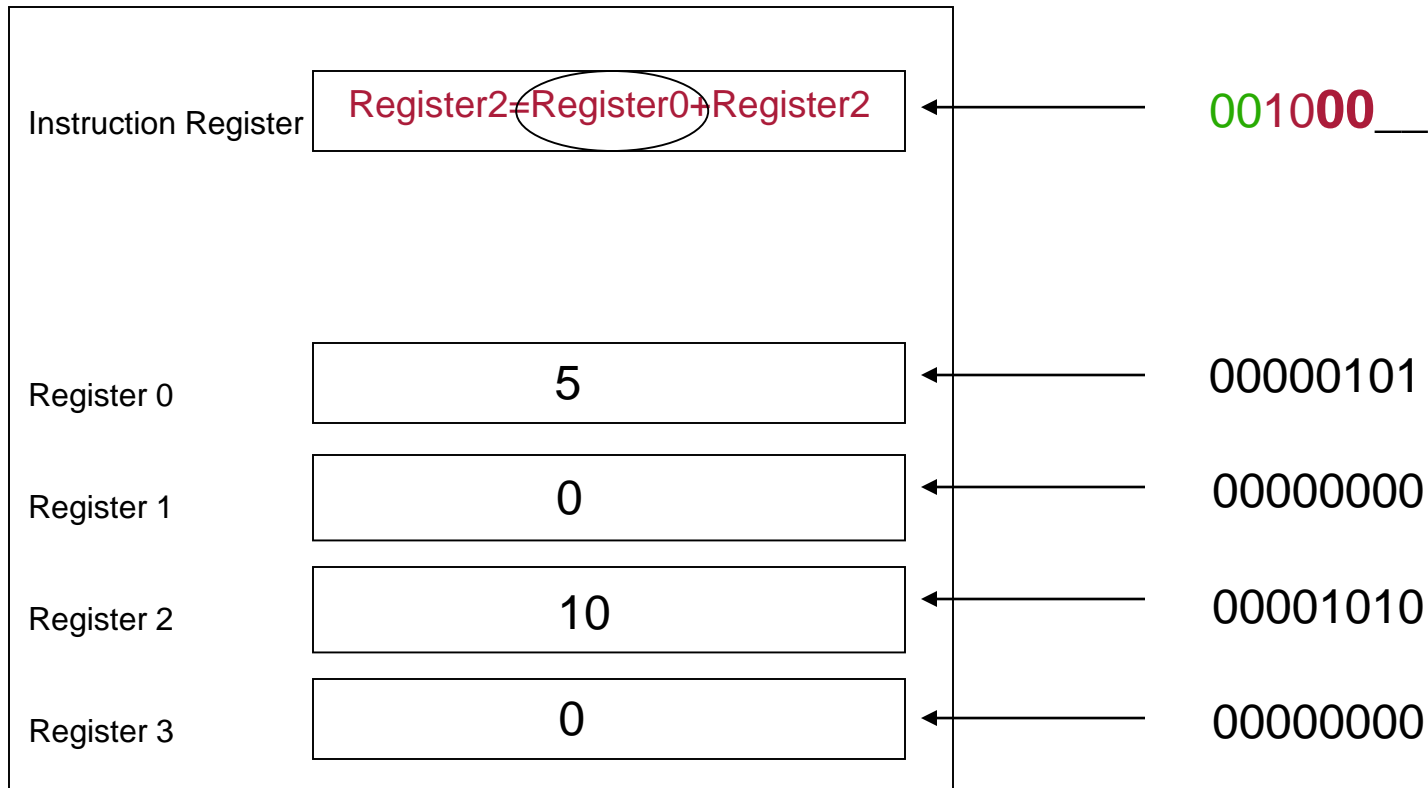
A “Calculator”

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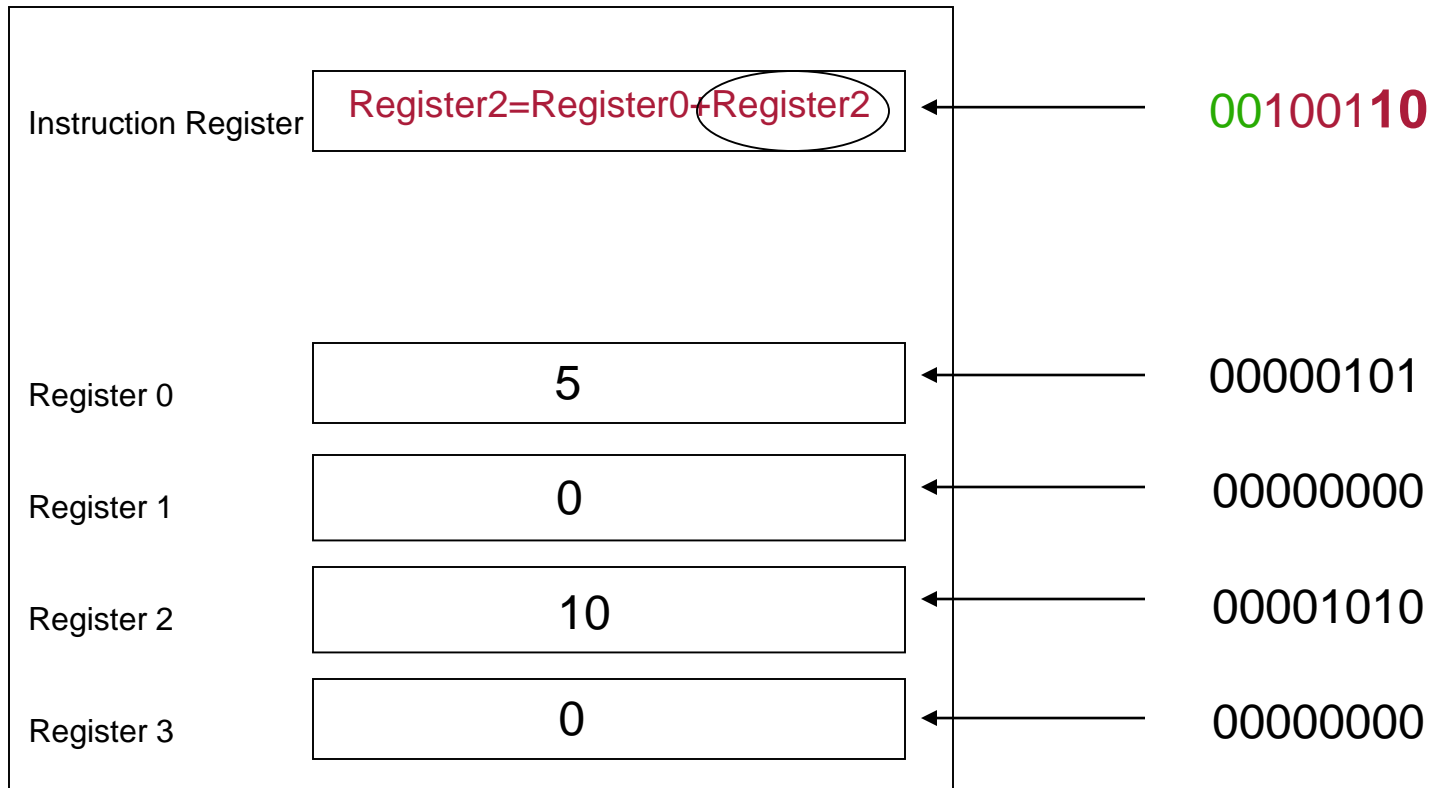
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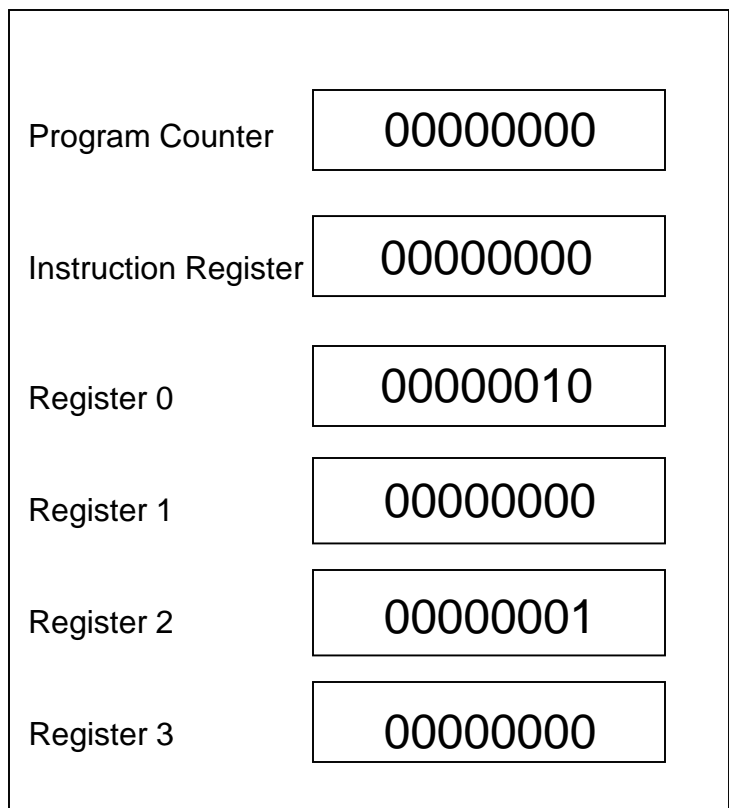
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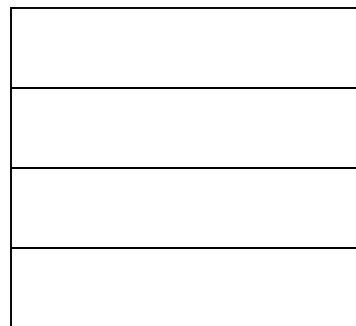
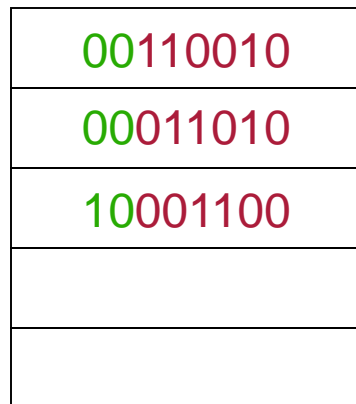


A Computer!

00 add
01 subtract
10 multiply
11 divide



Central Processing Unit (CPU)



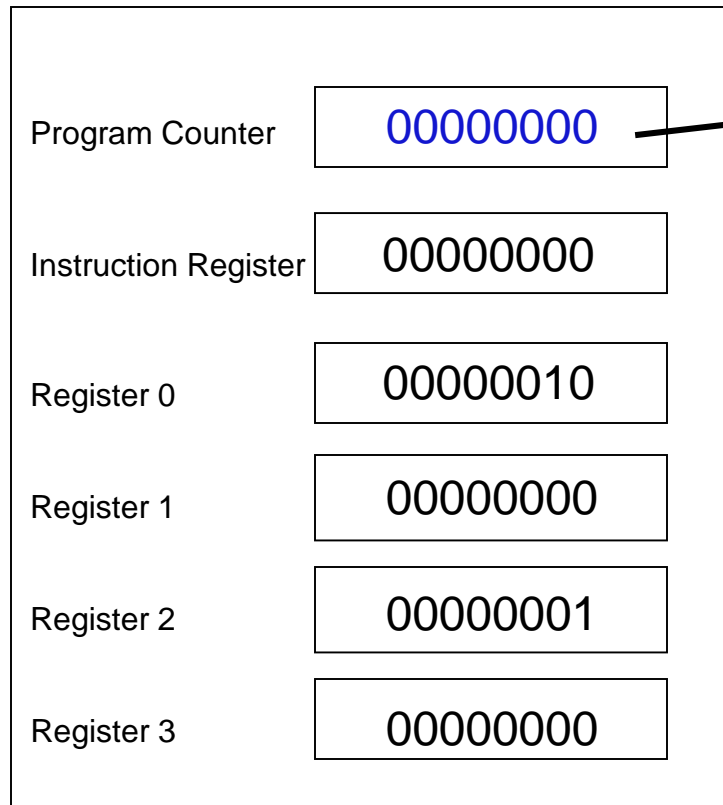
Memory

Memory Location

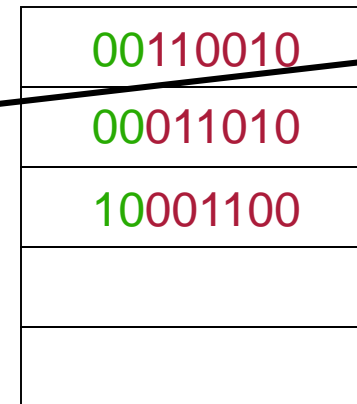
Binary	Base 10
00000000	0
00000001	1
00000010	2
00000011	3
00000100	4
11111111	255

A Computer!

00 add
01 subtract
10 multiply
11 divide



Central Processing Unit (CPU)



Memory

Memory Location

Binary Base 10

00000000 0

00000001 1

00000010 2

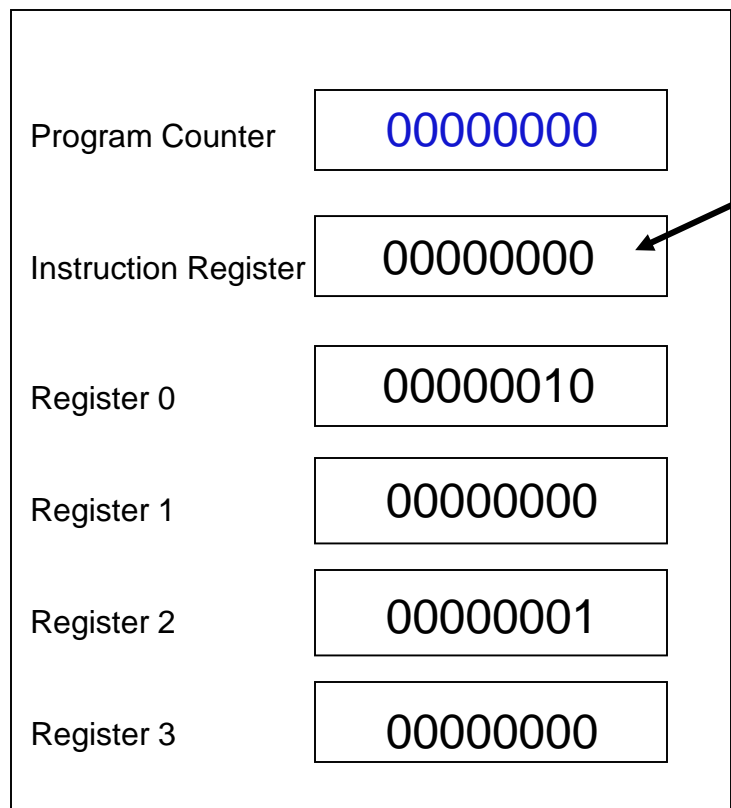
00000011 3

00000100 4

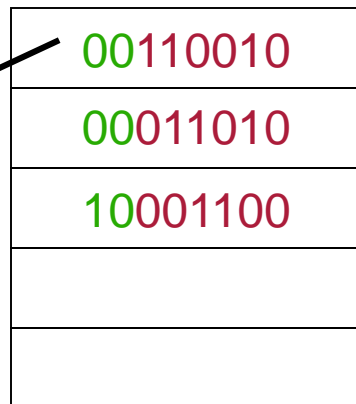
11111111 255

A Computer!

00 add
01 subtract
10 multiply
11 divide



Central Processing Unit (CPU)



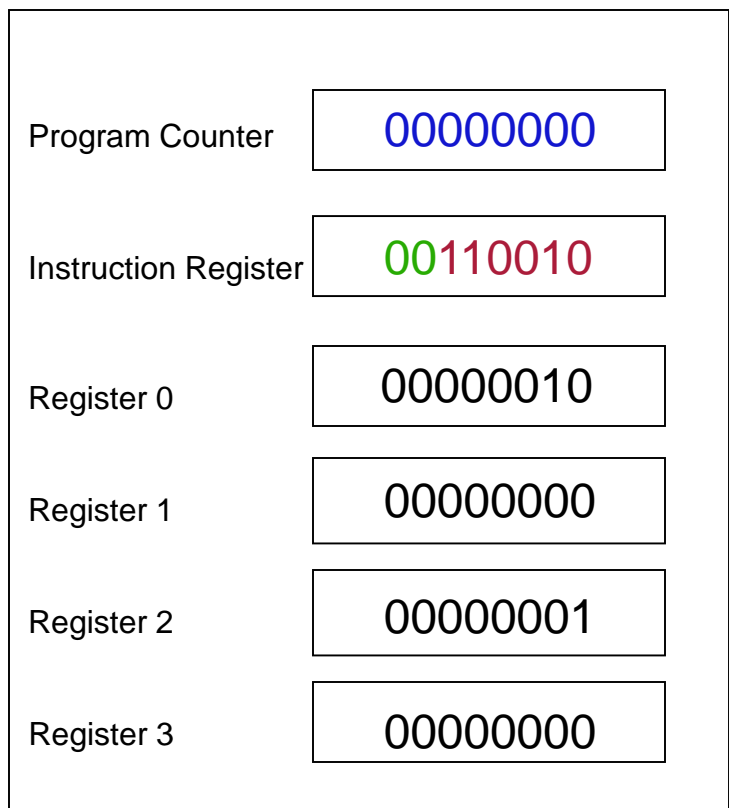
Memory

Memory Location

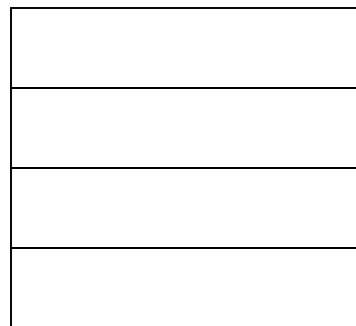
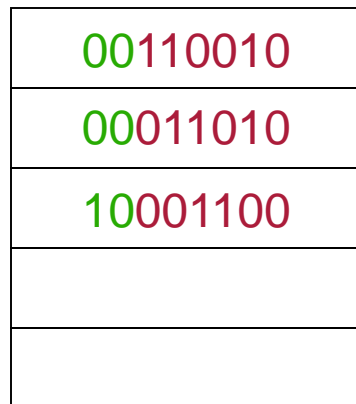
Binary	Base 10
00000000	0
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00000010	2
00000011	3
00000100	4
11111111	255

A Computer!

00 add
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11 divide



Central Processing Unit (CPU)



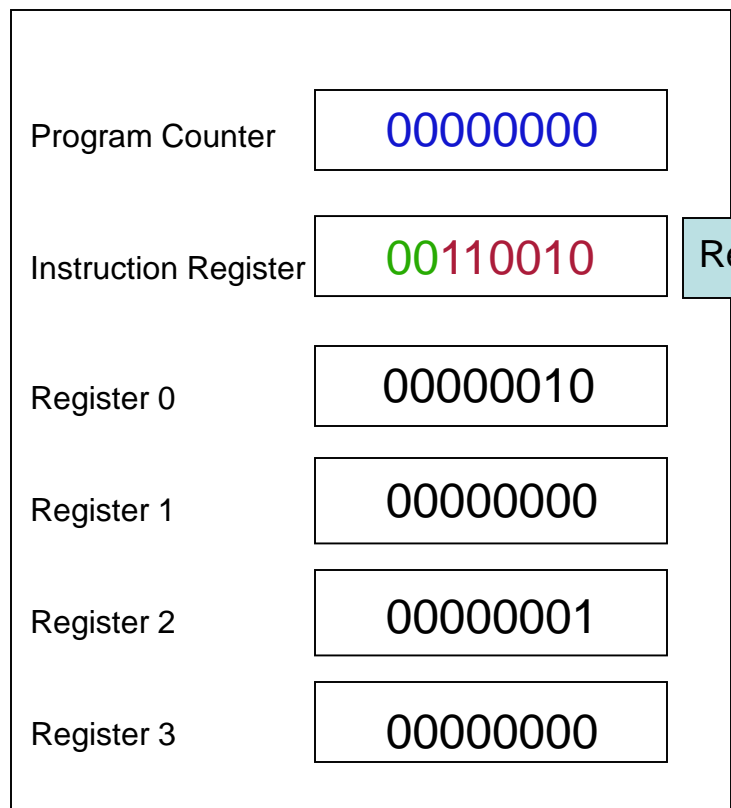
Memory

Memory Location

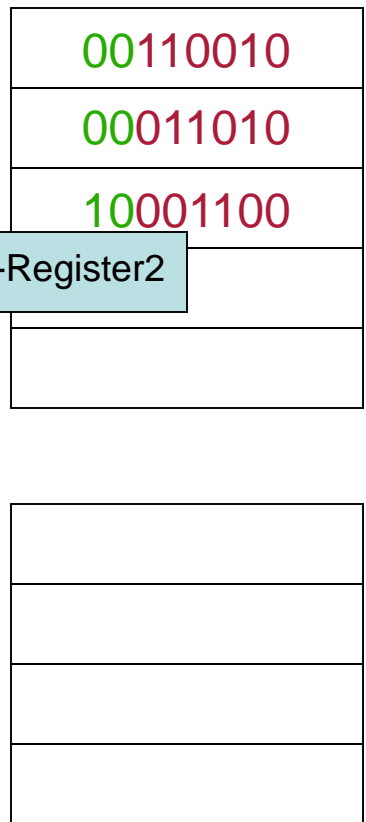
Binary	Base 10
00000000	0
00000001	1
00000010	2
00000011	3
00000100	4
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A Computer!

00 add
01 subtract
10 multiply
11 divide



Central Processing Unit (CPU)



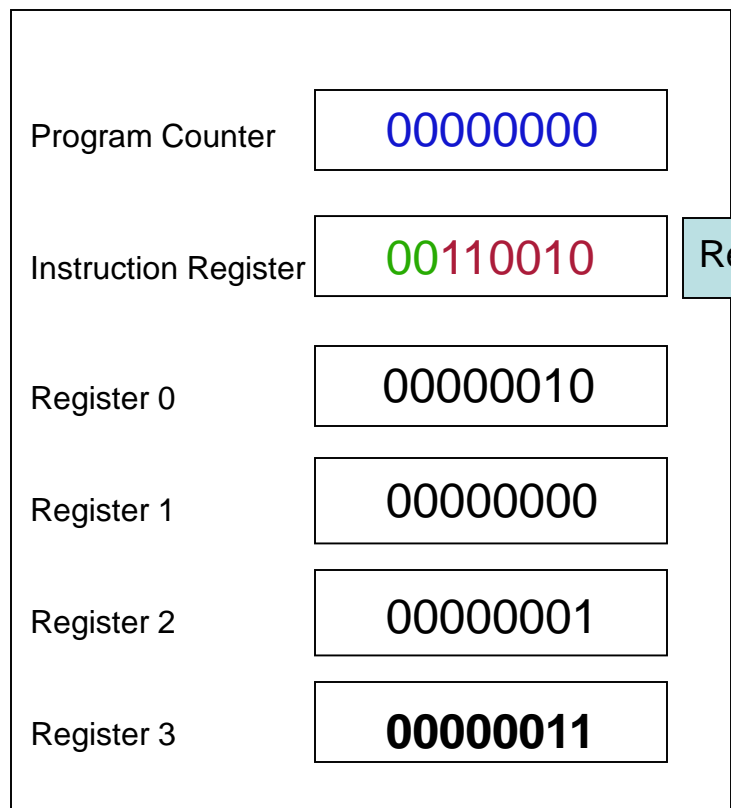
Memory

Memory Location

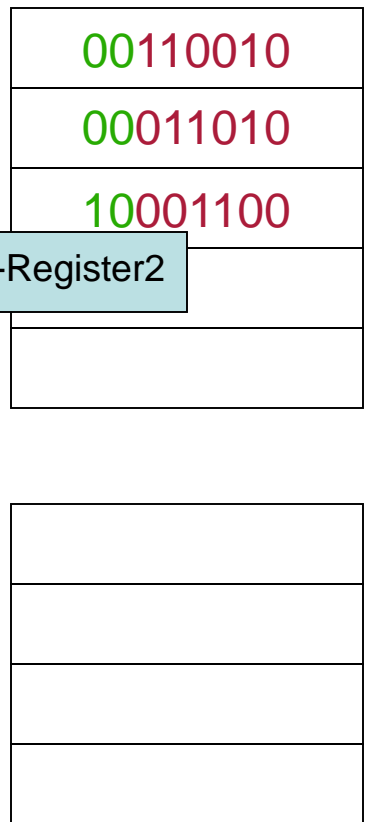
Binary	Base 10
00000000	0
00000001	1
00000010	2
00000011	3
00000100	4
11111111	255

A Computer!

00 add
01 subtract
10 multiply
11 divide



Register3=Register0+Register2



Memory Location

Binary	Base 10
00000000	0
00000001	1
00000010	2
00000011	3
00000100	4
11111111	255

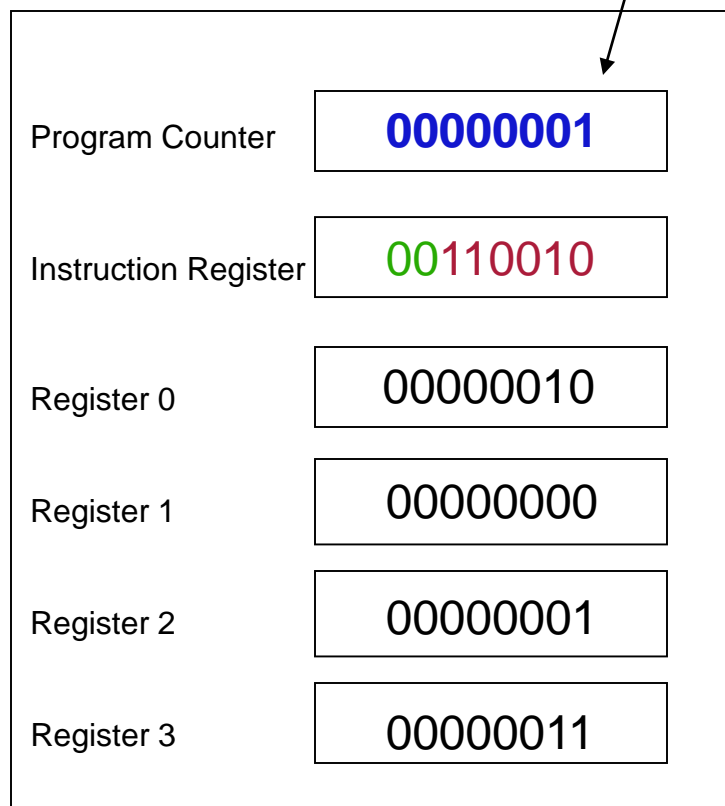
Central Processing Unit (CPU)

Memory

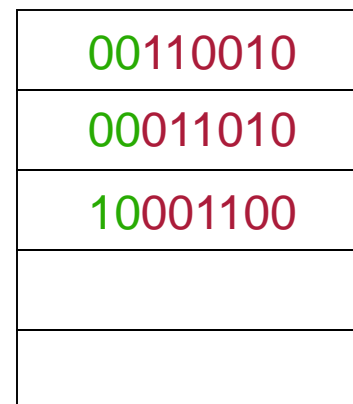
A Computer!

00 add
01 subtract
10 multiply
11 divide

Program Counter Incremented



Central Processing Unit (CPU)



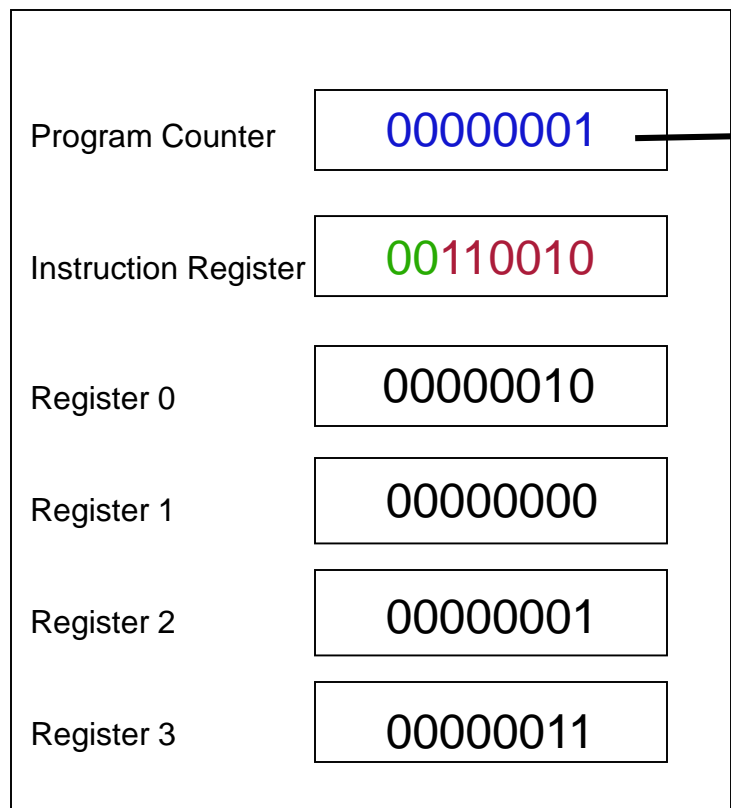
Memory

Memory Location

Binary	Base 10
00000000	0
00000001	1
00000010	2
00000011	3
00000100	4
11111111	255

A Computer!

00 add
01 subtract
10 multiply
11 divide



Central Processing Unit (CPU)



Memory

Memory Location

Binary Base 10

00000000 0

00000001 1

00000010 2

00000011 3

00000100 4

11111111 255

A Computer!

00 add
01 subtract
10 multiply
11 divide

What is
this
command
saying?

Program Counter

00000001

Instruction Register

00011010

Register 0

00000010

Register 1

00000000

Register 2

00000001

Register 3

00000011

Central Processing Unit (CPU)

00110010
00011010
10001100

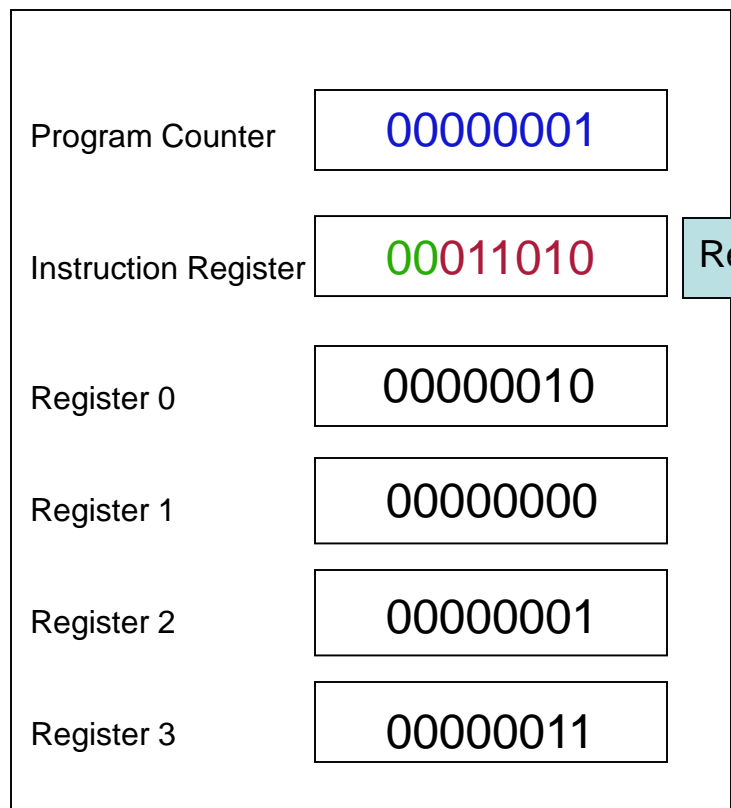
Memory

Memory Location

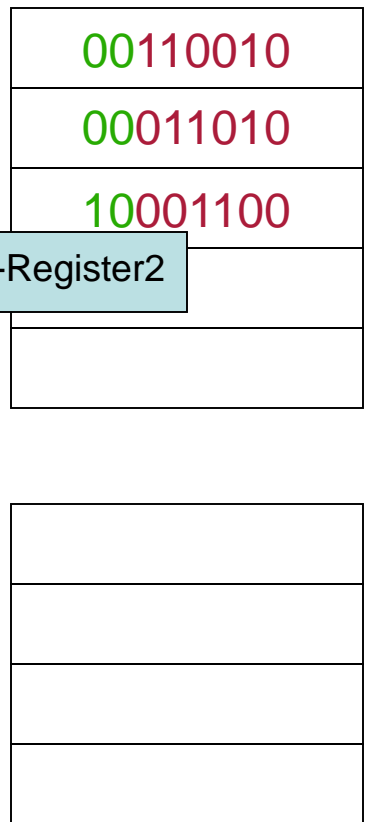
Binary	Base 10
00000000	0
00000001	1
00000010	2
00000011	3
00000100	4
11111111	255

A Computer!

00 add
01 subtract
10 multiply
11 divide



Register1=Register2+Register2



Memory Location

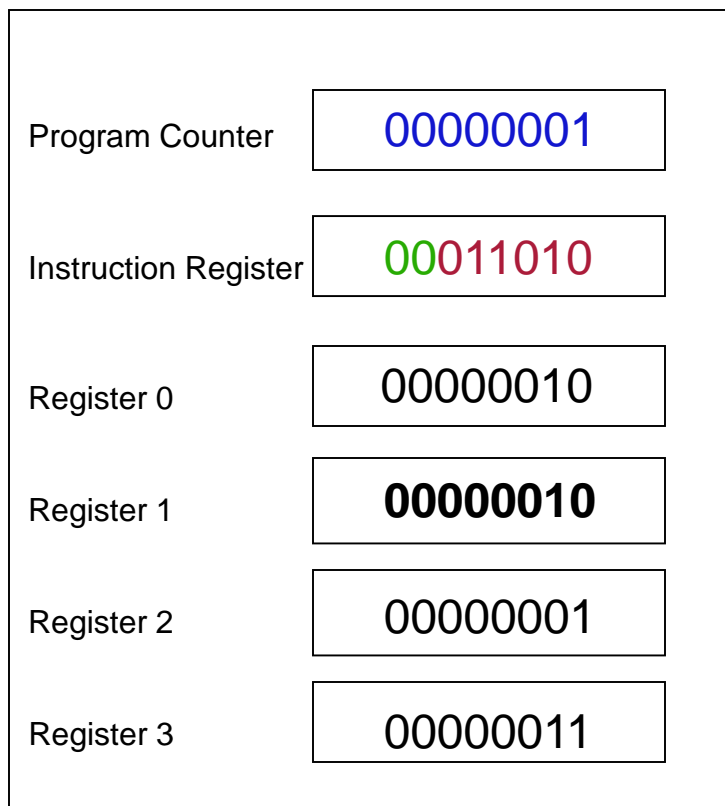
Binary	Base 10
00000000	0
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00000010	2
00000011	3
00000100	4
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Central Processing Unit (CPU)

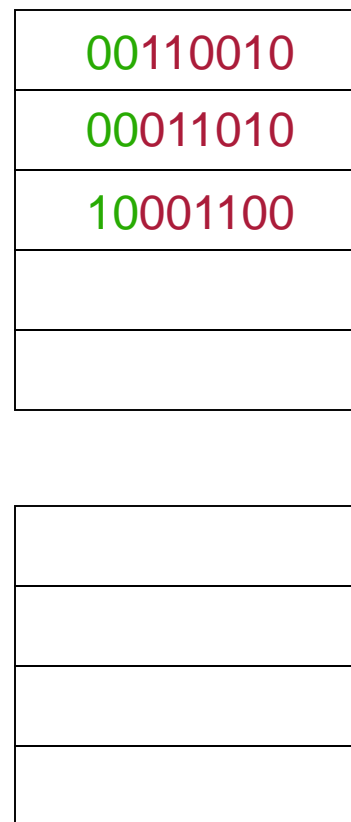
Memory

A Computer!

00 add
01 subtract
10 multiply
11 divide



Central Processing Unit (CPU)



Memory

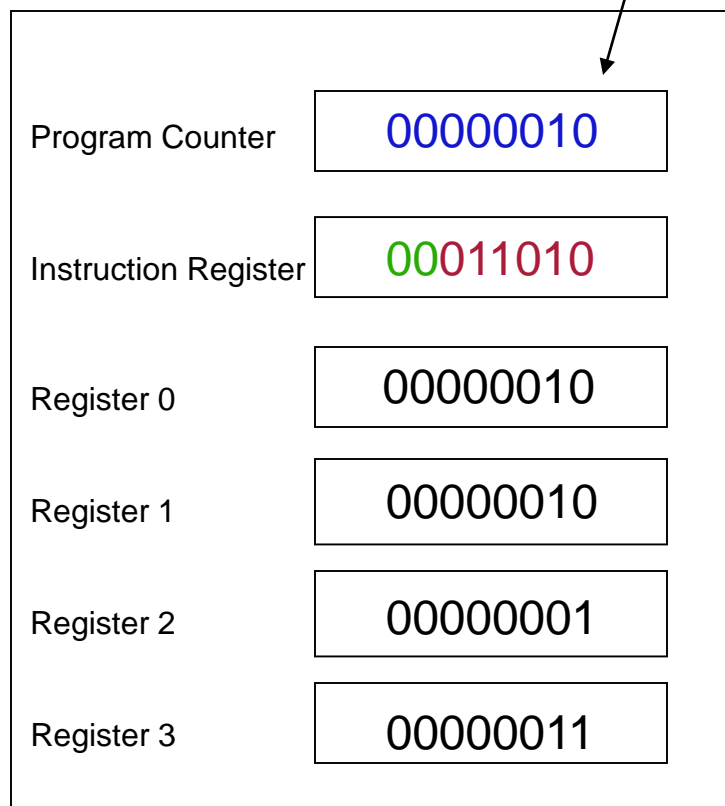
Memory Location

Binary	Base 10
00000000	0
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00000010	2
00000011	3
00000100	4
11111111	255

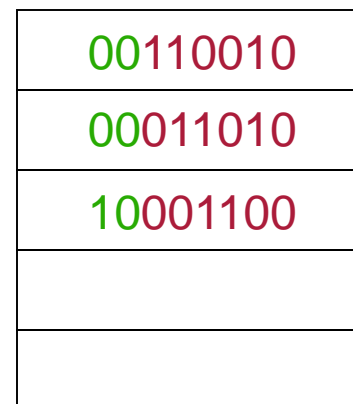
A Computer!

00 add
01 subtract
10 multiply
11 divide

Program Counter Incremented



Central Processing Unit (CPU)



Memory

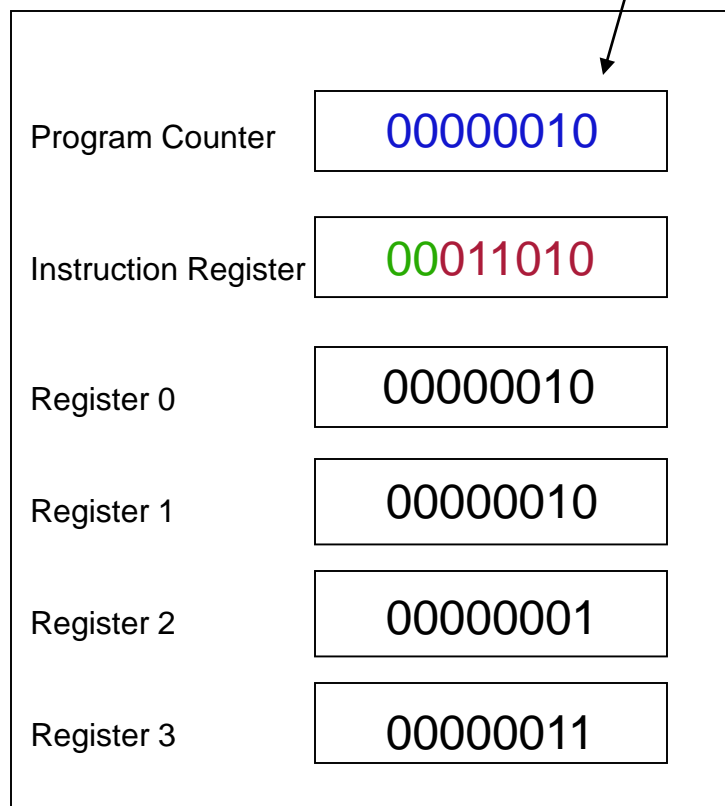
Memory Location

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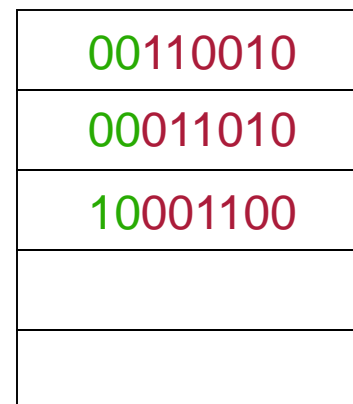
A Computer!

00 add
01 subtract
10 multiply
11 divide

Program Counter Incremented



Central Processing Unit (CPU)



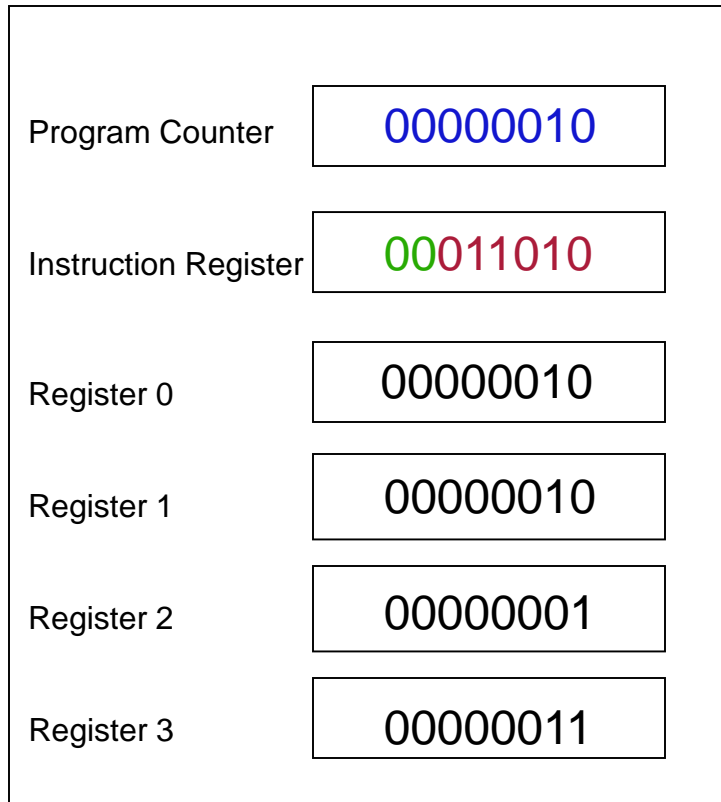
Memory

Memory Location

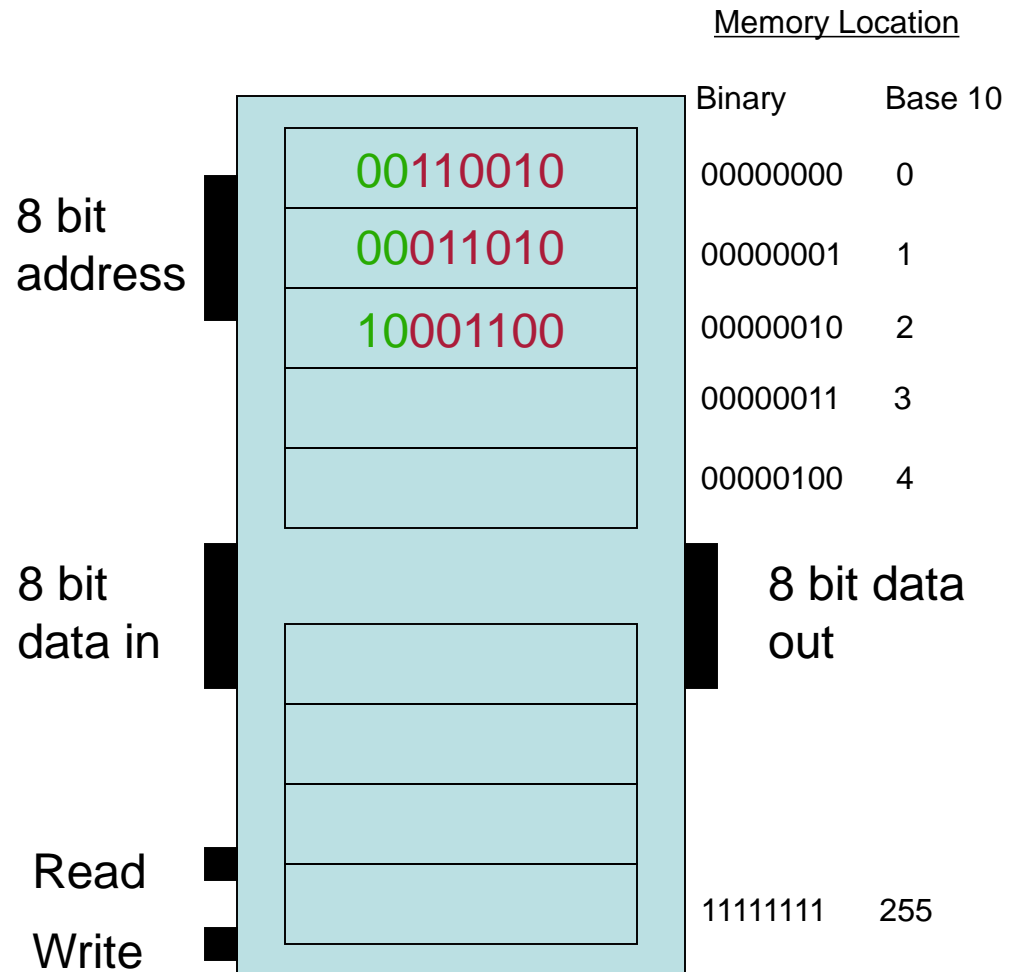
Binary	Base 10
00000000	0
00000001	1
00000010	2
00000011	3
00000100	4
...	
11111111	255

A Computer!

00 add
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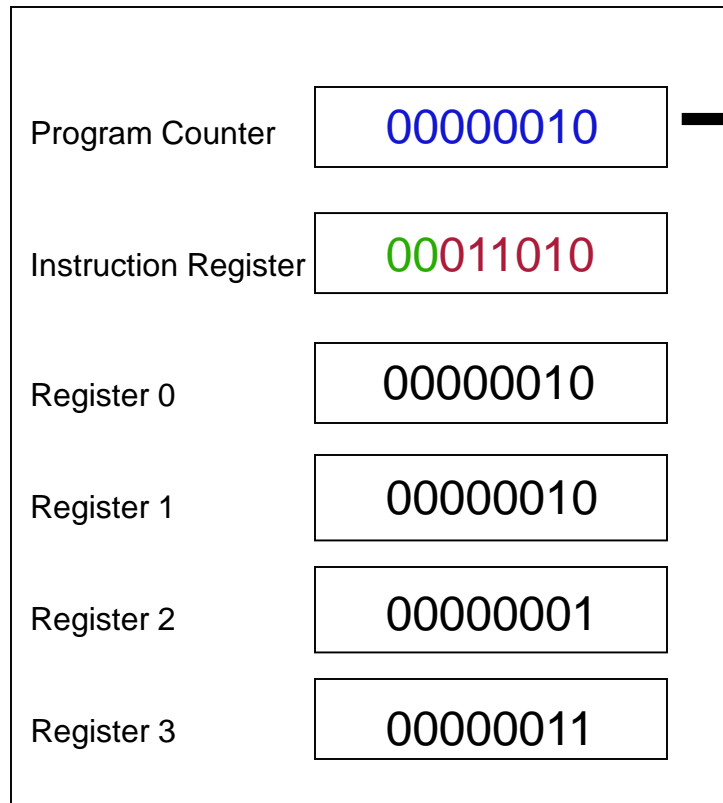
Central Processing Unit (CPU)



Memory

A Computer!

00 add
01 subtract
10 multiply
11 divide

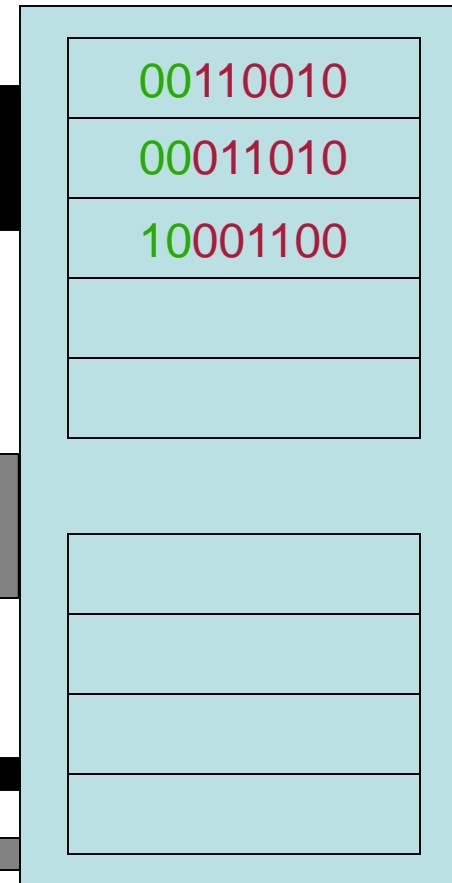


Central Processing Unit (CPU)

8 bit
address

8 bit
data in

1
Read
Write



Memory

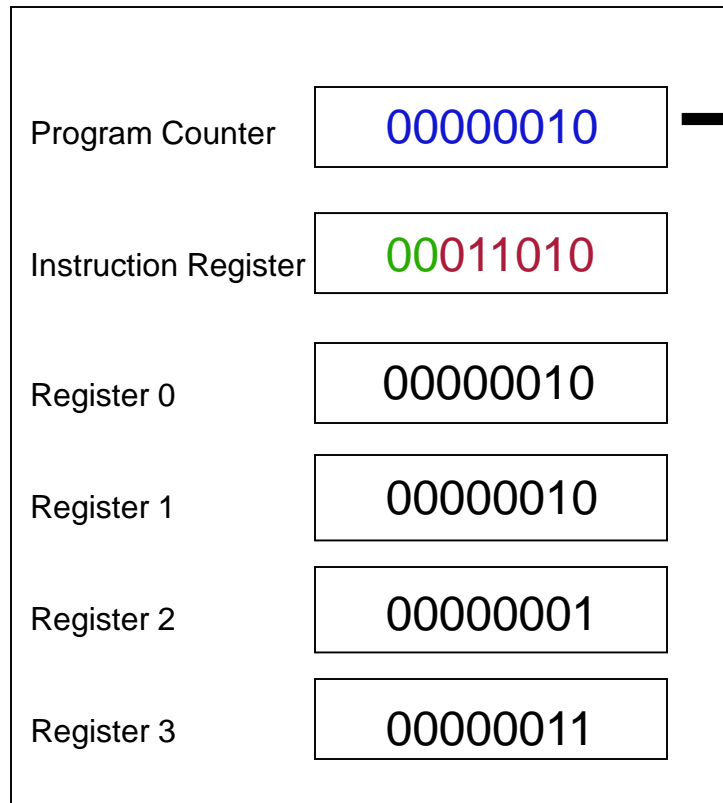
Memory Location

Binary	Base 10
00000000	0
00000001	1
00000010	2
00000011	3
00000100	4
11111111	255

8 bit data
out

A Computer!

00 add
01 subtract
10 multiply
11 divide

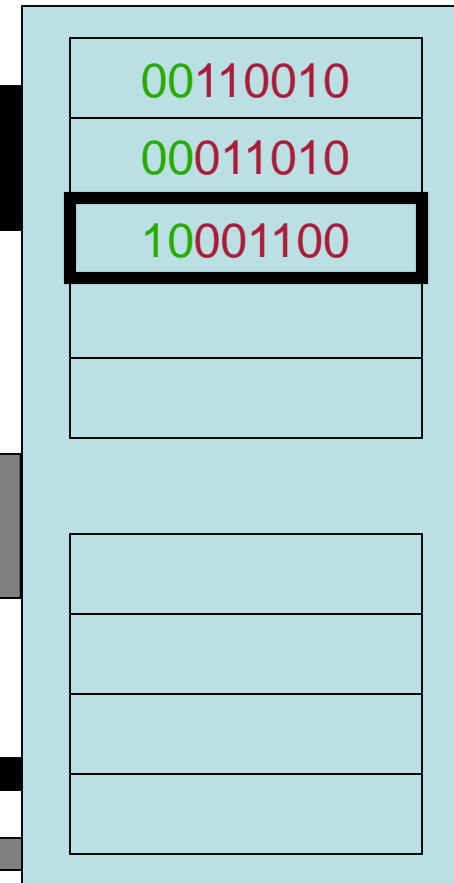


Central Processing Unit (CPU)

8 bit
address

8 bit
data in

1
Read
Write



Memory

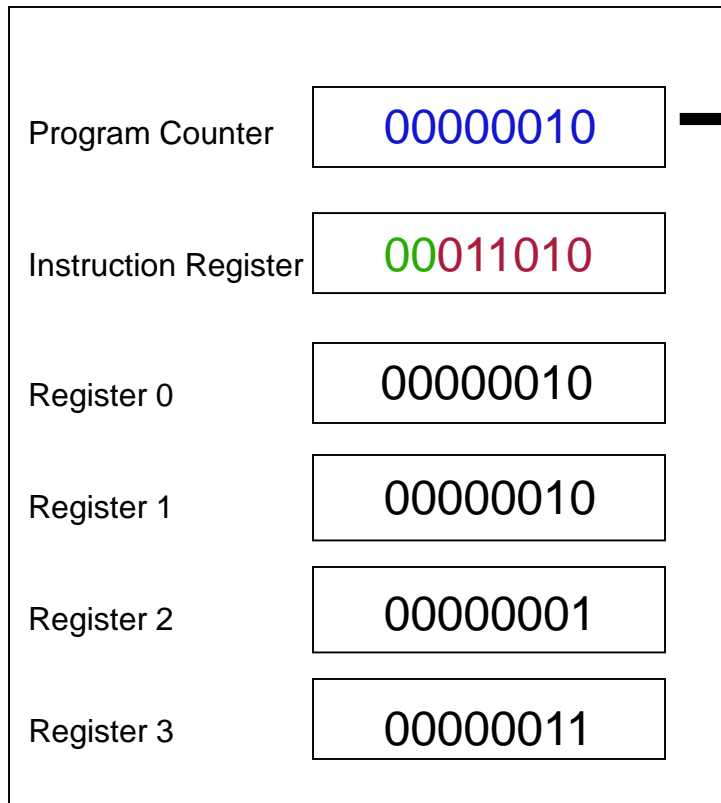
Memory Location

Binary	Base 10
00000000	0
00000001	1
00000010	2
00000011	3
00000100	4
11111111	255

8 bit data
out

A Computer!

00 add
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10 multiply
11 divide

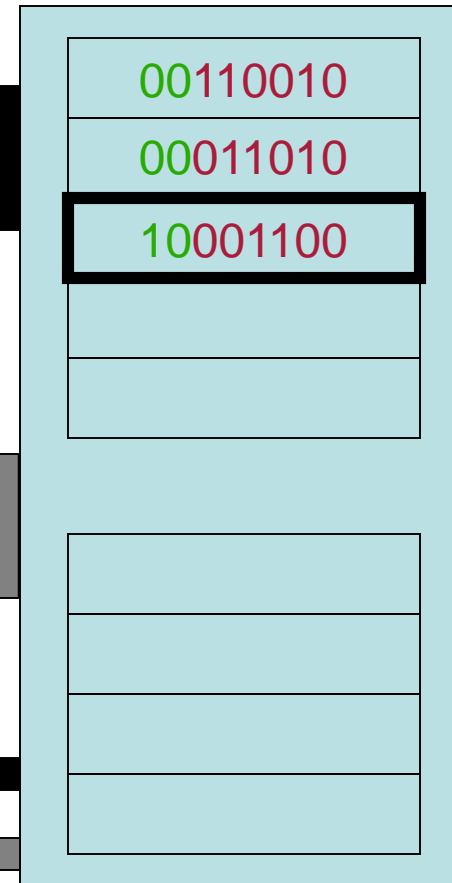


Central Processing Unit (CPU)

8 bit
address

8 bit
data in

1
Read
Write



Memory Location

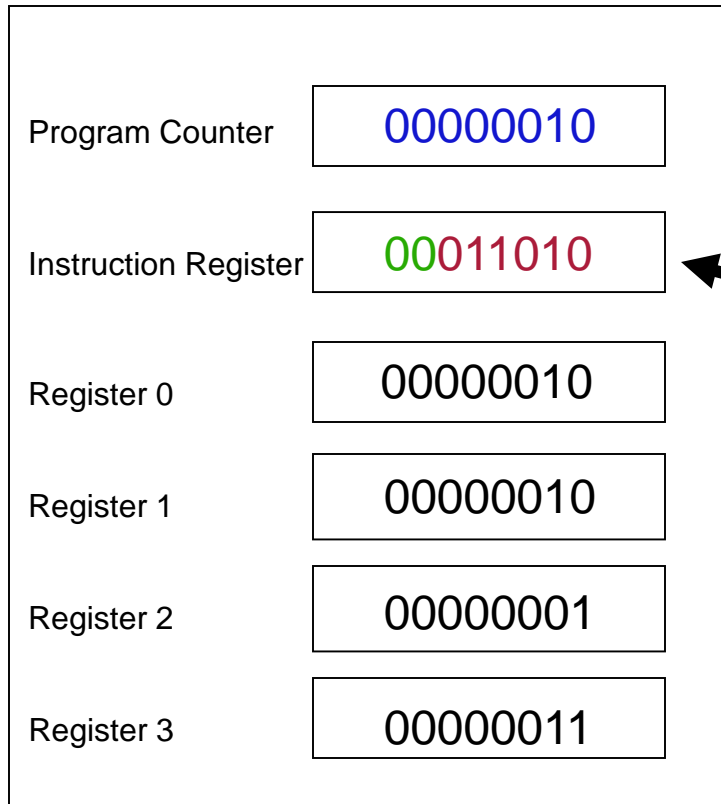
Binary	Base 10
00000000	0
00000001	1
00000010	2
00000011	3
00000100	4
11111111	255

8 bit data
out
10001100

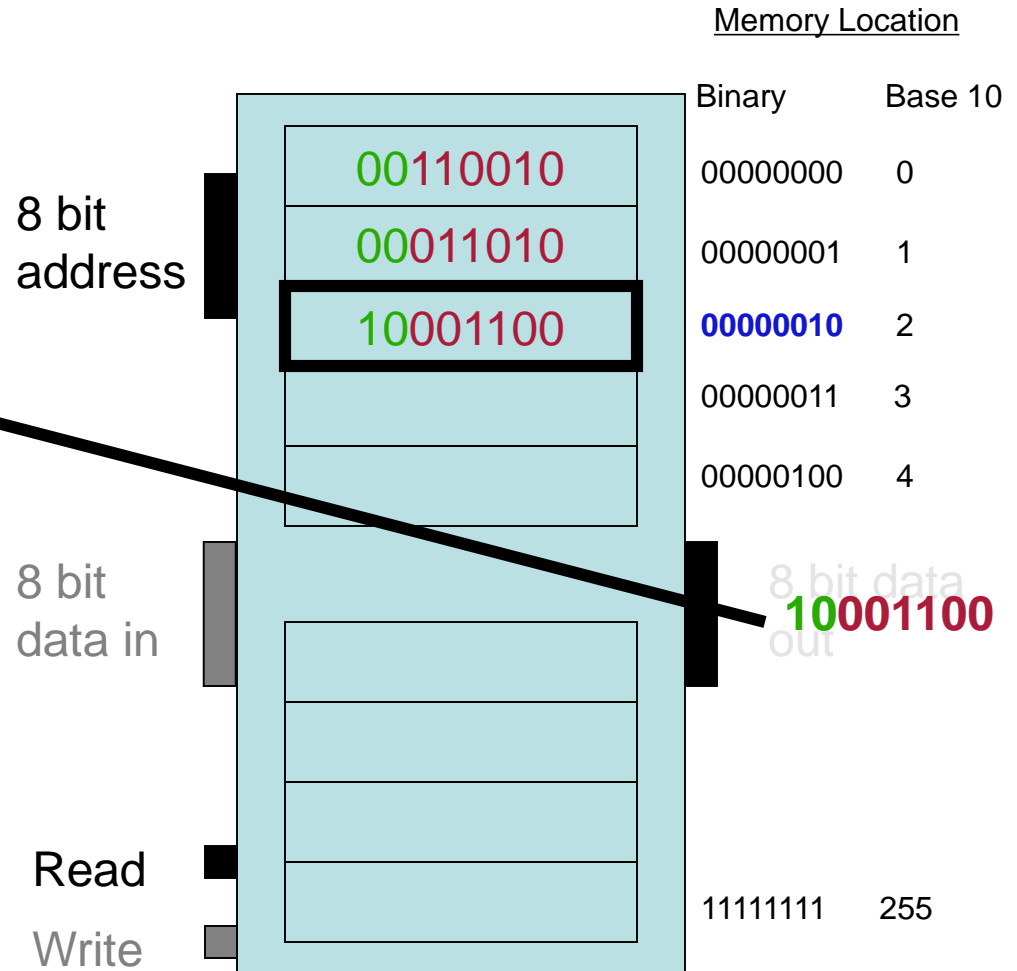
Memory

A Computer!

00 add
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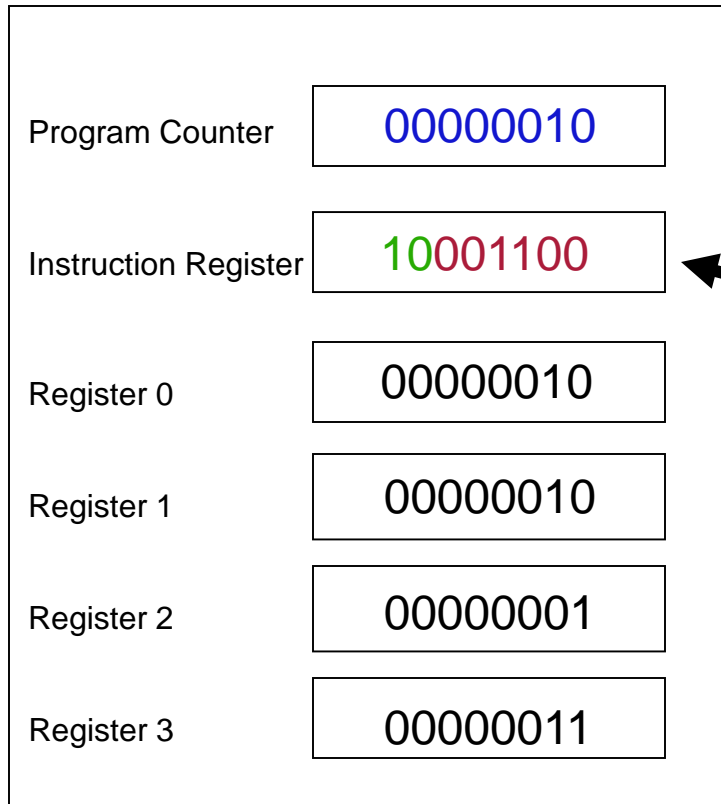
Central Processing Unit (CPU)



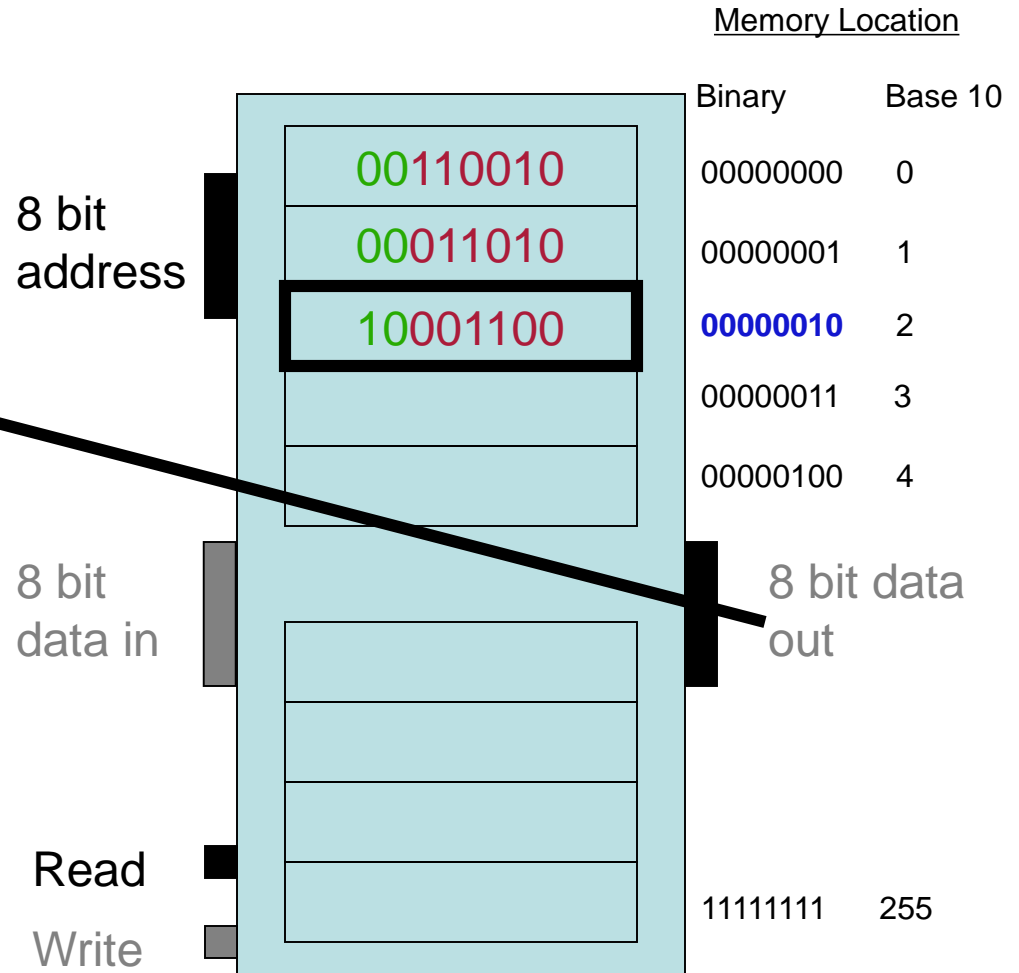
Memory

A Computer!

00	add
01	subtract
10	multiply
11	divide



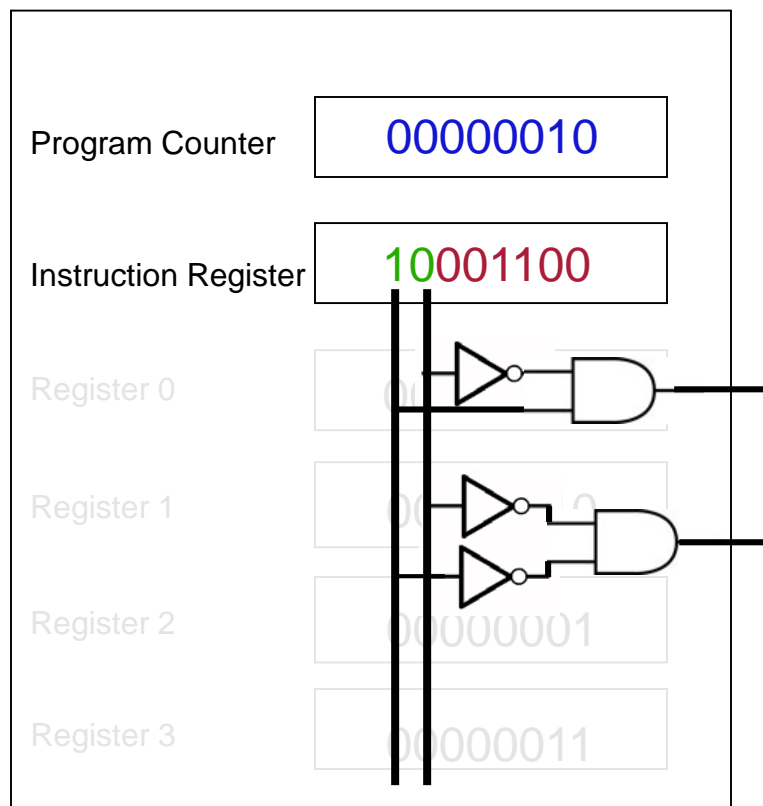
Central Processing Unit (CPU)



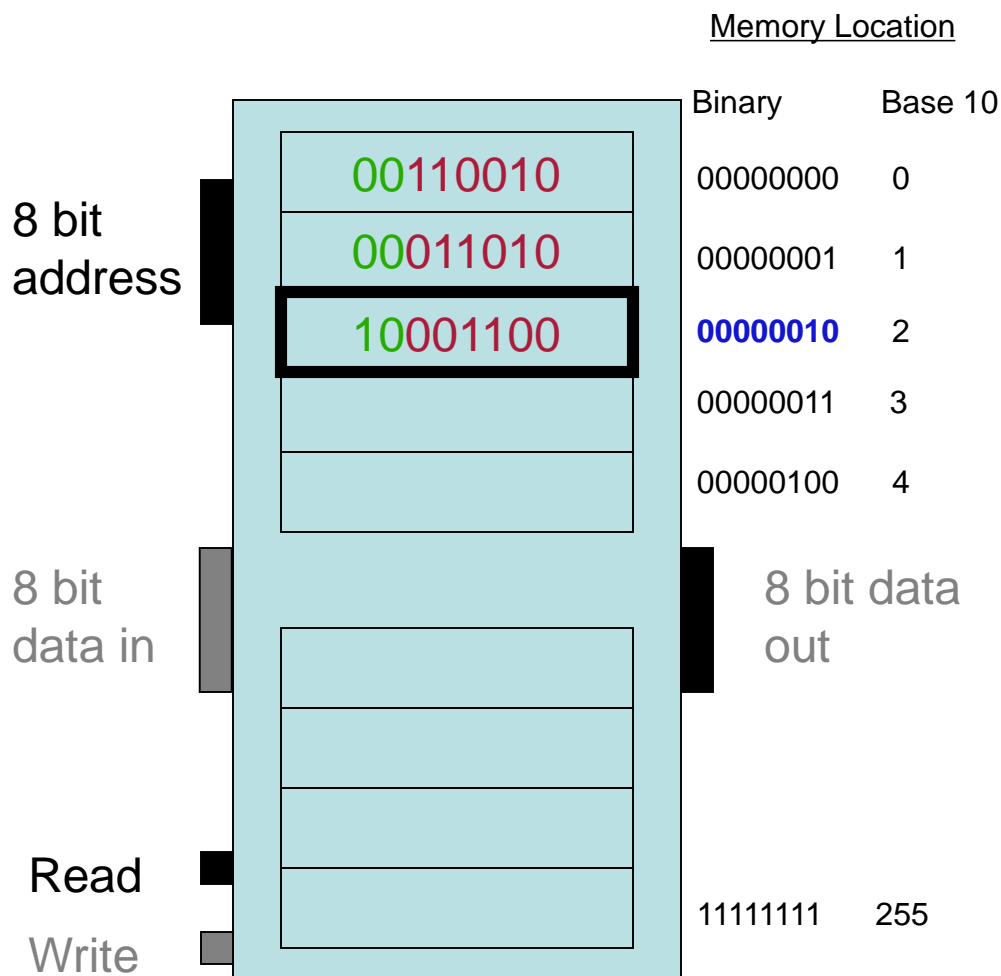
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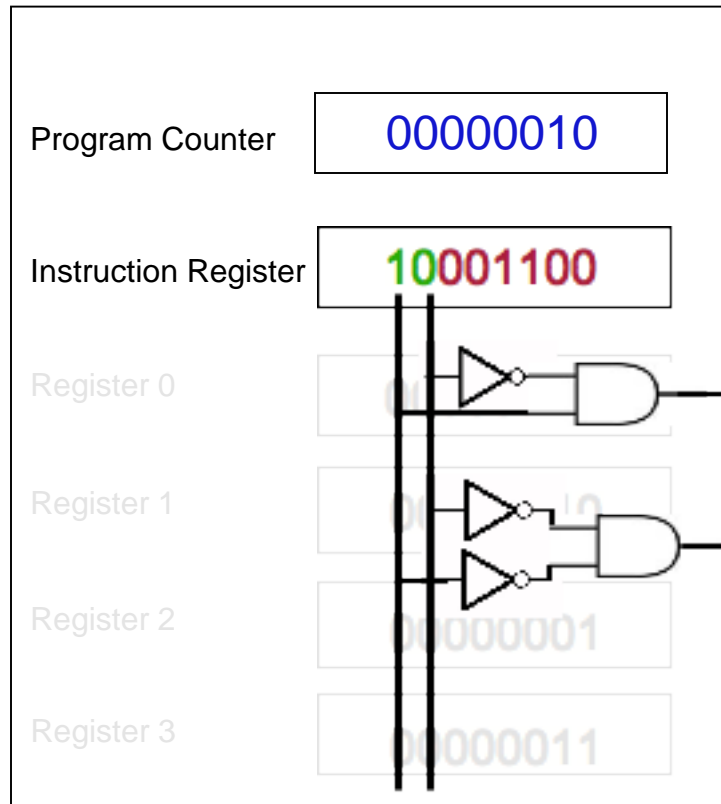
Central Processing Unit (CPU)



Memory

A Computer!

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11 divide

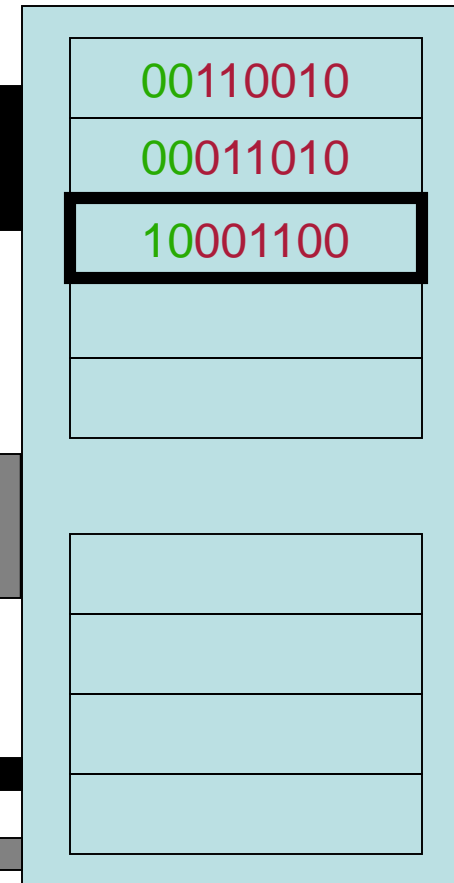


Central Processing Unit (CPU)

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address

8 bit
data in

Read
Write



Memory

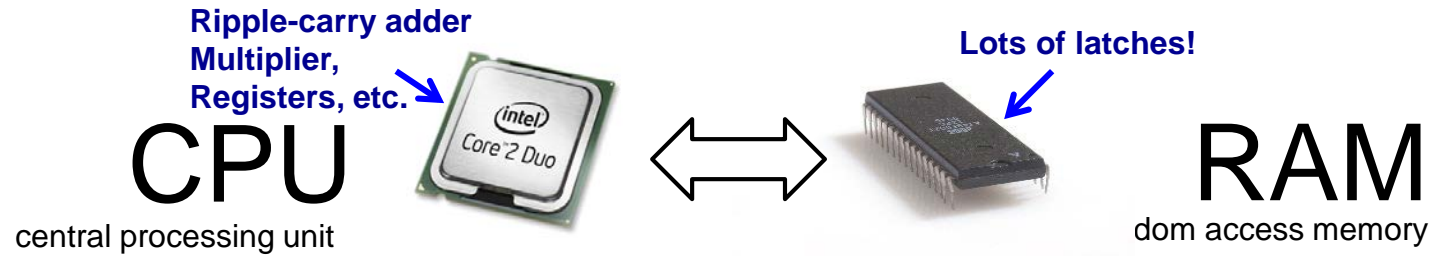
Memory Location

Binary	Base 10
00000000	0
00000001	1
00000010	2
00000011	3
00000100	4
11111111	255

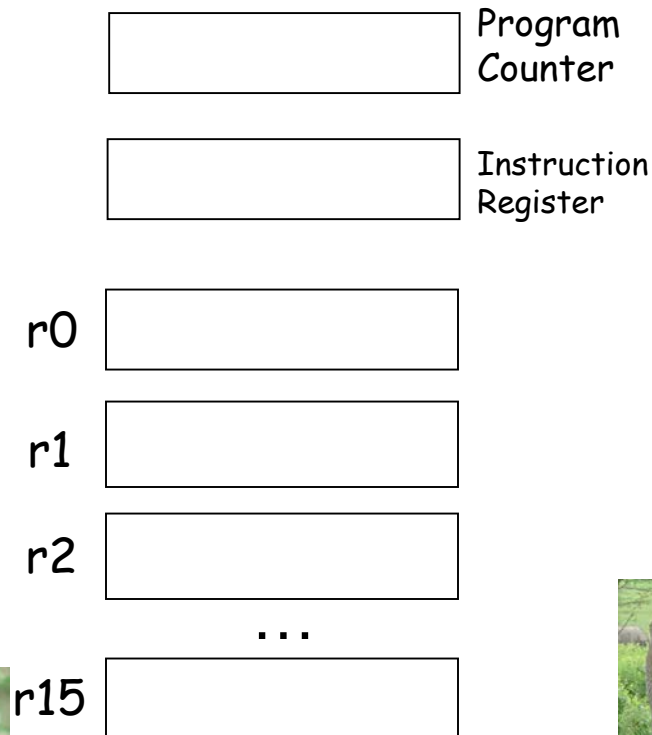
The von Neumann “architecture”



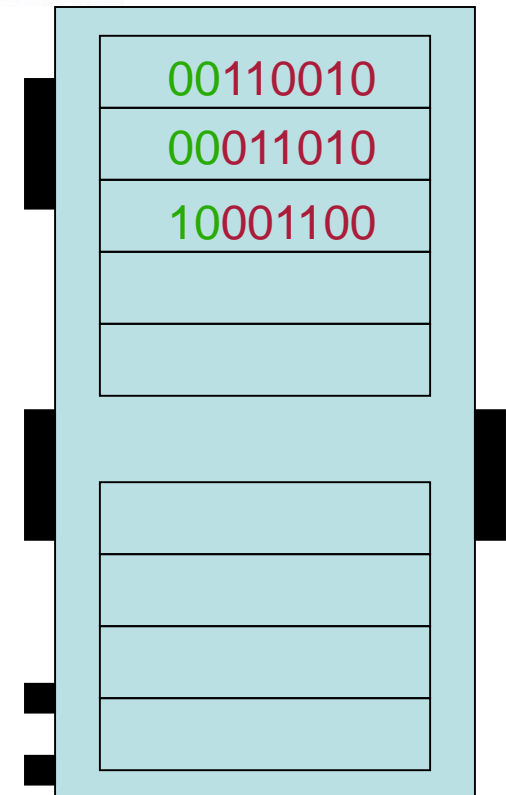
John von Neumann



Small number
of fast registers



Large but slow memory





2006

Intel Core 2 Duo

3 GHz clock

64-bit processor

291 million transistors

65 nm wires



It doesn't
look all that
fast to me!

