MOS 6502 / MOS 6510

Deep Dive Logical Operations

AND ORA EOR

AND AND Memory with Accumulator

A AND M -> A

N	Z	C	I	D	V
+	+	-	-	-	-

addressing	assembler	opc	bytes	cycls
immediate	AND #oper	29	2	2
zeropage	AND oper	25	2	3
zeropage,X	AND oper,X	35	2	4
absolute	AND oper	2D	3	4
absolute,X	AND oper,X	3D	3	4*
absolute,Y	AND oper,Y	39	3	4*
(indirect,X)	AND (oper,X)	21	2	6
(indirect),Y	AND (oper),Y	31	2	5*

* add 1 to cycles if page boundary is crossed

** add 1 to cycles if branch occurs on same page
   add 2 to cycles if branch occurs to different page

Legend to Flags: + ... modified
- .... not modified
1 .... set
0 .... cleared
M6 .... memory bit 6
M7 .... memory bit 7

A	.	B	=	C
0		0	=	0
0		1	=	0
1		0	=	0
1		1	=	1

```
 10010011
 00000111
 --------
 00000011
```

ORA OR Memory with Accumulator

A OR M -> A

N	Z	C	I	D	V
+	+	-	-	-	-

addressing	assembler	opc	bytes	cycls
immediate	ORA #oper	09	2	2
zeropage	ORA oper	05	2	3
zeropage,X	ORA oper,X	15	2	4
absolute	ORA oper	0D	3	4
absolute,X	ORA oper,X	1D	3	4*
absolute,Y	ORA oper,Y	19	3	4*
(indirect,X)	ORA (oper,X)	01	2	6
(indirect),Y	ORA (oper),Y	11	2	5*

* add 1 to cycles if page boundary is crossed

** add 1 to cycles if branch occurs on same page
   add 2 to cycles if branch occurs to different page

Legend to Flags: + ... modified
                  - .... not modified
                  1 .... set
                  0 .... cleared
                 M6 .... memory bit 6
                 M7 .... memory bit 7

A+B	=	C
0	0	= 0
0	1	= 1
1	0	= 1
1	1	= 1

```
 10010011
 00100011
 --------
 10110111
```

EOR Exclusive-OR Memory with Accumulator

A EOR M -> A

N	Z	C	I	D	V
+	+	-	-	-	-

addressing	assembler	opc	bytes	cycls
immediate	EOR #oper	49	2	2
zeropage	EOR oper	45	2	3
zeropage,X	EOR oper,X	55	2	4
absolute	EOR oper	4D	3	4
absolute,X	EOR oper,X	5D	3	4*
absolute,Y	EOR oper,Y	59	3	4*
(indirect,X)	EOR (oper,X)	41	2	6
(indirect),Y	EOR (oper),Y	51	2	5*

* add 1 to cycles if page boundary is crossed

** add 1 to cycles if branch occurs on same page
   add 2 to cycles if branch occurs to different page

Legend to Flags:
+ .... modified
- .... not modified
1 .... set
0 .... cleared
M6 .... memory bit 6
M7 .... memory bit 7

AoB	=	C
0	0	0
0	1	1
1	0	1
1	1	0

```
 10010011
 00100111
 --------
 10110100
```

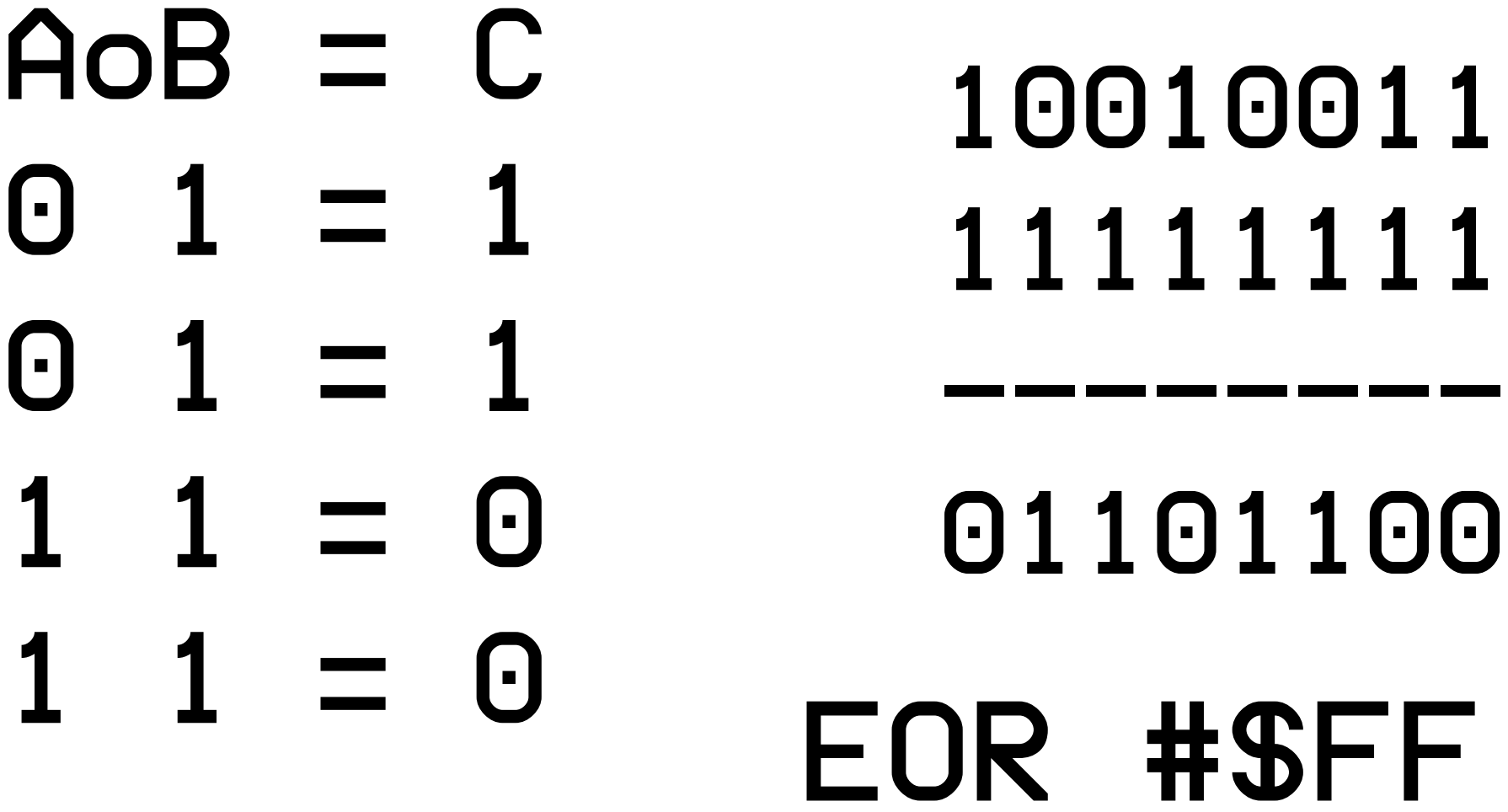
$\overline{A} = B$

$0 = 1$

$1 = 0$

```
 10010011
--------
 01101100
```

NOT Gate


AoB = C
0 1 = 1
0 1 = 1
1 1 = 0
1 1 = 0
10010011
11111111
01101100
EOR #$FF