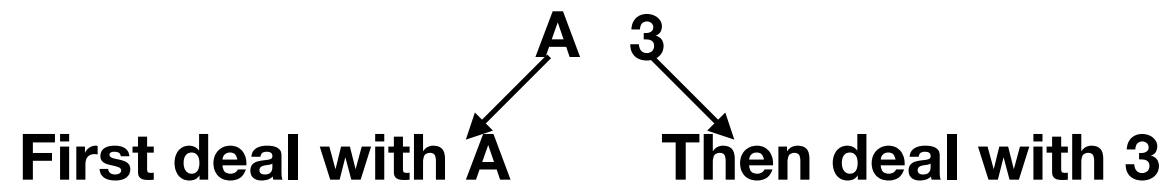


# **Conversion of Hexadecimal to Binary and Vice Versa**

# Worked Example 1 - Converting Hexadecimal to Binary

## Convert the hexadecimal A3 to 8-bit Binary



(1) Convert A to Denary; A in Decimal/Denary is 10

(2) Convert 10 to 4-bit Binary and that is 1010

(3) Convert 3 to Denary and is 3.

(4) Convert 3 to 4-bit Binary and that 0011

**(5) So A3 in Binary is 1010 0011**

DEN ARY	0	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16
HEX	0	1	2	3	4	5	6	7	8	9	A	B	C	D	E	F	20

### Check

$2^3$	$2^2$	$2^1$	$2^0$
8	4	2	1
1	0	1	0

$$(1 \times 8) + (1 \times 2)$$

$$= 8 + 2$$

$$= 10 \text{ (which is A in Hexadecimal)}$$

$2^3$	$2^2$	$2^1$	$2^0$
8	4	2	1
0	0	1	1

$$(1 \times 2) + (1 \times 1)$$

$$= 2 + 1$$

$$= 3$$

# Worked Example 2 - Converting Hexadecimal to Binary

## Convert the hexadecimal 8F to 8-bit Binary

First deal with 8      Then deal with F

(1) Convert 8 to Denary; 8 in Decimal/Denary is 8

(2) Convert 8 to 4-bit Binary and that is 1000

(3) Convert F to Denary and is 15

(4) Convert 15 to 4-bit Binary and that 1111

(5) So 8F in Binary is 1000 1111

DENARY 0 1 2 3 4 5 6 7 8 9 10 11 12 13 14 15 16

HEX 0 1 2 3 4 5 6 7 8 9 A B C D E F 20

## Check

$2^3$	$2^2$	$2^1$	$2^0$
8	4	2	1
1	0	0	0

(1\*8)

= 8

$2^3$	$2^2$	$2^1$	$2^0$
8	4	2	1
1	1	1	1

(1\*8) + (1\*4) + (1\*2) + (1\*1)

= 8 + 4 + 2 + 1

= 15 (which is F in Hexadecimal)

# Worked Example 3 - Converting Hexadecimal to Binary

Convert the hexadecimal 45 to 8-bit Binary

4 5  
↙ ↘  
First deal with 4 Then deal with 5

(1) Convert 4 to Denary; 4 in Decimal/Denary is 4

(2) Convert 4 to 4-bit Binary and that is 0100

(3) Convert 5 to Denary and that is 5

(4) Convert 5 to 4-bit Binary and that 0101

(5) So 45 in hexadecimal is 0100 0101 in 8-bit binary

DENARY 0 1 2 3 4 5 6 7 8 9 10 11 12 13 14 15 16

HEX 0 1 2 3 4 5 6 7 8 9 A B C D E F 20

Check

$2^3$	$2^2$	$2^1$	$2^0$
8	4	2	1
0	1	0	0

= (1\*4)

=4

$2^3$	$2^2$	$2^1$	$2^0$
8	4	2	1
0	1	0	1

(1\*4) + (1\*1)

= 4 + 1

= 5

## Questions on Converting Hexadecimal to Binary and Show your working

- (1) Convert the hexadecimal number 42 to binary.
- (2) Convert the hexadecimal number AB to binary.

DENARY	0	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16
HEX	0	1	2	3	4	5	6	7	8	9	A	B	C	D	E	F	20

# Worked Example 4 - Converting Binary to Hexadecimal

## Convert the binary number 1001 0011 to Hexadecimal



- (1) Note that the above binary number is made up of 2 nibbles; 4 bits make a nibble.
- (2) Take the 1st nibble 1001 and convert to denary. It is 9 in denary.
- (3) Take 9 and convert to hexadecimal. It is 9.
- (4) Take 2nd nibble 0011 and convert to denary. It is 3 in denary.
- (5) Take 3 and convert to hexadecimal. It is 3.
- (6) So 1001 0011 is 93 in Hexadecimal.

### Check

$2^3$	$2^2$	$2^1$	$2^0$	
8	4	2	1	
1	0	0	1	9

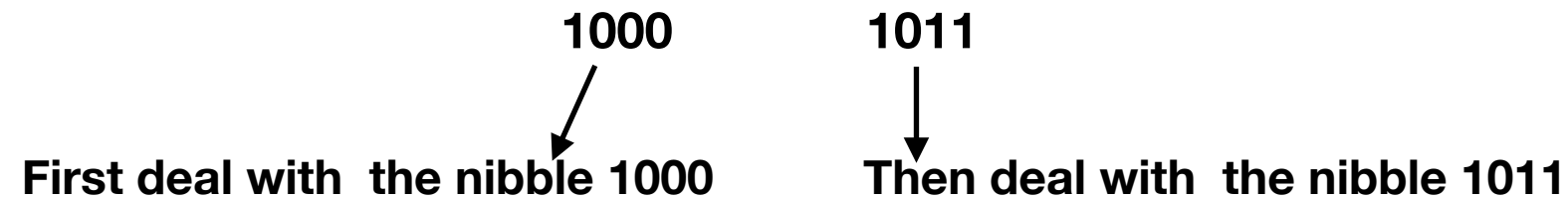
$2^3$	$2^2$	$2^1$	$2^0$	
8	4	2	1	
0	0	1	1	3

DENARY 0 1 2 3 4 5 6 7 8 9 10 11 12 13 14 15 16

HEX 0 1 2 3 4 5 6 7 8 9 A B C D E F 20

# Worked Example 5 - Converting Binary to Hexadecimal

## Convert the binary number 1000 1011 to Hexadecimal



- (1) Note that the above binary number is made up of 2 nibbles; 4 bits make a nibble.
- (2) Take the 1st nibble 1000 and convert to denary. It is 8 in denary.
- (3) Take 8 and convert to hexadecimal. It is 8.
- (4) Take 2nd nibble 1011 and convert to denary. It is 11 in denary.
- (5) Take 11 and convert to hexadecimal. It is B.
- (6) So 1000 1011 is 8B in Hexadecimal.**

### Check

2 <sup>3</sup>	2 <sup>2</sup>	2 <sup>1</sup>	2 <sup>0</sup>	
8	4	2	1	
1	0	0	0	8

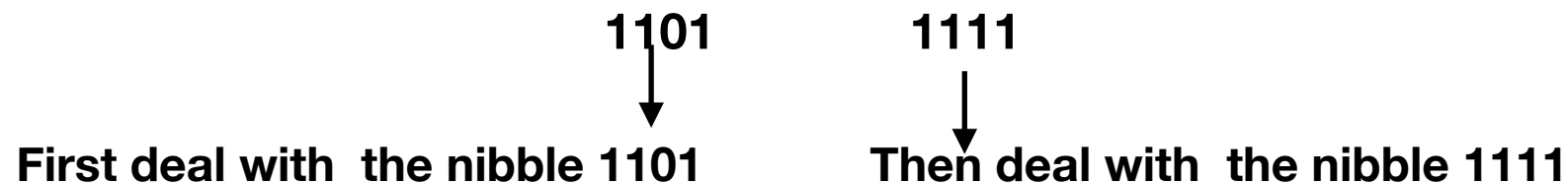
2 <sup>3</sup>	2 <sup>2</sup>	2 <sup>1</sup>	2 <sup>0</sup>	
8	4	2	1	
1	0	1	1	11 or B

DENARY 0 1 2 3 4 5 6 7 8 9 10 11 12 13 14 15 16

HEX 0 1 2 3 4 5 6 7 8 9 A B C D E F 20

# Worked Example 6 - Converting Binary to Hexadecimal

## Convert the binary number 1100 1111 to Hexadecimal



- (1) Note that the above binary number is made up of 2 nibbles; 4 bits make a nibble.
- (2) Take the 1st nibble 1100 and convert to denary. It is 12 in denary.
- (3) Take 12 and convert to hexadecimal. It is C
- (4) Take 2nd nibble 1111 and convert to denary. It is 15 in denary.
- (5) Take 15 and convert to hexadecimal. It is F.

### Check

$2^3$	$2^2$	$2^1$	$2^0$	
8	4	2	1	
1	1	0	1	12 or C

$2^3$	$2^2$	$2^1$	$2^0$	
8	4	2	1	
1	1	1	1	15 or F

**(6) So 1100 1111 is CF in Hexadecimal.**

DENARY	0	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16
HEX	0	1	2	3	4	5	6	7	8	9	A	B	C	D	E	F	20



## Questions on Converting Binary to Hexadecimal (and show your working)

- (1) Convert the binary number 1000 1010 to Hexadecimal.
- (2) Convert 0101 0001 to Hexadecimal.

DENARY 0 1 2 3 4 5 6 7 8 9 10 11 12 13 14 15 16

HEX 0 1 2 3 4 5 6 7 8 9 A B C D E F 20

# Questions and Answers on Converting Hexadecimal to Binary and Show your working

- (1) Convert the hexadecimal number 42 to binary.

$2^3$	$2^2$	$2^1$	$2^0$
8	4	2	1
0	0	1	0

- Ans: 0010 0010

$2^3$	$2^2$	$2^1$	$2^0$
8	4	2	1
0	0	1	0

- (2) Convert the hexadecimal number AB to binary.

**A      B**  
 ↓      ↓  
**10    11**  
**1010** **1011**

$2^3$	$2^2$	$2^1$	$2^0$
8	4	2	1
1	0	1	0

$2^3$	$2^2$	$2^1$	$2^0$
8	4	2	1
1	0	1	1

DENARY 0 1 2 3 4 5 6 7 8 9 10 11 12 13 14 15 16

HEX 0 1 2 3 4 5 6 7 8 9 A B C D E F 20

# Questions on Converting Binary to Hexadecimal (and show your working)

- (1) Convert the binary number 1000 1010 to Hexadecimal

**Ans: 8A**

$2^3$	$2^2$	$2^1$	$2^0$	
8	4	2	1	
1	0	0	0	8

$2^3$	$2^2$	$2^1$	$2^0$	
8	4	2	1	
1	0	1	0	10 or A

- (2) Convert 0101 0001 to Hexadecimal.

**Ans: 51**

$2^3$	$2^2$	$2^1$	$2^0$	
8	4	2	1	
0	1	0	1	5

$2^3$	$2^2$	$2^1$	$2^0$	
8	4	2	1	
0	0	0	1	1

DE  
NA 0 1 2 3 4 5 6 7 8 9 10 11 12 13 14 15 16  
RY

HEX 0 1 2 3 4 5 6 7 8 9 A B C D E F 20