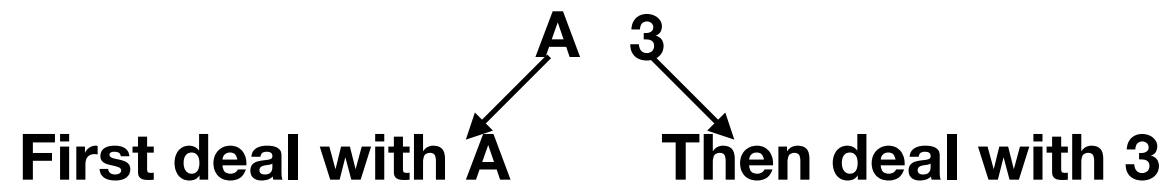# Conversion of Hexadecimal to Binary and Vice Versa

Worked Example 1 - Converting Hexadecimal to Binary

Convert the hexadecimal A3 to 8-bit Binary

A   3

First deal with A   Then deal with 3

(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

Check

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

(1*8) + (1*2)

= 8+ 2

= 10 (which is A in Hexadecimal)

(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

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

(1*2) + (1*1)

= 2 + 1

= 3

Worked Example 2 - Converting Hexadecimal to Binary

Convert the hexadecimal 8F to 8-bit Binary

8   F

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

Check

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

= (1*4)

=4

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

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

1001   0011

First deal with the nibble 1001   Then deal with the nibble 0011

(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.

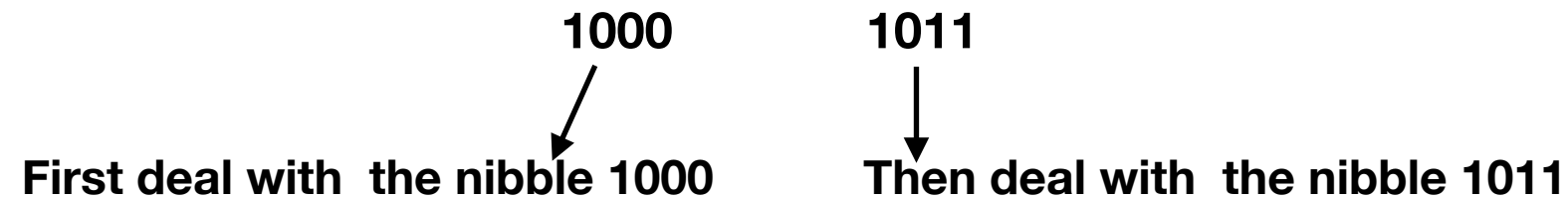## (6) So 1001 0011 is 93 in Hexadecimal.

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

1000   1011

First deal with the nibble 1000   Then deal with the nibble 1011

(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.

Check

(6) So 1000 1011 is 8B in Hexadecimal.

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

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

2^3	2^2	2^1	2^0	
8	4	2	1	
1	0	1	1	11 or B

Worked Example 6 - Converting Binary to Hexadecimal

Convert the binary number 1100 1111 to Hexadecimal
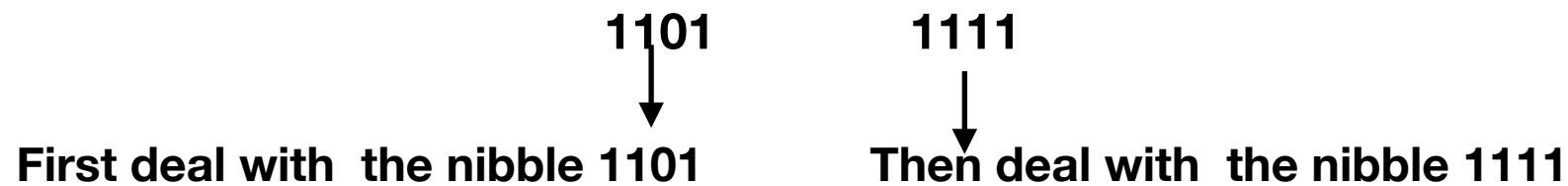
1101   1111

↓   ↓

First deal with the nibble 1101   Then deal with the nibble 1111

(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

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

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

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

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

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

  <u>Ans: 8A</u>

  - (2) Convert 0101 0001 to Hexadecimal.

  <u>Ans: 51</u>

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

2^3	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 RY	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 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