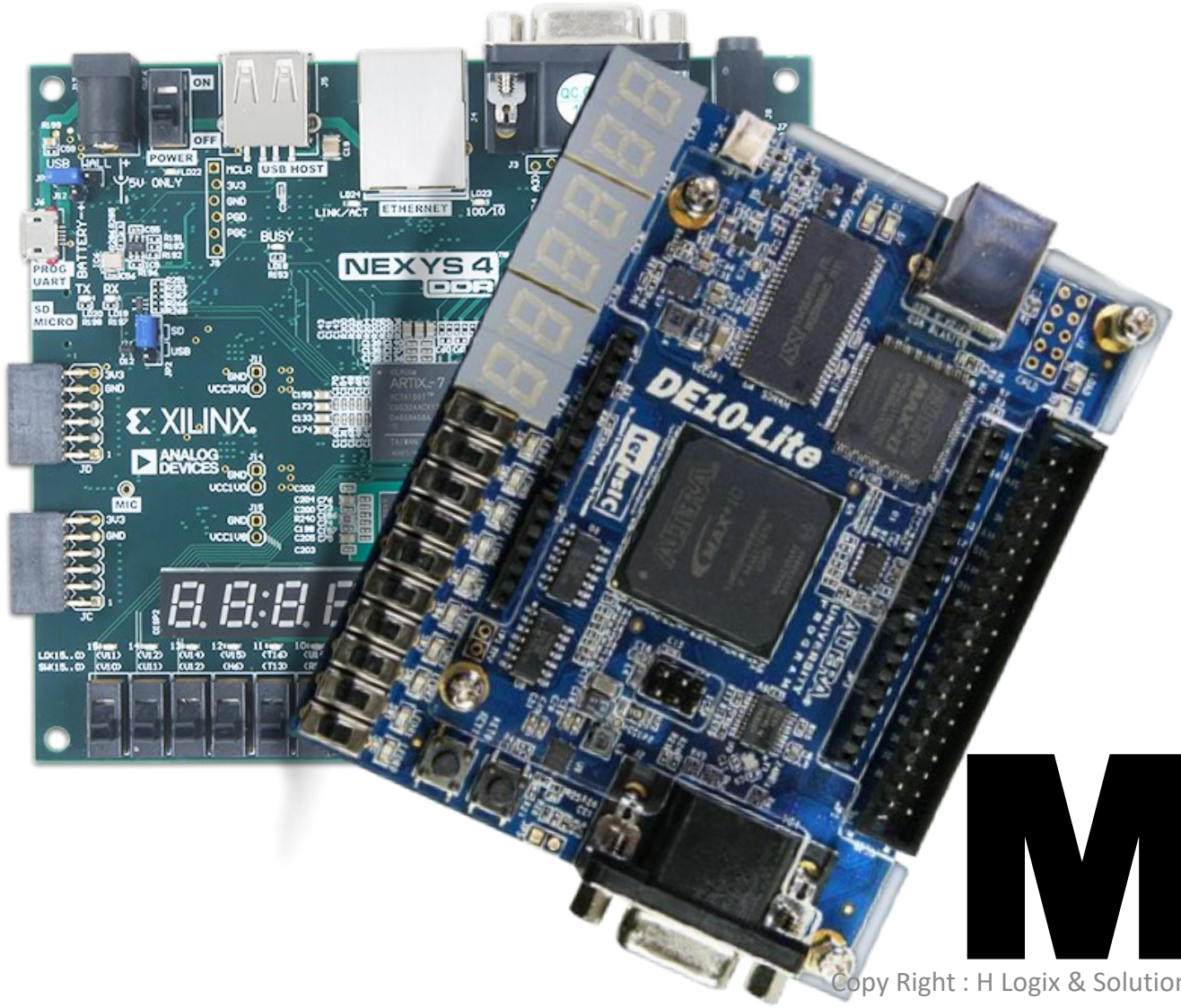
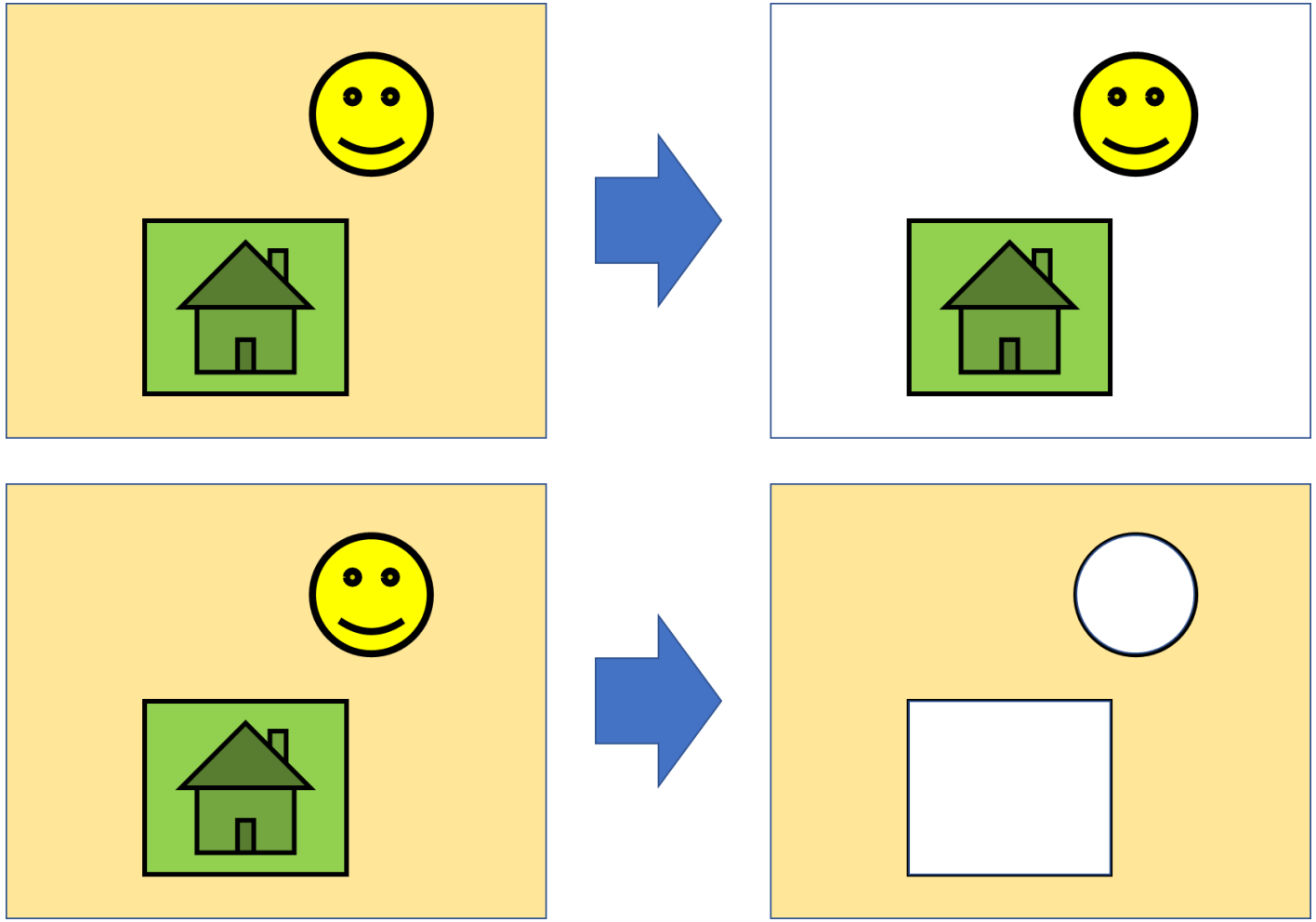
Bit Masking (AND, OR, & XOR)



Bit Masking

What is Masking?



select

remove

What is bit Masking?

1010_1110_1101_1011	**AX**
1111_1111_1101_1011	**Selects AL**
1010_1110_0000_0000	**Clears AL**
1010_1110_1101_0100	**Inverts AX**

How Bit Masking is done?

Bit-wise gate operations

OR, AND, XOR

OR Masking

1010_1110_1101_1011 **AX**

1111_1111_0000_0000 **BX as MASK**

Bits To hide **Bits To retain**

1111_1111_1101_1011 **OR** BX, AX

AND Masking

1010_1110_1101_1011 **AX**

1111_1111_0000_0000 **BX as MASK**

Bits To retain **Bits To clean**

1010_1110_0000_0000 **AND** BX, AX

XOR Masking

1010_1110_1101_1011 **AX**

1111_1111_0000_0000 **BX as MASK**

Bits To retain **Bits To invert**

1010_1110_0010_0100 **XOR** BX, AX

Activity 1

Write a program to swap every pair of bits in the AX register as shown in **Table** below:

A	Contents of A			
Before	0110	0100	0101	0001
After	1001	1000	1010	0010

Activity 1: Solution

Step 1: Separate the bits at [**odd** index] and the bits at [**even** index] through AND masking.

operation	Contents				
A	**0110**	**0100**	**0101**	**0001**	
Mask odd indices(O)	**1010**	**1010**	**1010**	**1010**	O = 0xAAAA
AND O, A	**0010**	**0000**	**0000**	**0000**	
Mask for even indices(E)	**0101**	**0101**	**0101**	**0101**	E = 0x5555
AND E, A	**0100**	**0100**	**0101**	**0001**	

Activity 1: Solution

Step 1:

A	0110	0100	0101	0001

E	0100	0100	0101	0001

O	0010	0000	0000	0000

Step 2:

Even to odd → shift left by 1

Odd to Even → shift right by 1

shl **E**, 1	1000	1000	1010	0010

shr **O**, 1	0001	0000	0000	0000

Step 3:

OR **E**, **O**	1001	1000	1010	0010

Activity 2

Modify your program in Activity 1 to swap two bits as shown in Table below:

A	Contents of A			
Before	0110	0100	0101	0001
After	1001	0001	0101	0100

Solution: Change the masks as below

O = 1100_1100_1100_1100 = 0xCCCC

E = 0011_0011_0011_0011 = 0x3333

shift O & E by 2 rather than 1.

Activity 3

Modify your program in Activity 1 to swap two nibbles as shown in Table below:

A	Contents of A
Before	0110 0100 0101 0001
After	0100 0110 0001 0101

Solution: Change the masks as below

O = 1111_0000_1111_0000 = 0xF0F0

E = 0000_1111_0000_1111 = 0x0F0F

shift O & E by 4.