

# Week 4 tutorial

# Question #1

- a) How do you write the number 78 as an 8-bit binary number?

128	64	32	16	8	4	2	1
0	1	0	0	1	1	1	0

- b) What is the two's complement of 01101101?

10010011

- c) What is the sum of 01101101 and 01101101?

11011010

← Note what's happening here!

## Question #2

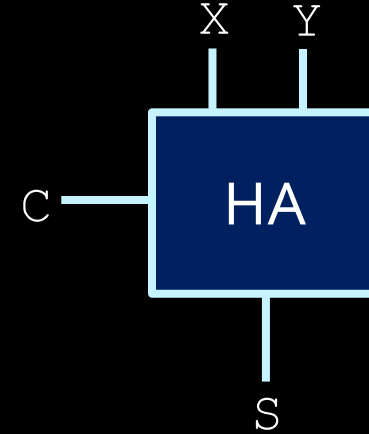
- What groupings are in the K-map on the right?

	$\bar{C} \cdot \bar{D}$	$C \cdot \bar{D}$	$C \cdot D$	$\bar{C} \cdot D$
$\bar{A} \cdot \bar{B}$	1	1	X	1
$A \cdot \bar{B}$	X	0	X	1
$A \cdot B$	1	X	X	1
$\bar{A} \cdot B$	1	X	0	X

- What logic equations do these groupings represent?

$$\bar{A} \cdot \bar{B} + \bar{C}$$

## Question #3



- Implement a half adder in Verilog.
- **Step 1:** What is the half adder logic equation?

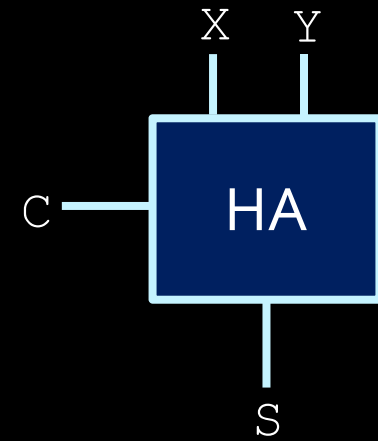
$$\begin{aligned} C &= X \cdot Y & S &= X \cdot \bar{Y} + \bar{X} \cdot Y \\ & & &= X \oplus Y \end{aligned}$$

- **Step 2:** Equivalent Verilog components.

```
assign C = X & Y;  
assign S = X & ~Y | ~X & Y;
```

## Question #3 (cont'd)

- **Step 3:** What is the complete Verilog code for this device?



```
module half_adder(X, Y, C, S);  
    input X, Y;  
    output C, S;  
  
    assign C = X & Y;  
    assign S = X & ~Y | ~X & Y;  
endmodule
```