Week 3 review

Announcements

- Mid-term exam for CSC 258:
  - On Friday, 22 June 2018, 2.00 – 4.00pm
  - Last names: A – M at BA2145
  - Last names: O – Z at BA2155
- Class List – sign while submitting in-class exercise
- In-Class Exercise
  - **underline** your last name
  - write the PS set number (PS 04) or today's date
  - write the course code (CSC 258)
  - sign the PS submission list when submitting your set

Question #1

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

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

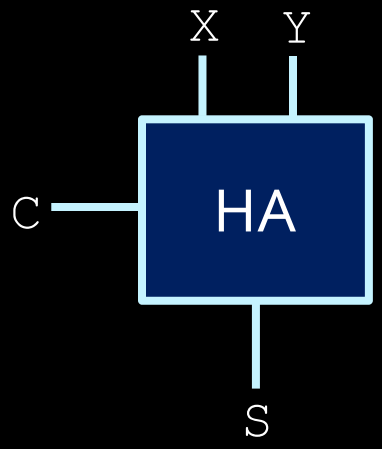
- What groupings are in the K-map on the right?

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

- What logic equations do these groupings represent?

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

Question #3



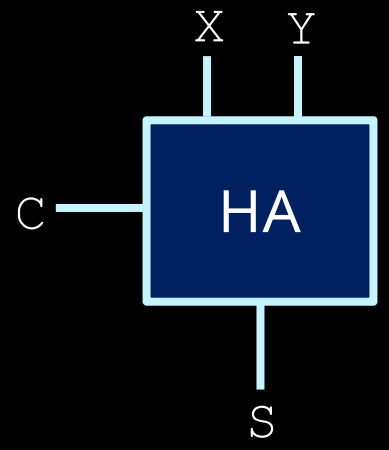
- Implement a half adder in Verilog.
- Step 1: What is the half adder logic equation?

$$C = X \cdot Y \qquad S = X \cdot \overline{Y} + \overline{X} \cdot Y = X \oplus Y$$

- 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?

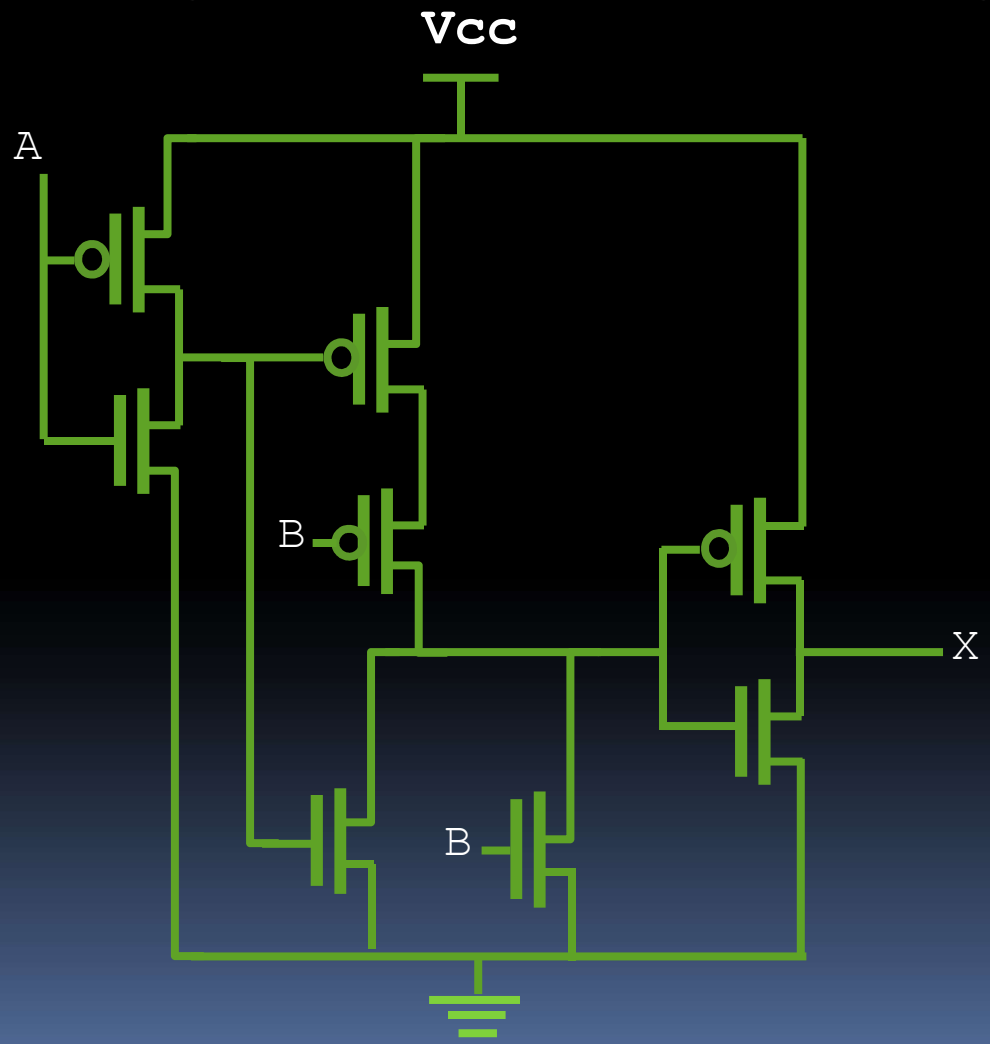
```
module half_adder(X, Y, C, S);
    input X, Y;
    output C, S;

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

Problem Set 03

Question 1

What gate is created by the following?



A	B	X
0	0	1
0	1	1
1	0	0
1	1	1

A	B	X
0	0	1
0	1	1
1	0	1
1	1	0

$X = \overline{(A \cdot \overline{B})}$ or

$X = \overline{A} + B$

Question 2 - Minterms

- Write Y in SOM (Sum Of Minterms) form.

A	B	C	Y
0	0	0	0
0	0	1	1
0	1	0	1
0	1	1	0
1	0	0	1
1	0	1	0
1	1	0	0
1	1	1	1

$$Y = \overline{A} \cdot \overline{B} \cdot C + \overline{A} \cdot B \cdot \overline{C} + A \cdot \overline{B} \cdot \overline{C} + A \cdot B \cdot C$$

$$Y = m_1 + m_2 + m_4 + m_7$$

Question 3

- What is the most reduced form, in sum of products form, of the function from the truth table on the right?

$$Y = m_0 + m_1 + m_2 + m_5 + m_7 + m_8 + m_9 + m_{10} + m_{13} + m_{15}$$

A	B	C	D	Y
0	0	0	0	1
0	0	0	1	1
0	0	1	0	1
0	0	1	1	0
0	1	0	0	0
0	1	0	1	1
0	1	1	0	0
0	1	1	1	1
1	0	0	0	1
1	0	0	1	1
1	0	1	0	1
1	0	1	1	0
1	1	0	0	0
1	1	0	1	1
1	1	1	0	0
1	1	1	1	1

Question #4 (cont'd)

	$\overline{C}\cdot\overline{D}$	$\overline{C}\cdot D$	$C\cdot D$	$C\cdot\overline{D}$
$\overline{A}\cdot\overline{B}$	1	1	0	1
$\overline{A}\cdot B$	0	1	1	0
$A\cdot B$	0	1	1	0
$A\cdot\overline{B}$	1	1	0	1

$$Y = \overline{C}\cdot D + B\cdot D + \overline{B}\cdot\overline{D}$$

Question #4 (alternative)

- An alternative grouping:

	$\overline{C}\cdot\overline{D}$	$\overline{C}\cdot D$	$C\cdot D$	$C\cdot\overline{D}$
$\overline{A}\cdot\overline{B}$	1	1	0	1
$\overline{A}\cdot B$	0	1	1	0
$A\cdot B$	0	1	1	0
$A\cdot\overline{B}$	1	1	0	1

$$Y = \overline{B}\cdot\overline{C} + B\cdot D + \overline{B}\cdot\overline{D}$$

Problem Set 03

Questions

1. Convert the following decimal values to 2's complement number:
   - -89
   - -62
2. Convert the following 2's complement number to it's decimal equivalent
   - 10110011
   - 10000011
3. Preform binary subtraction on these two numbers: 103 and 69. Show the steps.

Question 4: Full Adder

X	Y	Z	C	S
0	0	0	0	0
0	0	1	0	1
0	1	0	0	1
0	1	1	1	0
1	0	0	0	1
1	0	1	1	0
1	1	0	1	0
1	1	1	1	1

Simplify the following two equations so that they use at least one XOR gate ($\oplus$):

$C = \sum(3,5,6,7)$

$=$

$=$

$S = \sum(1,2,4,7)$

$=$

$=$