Week 3 review

Question #1

- What groupings in the K-map 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?

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

- What logic equations do these groupings represent?

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

Question #2

- Find the groupings in the following K-Map

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

- Produce a logical equation for these groupings:

Question #2

- Find the groupings in the following K-Map

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

- Produce a logical equation for these groupings:

$$A + \overline{D}$$

Question #2: alternative

- Find the groupings in the following K-Map

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

- Produce a logical equation for these groupings:

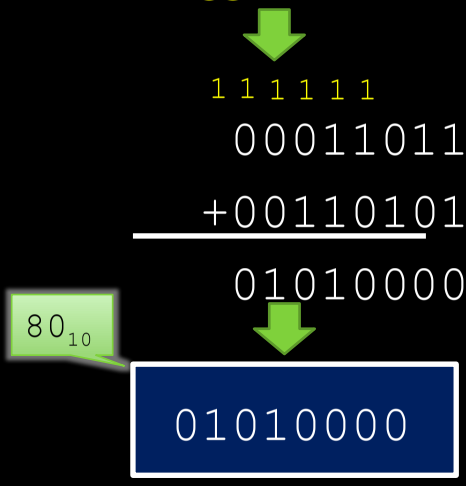
$$\overline{D} + C$$

Unsigned binary addition

- 27 + 53

27 = 00011011

53 = 00110101



- 95 + 181

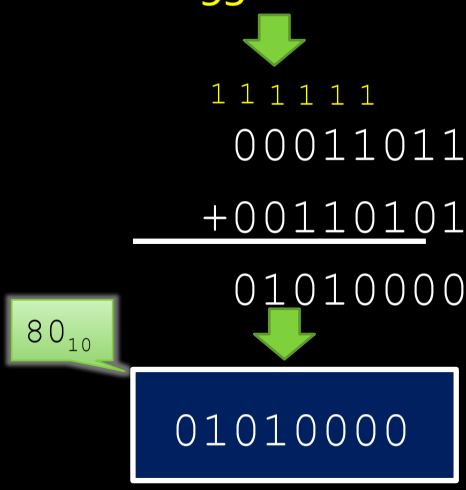
```
 01011111
+10110101
```

Unsigned binary addition

- 27 + 53

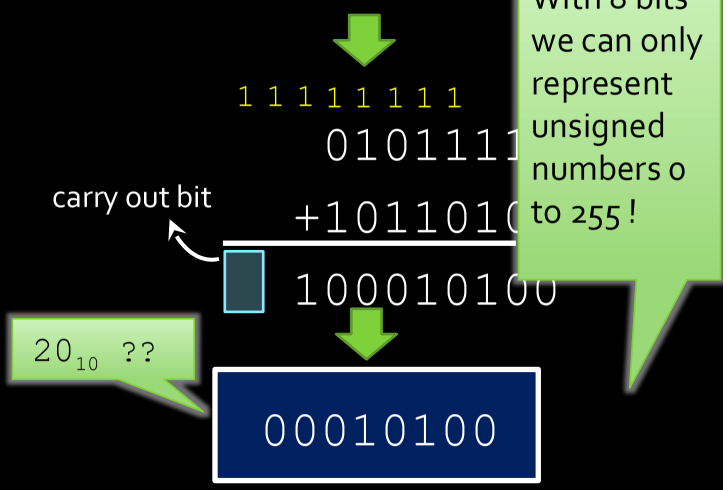
27 = 00011011

53 = 00110101



- 95 + 181

```
 01011111
+1011010
```



With 8 bits we can only represent unsigned numbers o to 255 !

Question #3

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

b) What is `11001010` In decimal?

202

We will revisit this!

Negative Binary Numbers

- two's complement also known as signed
  - All bits are data bits.
  - Most significant bit (MSB) has negative value.
- Example:
  Represent -18 as a 6-bit signed number:

bit value:	-2^5	2^4	2^3	2^2	2^1	2^0
	1	0	1	1	1	0

Most significant bit (MSB) is worth **-32**

Key Idea

- By design:
  X + 2's-complement(X) = 0
  - Always!
- Therefore:
  2's complement of X is –X
- Tradeoff with signed 2's complement :
  can represent fewer positive numbers with same number of bits.

Signed Subtraction example

- 7 – 3

```
    0111
   -0011
   ------
    0111
   +1101
   ------
   10100
```

discarded

$0100 = 4_{10}$

- -3 – 2

```
    1101
   -0010
   ------
    1101
   +1110
   ------
   11011
```

discarded

$1011 = -5_{10}$

Question #4

a) What is the two's complement of `01101101`?

`10010011`

b) What is `11001010` In decimal?

Unsigned **202**

Signed (2's complement) **-54**

Question #5

- Compute in 8 bits:
  - 75 – 120

```
 75 = 0100 1011
120 = 0111 1000
```

  - 98 – 35

Question #5

- Compute in 8 bits:
  - 75 – 120

```
 75 = 0100 1011
120 = 0111 1000

-120 = 1000 1000

75-120= -45 = 1101 0011
```

  - 98 – 35

Question #5

- Compute in 8 bits:
  - 75 – 120

```
 75 = 0100 1011
120 = 0111 1000

-120 = 1000 1000

75-120= -45 = 1101 0011
```

  - 98 – 35

```
 98 = 0110 0010
 35 = 0010 0011
```

Question #5

- Compute in 8 bits:
  - 75 – 120

```
  75 = 0100 1011
 120 = 0111 1000

-120 = 1000 1000

75-120= -45 = 1101 0011
```

  - 98 – 35

```
  98 = 0110 0010
  35 = 0010 0011

 -35 = 1101 1101

98-35=  63 = 0011 1111
```