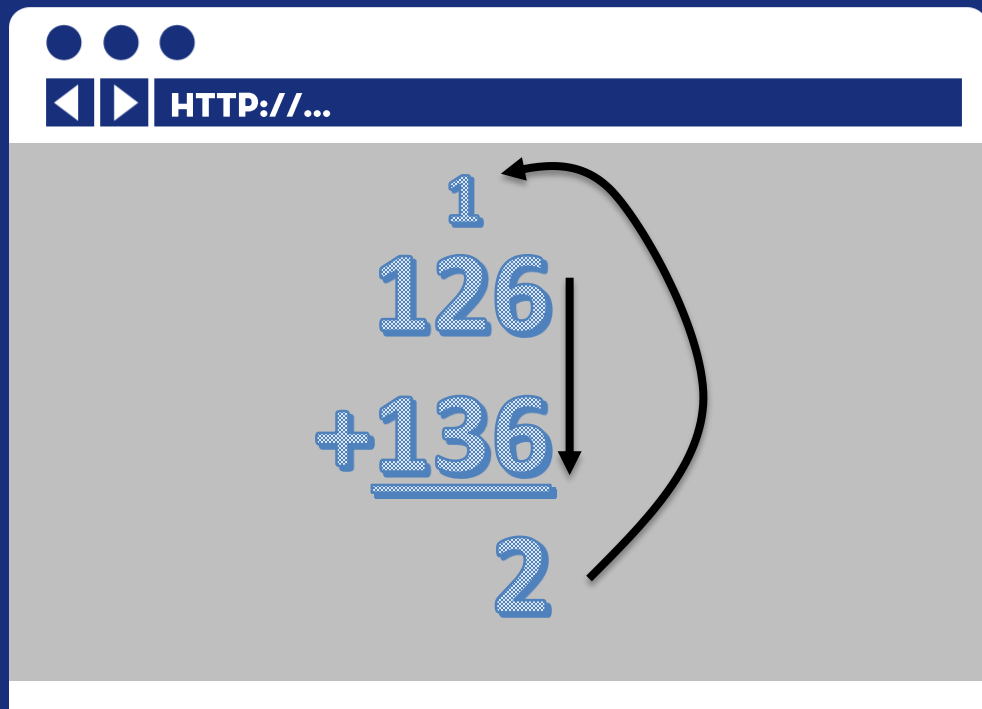


# ADDING BINARY NUMBERS

# REVIEW: ADDING DECIMAL #'S

## COLUMN-BY-COLUMN

- STARTING WITH 1'S COLUMN
  - ADD TOP-TO-BOTTOM
  - IF RESULT IS GREATER THAN ONE DIGIT CAN REPRESENT, WE CARRY A ONE TO THE TOP OF NEXT COLUMN
- REPEAT PROCEDURE FOR EVERY COLUMN MOVING RIGHT-TO-LEFT



# AN EXAMPLE

## DECIMAL ADDITION

### •ONES COLUMN:

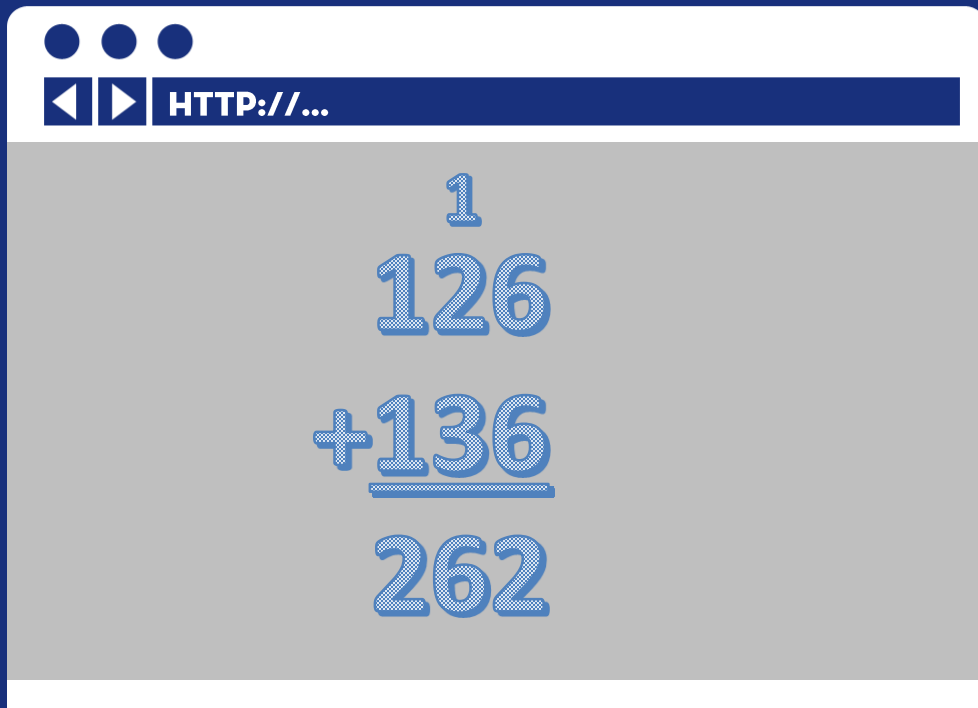
- $6+6 = 12$
- TOO BIG FOR ONE COLUMN
- LEAVE THE 2
- CARRY THE 1 TO THE TENS COL.

### •TENS COLUMN:

- 1 CARRIED FROM BEFORE, SO...
- $(1+)2+3 = 6$
- ALL GOOD, NO NEED TO CARRY
- LEAVE THE 6

### •HUNDREDS COLUMN:

- NO CARRY FROM BEFORE
- $1+1 = 2$
- NO CARRY NEEDED
- LEAVE THE 2
- DONE!!



# BINARY ADDITION

## VERY SIMILAR

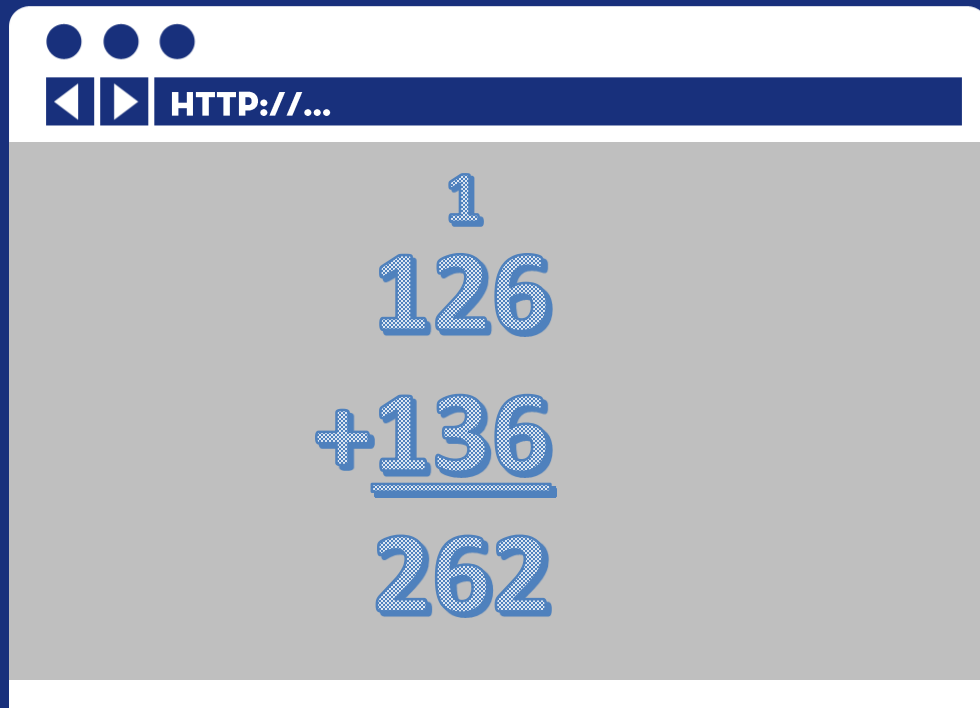
### ▪THE MAIN DIFFERENCE:

- 1 IS THE BIGGEST DIGIT
- IF ADDITION RESULT IS GREATER THAN 1, WE NEED A CARRY

### ▪JUST REMEMBER, FOR A SINGLE COLUMN:

- $0+0 = 0$
- $1+0 = 1$
- $0+1 = 1$
- $1+1 = 10$  (1 IS CARRIED)
- $1+1+1 = 11$  (1 IS CARRIED)

### ▪LAST CASE HAPPENS ONLY WHEN PREVIOUS COLUMN HAD A CARRY



# AN EXAMPLE

## BINARY ADDITION

•FOR THE PROBLEM TO THE RIGHT:

•ONES COLUMN:

• $1+1 = 10$  (CARRY THE 1)

•TWS COLUMN:

• $1+0+0 = 1$

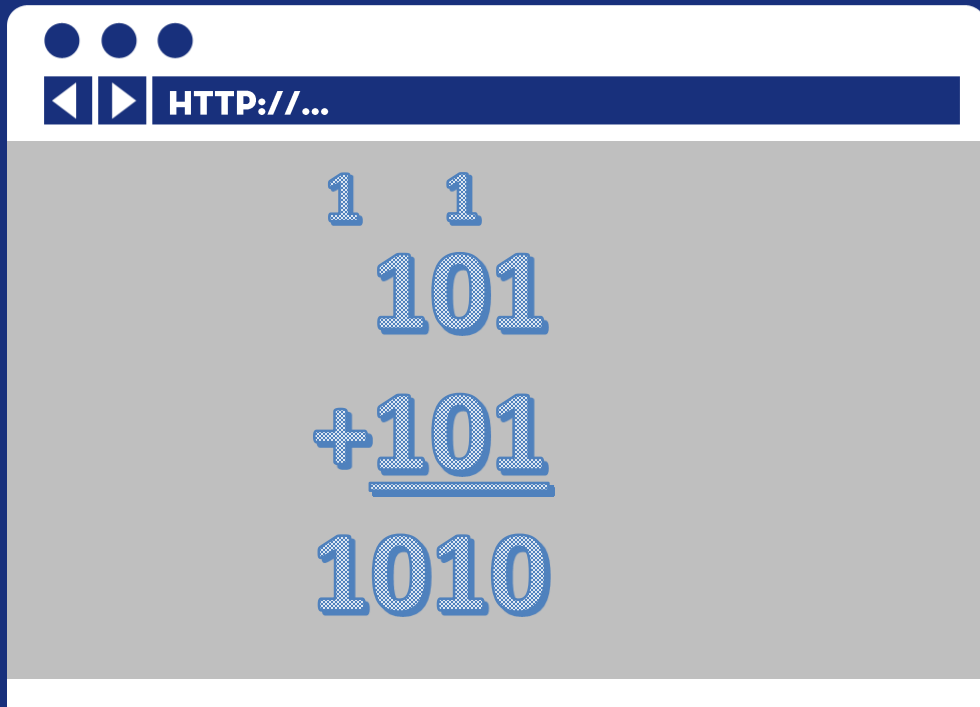
•FOURS COLUMN:

• $1+1 = 10$  (CARRY THE 1)

•EIGHTS COLUMN:

• $1+0+0 = 1$

•DONE!



# AN EXAMPLE

## CHECKING YOUR WORK


• YOU CAN CHECK BY CONVERTING ORIGINAL NUMBERS TO DECIMAL AND PERFORMING THAT PROBLEM SEPEARTELY

• WHEN DONE, CONVERT THE RESULT BACK TO BINARY.

• IF CORRECT, THE RESULTS WILL BE THE SAME

A browser window with a dark blue header containing navigation arrows and the text "HTTP://...". The main content area is light gray and displays a binary addition problem. On the left, under the heading "Binary", the numbers "1 1" are stacked above "101", which is added to "+101". The result is "1010". On the right, under the heading "Decimal", the number "5" is added to "+5", resulting in "10". To the right of the decimal result is the text "Convert Back" with a checkmark icon. The final result is shown as "10 = 1010<sub>2</sub>".

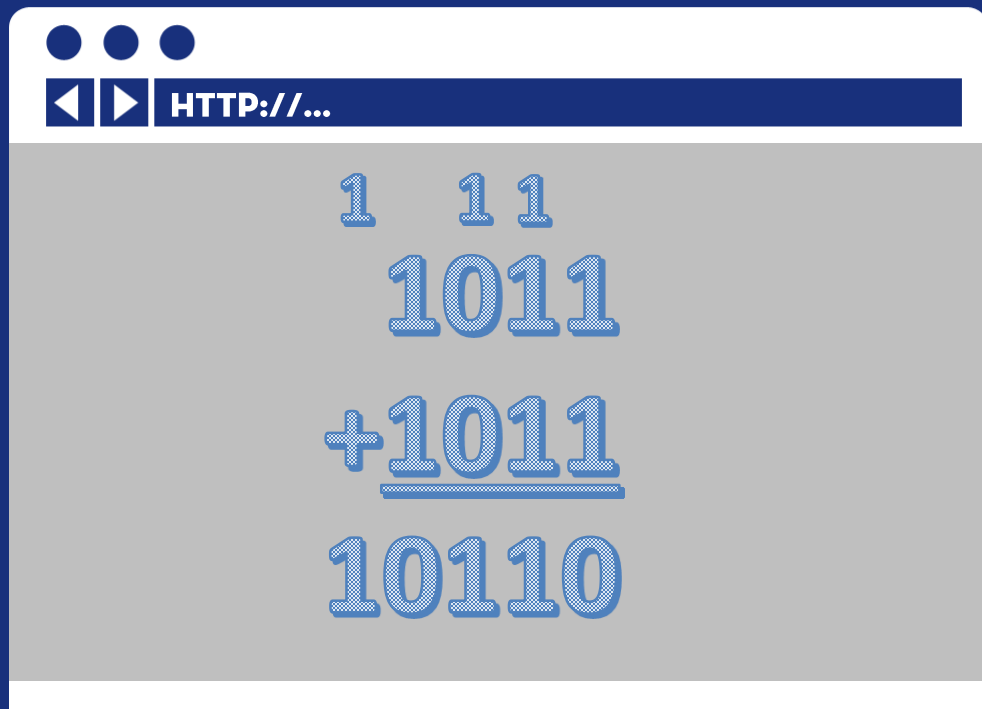
Binary	Decimal
1 1	
101	5
+ <u>101</u>	+ <u>5</u>
1010	10 = 1010 <sub>2</sub>

Convert Back 

# ANOTHER EXAMPLE

## LOTS OF CARRIES

- ONES COLUMN:  $1+1 = 10$  (CARRY)
- TWOS COLUMN:  $1+1+1 = 11$  (CARRY)
- FOURS COLUMN:  $1+0+0 = 1$
- EIGHTS COLUMN:  $1+1 = 10$  (CARRY)
- SIXTEENS COLUMN:  $1+0+0 = 1$
- (DONE!)



**THE END!**