Simple Binary Addition

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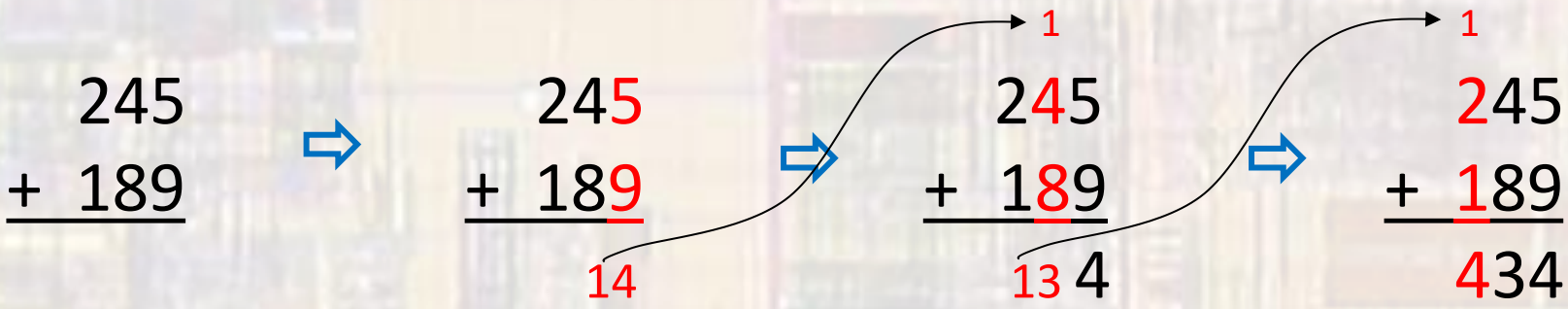
These slides introduce simple addition with Binary Numbers

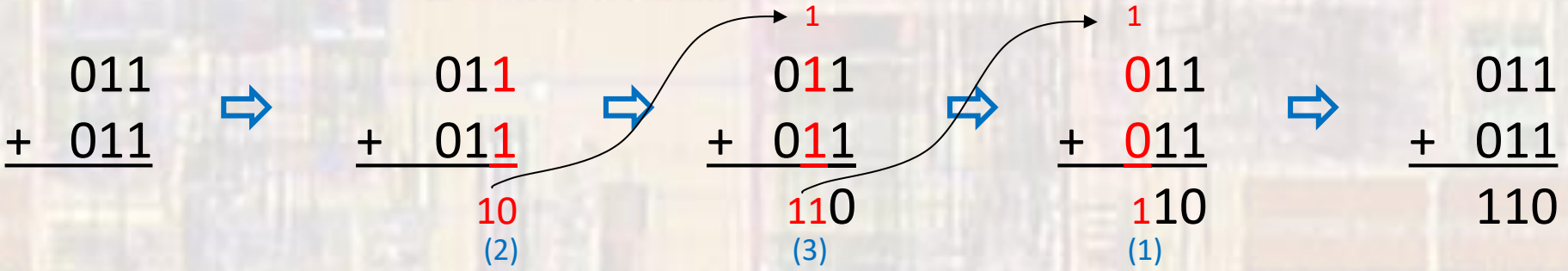
Simple Binary Addition

- Elementary school concepts
  - Add columns of numbers and keep track of the carry over to the next column
  - We normally use the decimal number system
    - Digits: 0-9
    - Carry over is in sets of 10



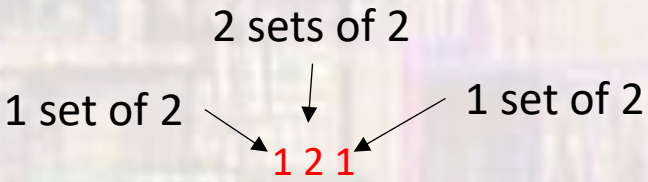
Simple Binary Addition

- Extend elementary school concepts
  - Add columns of numbers and keep track of the carry over to the next column
  - Use the binary number system
    - Digits: 0-1
    - Carry over is in sets of 2



Simple Binary Addition

- Examples




```
  1 2 1
  0010
  0011
+ 0111
------
  1100
```

```
  1 1
  001
+ 011
-----
  100
```

```
  1 2 2 2 1
  000110
  001111
+ 001111
--------
  100100
```

```
  1 3 2 2 1
  001110
  001110
  001001
+ 001011
--------
  110000
```

Simple Binary Addition

- Overflow
  - In elementary school we did not care how many digits the answer required

```
  745
+ 589
 1334
```

  - In binary addition – we are generally representing something that ultimately is to be executed in hardware
    - Our hardware cannot change the number of bits (wires) it can hold
    - We must establish a maximum number size (# of bits) and create an error when the result of the addition does not fit in this size
    - The error is called an overflow
  - We will deal with this issue in a future lecture