

# DFA Examples

## Lecture 5 Section 2.1

Robb T. Koether

Hampden-Sydney College

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# Outline

- 1 Examples
- 2 Assignment

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# Examples

## Example (Regular languages)

Design finite automata that will recognize the following languages over  $\Sigma = \{\mathbf{a}, \mathbf{b}\}$ .

- All strings in which each **a** is followed immediately by **b**.
- All strings that contain **aba** or **bab**.
- All strings that contain **aba** and **bab**.

# Examples

## Example (Regular languages in C++)

Over the alphabet of ASCII symbols.

- All strings that represent C++ identifiers.
- All strings that represent C++ **ints**.

# Examples

## Example (Binary Addition)

- Design a DFA that will recognize mathematically correct binary addition problems.
- For example:

$$\begin{array}{r} 10110 \\ \underline{00100} \\ 11010 \end{array}$$

- The input symbols are triples of binary digits (000, 001, 010, etc.), representing the columns.
- Read the columns from right to left.

# Examples

## Example (Binary Addition)

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- Read the columns from right to left.
- Can we also process them from left to right with a DFA?

# Examples

## Example (Binary Multiplication by 2)

- Design a DFA that will recognize mathematically correct binary multiplication by 2.
- That is, given two binary numbers, does the second one equal 2 times the first one?
- For example,  $11 \times 2 = 22$ :

```
01011
10110
```

- The input symbols are pairs of binary digits (00, 01, 10, 11), representing the columns.
- Read the columns from right to left.

# Examples

## Example (Binary Multiplication by 2)

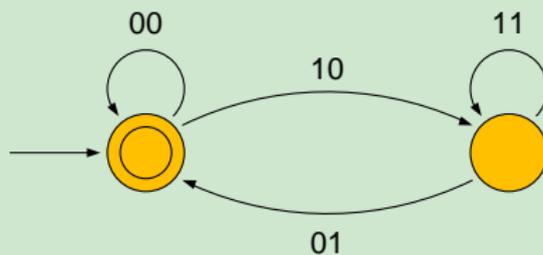
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# Examples

## Example



# Examples

## Example (Binary Multiplication by 3)

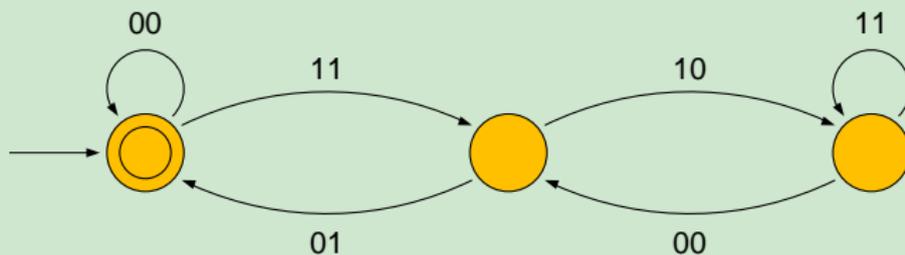
- Design a DFA that will recognize mathematically correct binary multiplication by 3.
- That is, given two binary numbers, does the second one equal 3 times the first one?
- For example,  $13 \times 3 = 39$ :

```
001101
100111
```

- The input symbols are pairs of binary digits (00, 01, 10, 11), representing the columns.
- Read the columns from right to left.

# Examples

## Example



# Examples

## Example (Binary Multiplication by 5)

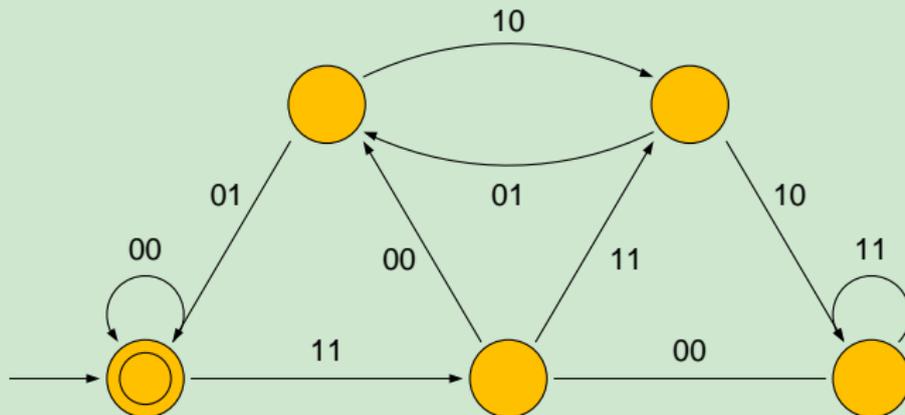
- Design a DFA that will recognize mathematically correct binary multiplication by 5.
- That is, given two binary numbers, does the second one equal 3 times the first one?
- For example,  $19 \times 5 = 95$ :

```
0010011
1011111
```

- The input symbols are pairs of binary digits (00, 01, 10, 11), representing the columns.
- Read the columns from right to left.

# Examples

## Example



# Examples

## Example (Binary Multiplication by 6)

- For any fixed integer  $n$ , can a DFA recognize multiplication by  $n$ ?

# Outline

- 1 Examples
- 2 Assignment**

# Assignment

## Assignment

- Section 2.1 Exercises 11abd, 12, 13, 14, 16, 19, 22, 28.