CC141
Discrete Structures

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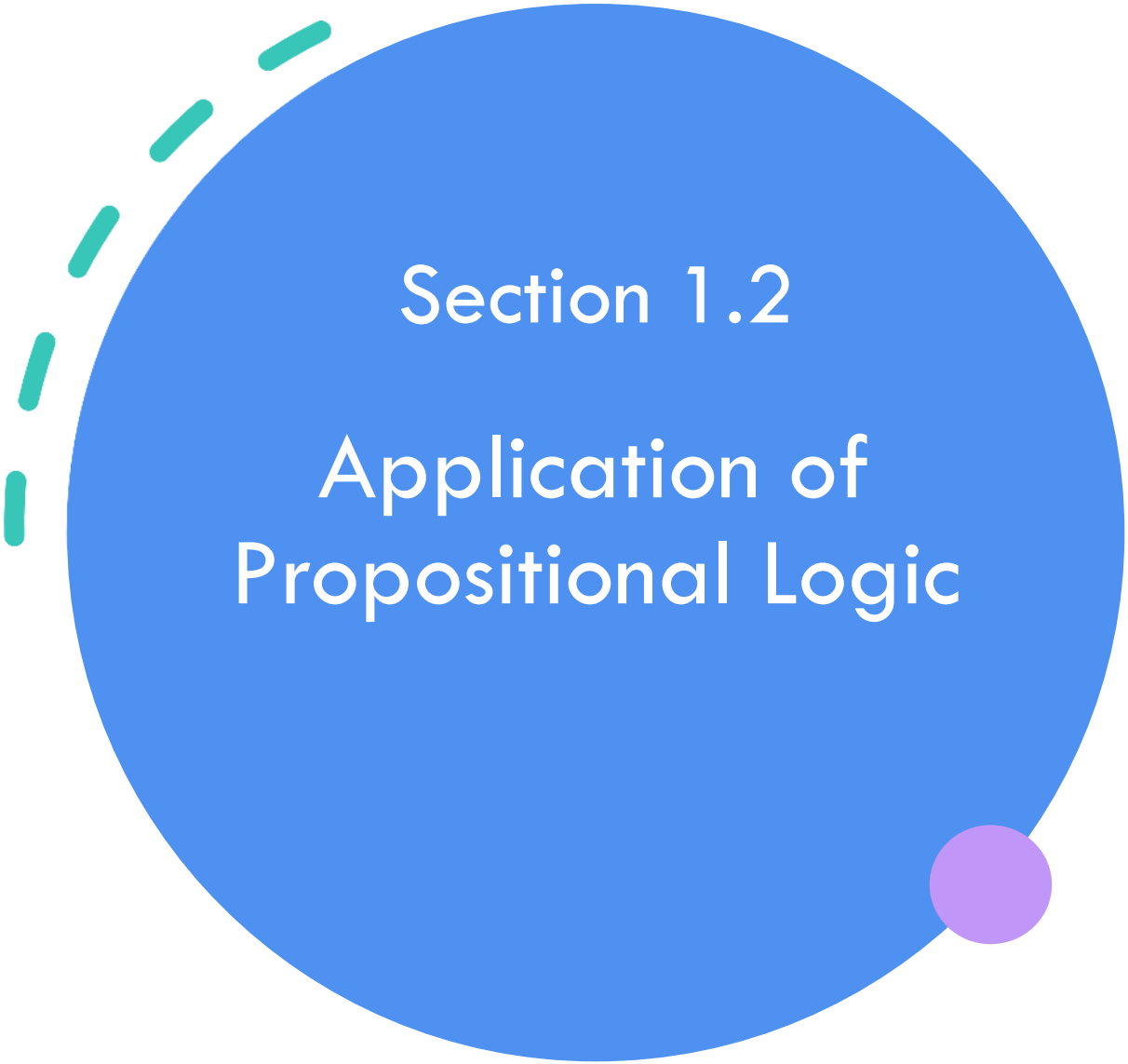

Section 1.2
Application of
Propositional Logic

Application of Logic

- Translating English Sentences
- System Specifications
- Boolean Searches
- Logic Puzzles
- Logic Circuits

Translating English Sentences

Step 1 : find logical connectives

Step 2: break the sentence into basic propositions

Step 3: rewrite the sentence in propositional logic

Translating English Sentences

Example:

- If you are senior citizen and it is a Tuesday, then you can have free coffee

Step 1 : find logical connectives

Step 2: break the sentence into basic propositions

Translating English Sentences

Step 2: break the sentence into basic propositions

Example:

if you are senior citizen and it is a Tuesday then

a b

you can have free coffee

c

Translating English Sentences

Step 3: rewrite the sentence in propositional logic

Example:

if you are senior citizen and it is a Tuesday then

a b

you can have free coffee

c

$a \wedge b \rightarrow c$

System Specifications

- “The automated reply cannot be sent when the file system is full”

System Specifications

p="The automated reply can be sent"

q="The file system is full."

Then ¬p represents "It is not the case that the automated reply can be sent," which can also be expressed as "The automated reply cannot be sent."

System Specifications

"The automated reply cannot be sent when the file system is full"

- p="The automated reply can be sent"
- q="The file system is full."

- Consequently, our specification can be represented by the conditional statement
  - $q \rightarrow \neg p$

Boolean Searches

Boolean Searches

Logical connectives are used extensively in searches of large collections of information, such as indexes of Web pages. Because these searches employ techniques from propositional logic, Links they are called Boolean searches

Example: Web Search:

UMT AND CS AND DISCRETE

UMT OR CS OR DISCRETE

Logical Puzzles

Puzzles that can be solved using logical reasoning are known as logic puzzles

Logic Puzzles

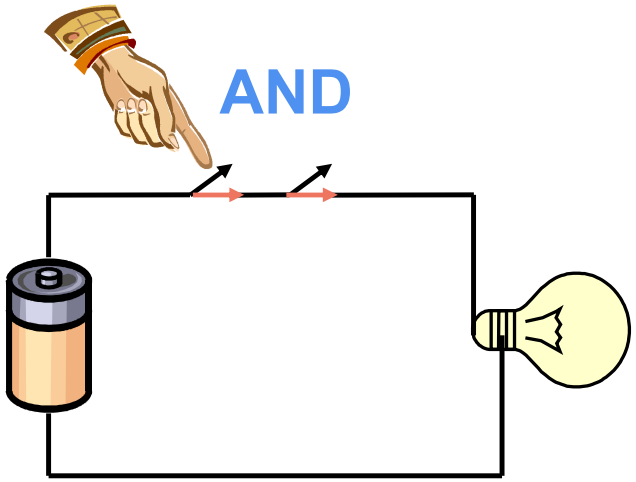
- There is an island that has two kinds of inhabitants,
  - knights, who always tell the truth,
    and their opposites,
  - knaves, who always lie.
- You encounter two people A and B.
- What are A and B if A says “B is a knight” and B says “The two of us are opposite types?”

Logical Circuits

Switches “in series”

Switches “in parallel”

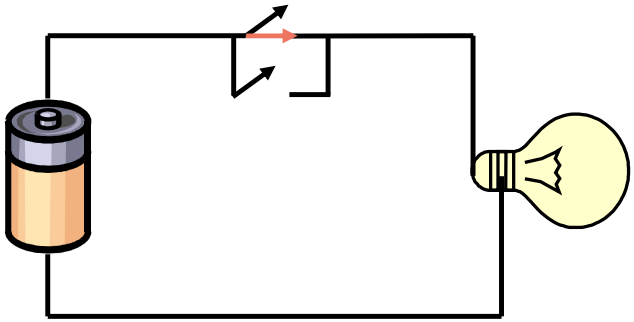
Switching Circuits – Series Circuit



Switches		Light Bulb
P	Q	State
Closed	Closed	On
Closed	Open	Off
Open	Closed	Off
Open	Open	Off

Switching Circuits – Parallel Circuit

OR



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Logic Circuits

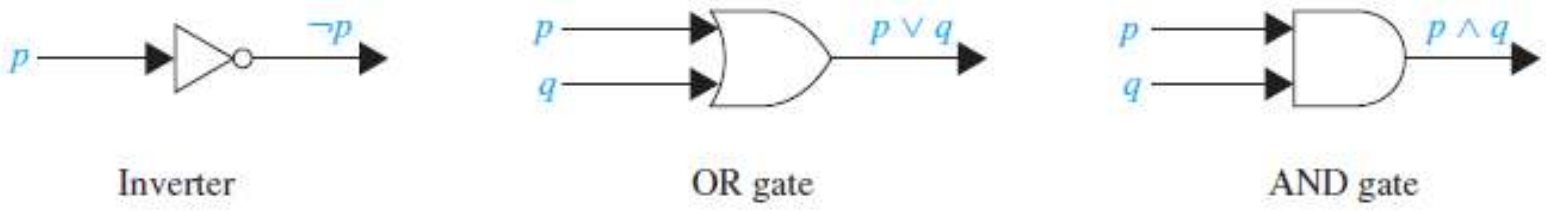
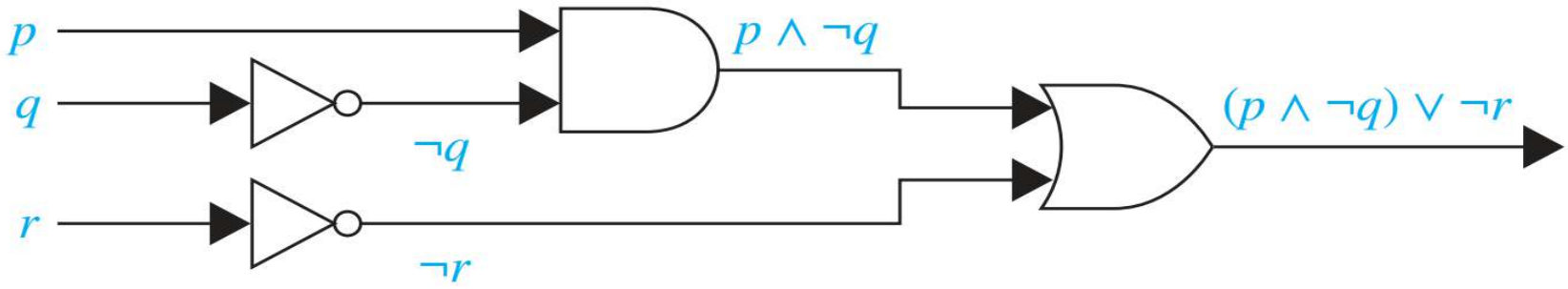


FIGURE 1 **Basic logic gates.**

Logic Circuits

- Determine the output for the combinatorial circuit in following Figure

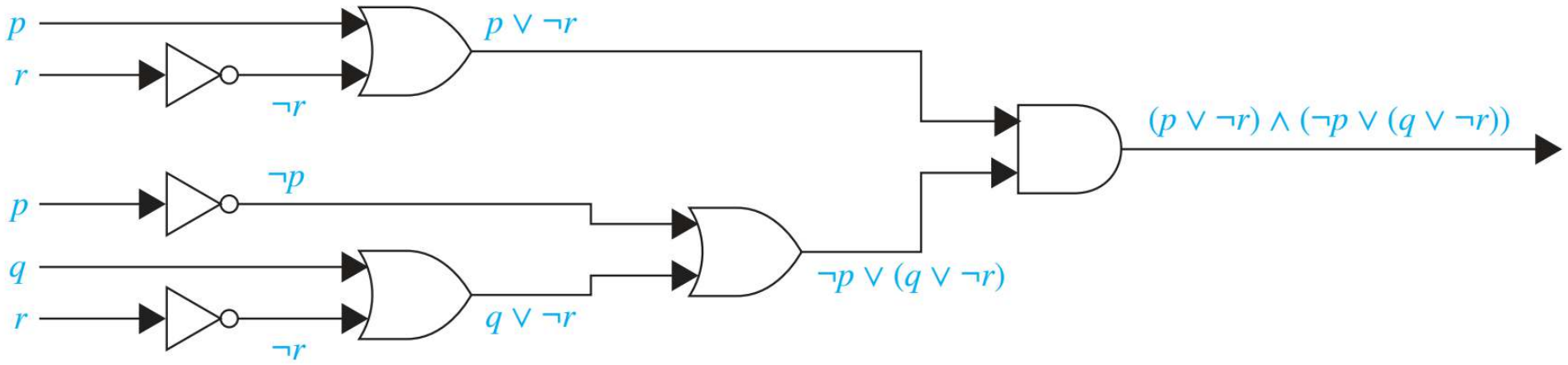


Logic Circuits

- Build a digital circuit that produces the output

  (p ∨¬r) ∧ (¬p ∨ (q ∨¬r))

- when given input bits p, q, and r.



Summary

1.2 Application of Propositional Logic

- ✓ Translating English Sentences
- ✓ System Specifications
- ✓ Boolean Searches
- ✓ Logic Puzzles
- ✓ Logic Circuits