Electrical Circuits and Logic

Text Chapter 3 – Section 7

Proposition – Electrical Switch

o A proposition is true or false, not both.

o An electric switch is on or off, not both.

o If a switch is open (off) the power can not pass through.

o If a switch is closed (on) the power will pass through.
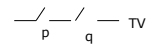
No in-class assignment problem

Electrical Circuits – Logical Statements

o Switch on(closed)will be represented by T.
o Switch off (open) will be represented by F.
o A TV is plugged into a wall outlet governed by a switch.
o The TV has an on-off button.
o The TV will be on only if both the wall switch and the on-off button the TV are on.
o Let wall switch be p and the on-off switch be q.

No in-class assignment problem

Series – One path for power

o This type of circuit is called a series.
o A series circuit may be logically represented as a conjunction.
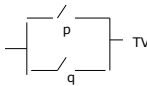o TV on only if both are on.
o Series ↔ Conjunction

p	q	TV	p∧q
T	T	T - on	T
T	F	F - off	F
F	T	F - off	F
F	F	F - off	F

No in-class assignment problem

Parallel – 2 or more paths for power

o In this case the power can flow through either path or both.
o A parallel circuit can be logically represented as a disjunction.
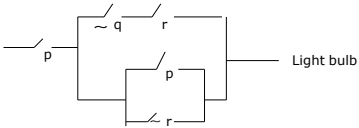o Parallel → Disjunction.

p	q	TV	p∨q
T	T	T - on	T
T	F	T - on	T
F	T	T - on	T
F	F	F - off	F

No in-class assignment

A Switching Circuit as a Symbolic Statement

1. Can the power go through more than one path? – parallel - or
2. In some parts can the power only go through one part? – series – and

Light bulb

No in-class assignment

The Symbolic Statement

○ Write the symbolic statement.
○ Make a truth table to determine under what conditions the light bulb will go on.

$$p \wedge \left[\sim q \wedge r \ \vee \ p \vee \sim r \right]$$

In-class Assignment 15 - 1

The Truth Table for the Circuit

$$p \wedge \left[\ \sim q \wedge r \ \vee \ p \vee \sim r \ \right]$$

p	q	r	~q	~r	1 ~q∧r	2 p∨~r	1∨2	p∧(1∨2)
T	T	T	F	F	F	T	T	T
T	T	F	F	T	F	T	T	T
T	F	T	T	F	T	T	T	T
T	F	F	T	T	F	T	T	T
F	T	T	F	F	F	F	F	F
F	T	F	F	T	F	T	T	F
F	F	T	T	F	T	F	T	F
F	F	F	T	T	F	T	T	F

In-class Assignment 15 - 2

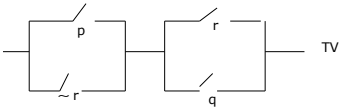## Drawing an Electrical Circuit from a Symbolic Statement

○ Note the conjunctions which mean these switches will be connected in series (in the same line).
○ Note the disjunctions which these switches will be connected in parallel (different lines),

$$p \vee \sim r \ \wedge \ r \vee q$$

In-class Assignment 15 - 3

The Switching Circuit

$$p \vee \sim r \ \wedge \ r \vee q$$

TV

In-class Assignment 15 – 3