Comp3402   Simplification using Boolean Algebra

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Purpose	(i) To learn how to simplify logic expressions using Boolean Algebra
Files Required	Logisim Software (open source)
ILO Contribution	LO 4
Send to Me	nix
Homework	Read chapter 11 (WIP)

You may need the following *identities (rules)* for your simplifications

distributive	$X \cdot Y + X \cdot Z = X \cdot (Y + Z)$
complement	$X + {\sim}X = 1$
identity	$X \cdot 1 = X$
absorption	$X + X \cdot Y = X$
De Morgan	${\sim}X + {\sim}Y = {\sim}(X \cdot Y)$

Simplification of L = … expressions leading to simpler language descriptions

Here we shall revisit the four **L = …** expressions you created in worksheet 1, and following the hints provided you will simplify the expressions, and therefore produce a simpler language description of the circuits.

For each of the four examples from worksheet 1, do the following:

(a) Use the hints provided to simplify the expression **Write down each step of the simplification**
(b) Write down the expression in simple English

1   Hints:

(a) first use the distributive rule
(b) Then use the complement rule
(c) Finally use the identity rule.

2   Hints:

(a) first use the distributive rule
(b) Then use the complement rule

(c) Finally use the identity rule.

3   Hints:

(a) Use the distributive rule for two of the three mini-terms (you must choose)
(b) Use the complement rule on the result of (a)
(c) You will have two terms remaining. One will be a single variable. Use the absorption rule on this to add another term. **Hint:** Choose this to cancel out the third original mini-term.
(d) Now apply the complement rule
(e) And finally apply the identity rule.

(f) You can make a further simplification using De Morgan. Write down the simple English statement of your result.

4   Proceed as in **3.**

5   **Preparation for the Position Paper**

In the position paper you are required to explain "the relationship between natural language and digital logic". Here's how the first two worksheets could help.

The four examples in worksheet 1 were all expressed in clear but involved English language.

The same four examples revisited here were simplified using Boolean algebra. So the expression of the solution in English language should be simpler too.

Perhaps you may like to compare both English language descriptions, before and after simplification.