Foundations of Information Systems

Winter Semester 2023–24, Exercise 2

For discussion on Tuesday(!), October 31, 2023

1. Prove the following statements, referring to the axioms of Boolean algebra and, if applicable, elementary theorems from class:

   (a) $(a \wedge b) \vee (a \wedge b') = a$

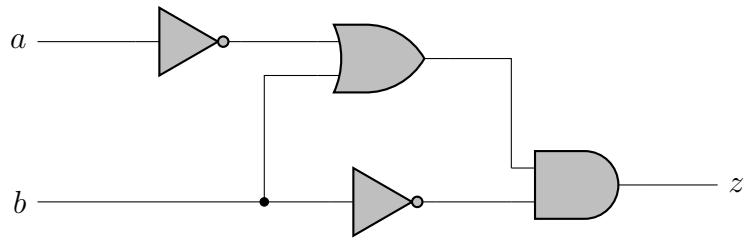
   (b) $(a \wedge b') \vee b = a \vee b$

   (c) $(a \vee b) \wedge (b \vee c) \wedge (a' \vee c) = (a \vee b) \wedge (a' \vee c)$

2. Derive and simplify a Boolean algebra expression for the following binary truth table:

a	b	c	z
0	0	0	0
0	0	1	1
0	1	0	0
0	1	1	1
1	0	0	1
1	0	1	0
1	1	0	1
1	1	1	0

3. (a) Convert the following circuit diagram into a Boolean expression and simplify, if possible:



   (b) Draw a circuit diagram implementing the following Boolean expression:

$$z = (a \wedge b' \wedge c) \vee (a' \wedge b) \vee (a \wedge c)'$$

4. Perform the following conversion to different number systems:

   (a) $(\mathrm{DC})_{16} = (\ldots)_2 = (\ldots)_{10}$

   (b) $(110101)_2 = (\ldots)_{10} = (\ldots)_{16}$

   (c) $(1000)_{10} = (\ldots)_2 = (\ldots)_{16}$