1. Simplify the following boolean expressions, using nothing more than the properties listed in Tables 2.13, 2.14, 2.15 in the textbook:
   a) \(A.B.C.D + A.B.C.D + B.D\)
   b) \((A + B). (A + C). (B.C + D)\), hint: use distributive property only
   c) \((A+C). (A + \bar{C})\)
   d) \(A + A.B + A.B.C + A.B. D\)
   e) \(A. \bar{A} + B.C\)
   f) \(A + \bar{A}. B + \bar{A}. \bar{B}\)
   g) \((A+B. \bar{B}). \bar{A}\)

2. Use truth tables to show that
   a) \(\bar{A} + \bar{B} \neq (A + \bar{B})\), but \(\bar{A} + B = \bar{A}.B\). These imply \((A+B) \neq \bar{A}.B\)
   b) \(\bar{A}. B + A. \bar{B} \neq 1\), but \(\bar{A}. B + (A. B) = 1\). These imply \(A. \bar{B} \neq (A. B)\)
   c) \(A.B + \bar{A}. B \neq 1\), but \(A.B + \bar{A}B = 1\). These imply, \(A. B \neq \bar{A}B\)

3. Use De-Morgan’s laws to show that
   a) \(X.Y + (X. Z) = 1\)
   b) \((A. \bar{B} + A. \bar{C}) = \bar{A} + B. C\)
   c) \(Y = (P.Q + \bar{Q}).(P + Q) = 1\)
   d) \((A + B + \bar{C}). (\bar{A} + B + C). (A + B + C). (A + \bar{B} + \bar{C}). (A + \bar{B} + C) = A.B + A.C\)

4. Simplify the expressions in 2.6(e), 2.9(a), 2.10(b), 2.10(c), on page 99 in the textbook, using Boolean Algebra.

5. Assume that A and B are two \(n\)-bit binary numbers. What is the result of the following 3 operations, performed in this order?
   
   \[A \leftarrow A \text{EOR} B\]
   \[B \leftarrow A \text{EOR} B\]
   \[A \leftarrow A \text{EOR} B\]

   where \(A \leftarrow A \text{EOR} B\) means the result of bit-wise EX-OR between A and B is assigned to A (or saved in A, overwriting its previous content). EX-OR is short for the exclusive-OR gate, which returns 1 when its two input bits are different (1,0 or 0,1), but returns 0 when the inputs are the same (0,0 or 1,1). Hint: Work out a few examples assuming some specific bit patterns for A,B, and try to make sense of the outcome.