Boolean Algebra

1. Prove De Morgan's theorem

   $$\overline{(A+B)} = \overline{A} * \overline{B}$$

   $$\overline{(A*B)} = \overline{A} + \overline{B}$$

2. Simplify the following expressions using DeMorgan's theorems.

   a) $\overline{\overline{A}\,B\,\overline{C}}$

   b) $\overline{(M + \overline{N})(\overline{M} + N)}$

   c) $\overline{A(\overline{B + \overline{C}})D}$

   d) $\overline{\overline{A} + \overline{B}\,C}$

   e) $\overline{\overline{A}\,\overline{B}}$

   f) $\overline{A + \overline{B}}$

3. A quick overview of boolean theorems can be found here. Using boolean theorems, simplify the following expressions:

   a) $x = (M + N)(\overline{M} + P)(\overline{N} + \overline{P})$

   b) $y = (\overline{A}B\overline{C} + AB\overline{C} + B\overline{C}D)$

   c) $z = \overline{A}(A + B) + (B + AA)(A + \overline{B})$