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Quiz Unit 4 Solutions

1. A bank vault has three locks with a different key for each lock. Each key is owned by a different person. To open the door, at least two people must insert their keys into the assigned locks. The signal lines *A*, *B*, and *C* are 1 if there is a key inserted into lock 1, 2, or 3, respectively. Write an equation for the variable *F* which is 1 iff the door should open.

   (a) Construct the truth table for *F*.

A	*B*	*C*	*F*
0	0	0	a_0
0	0	1	a_1
0	1	0	a_2
0	1	1	a_3
1	0	0	a_4
1	0	1	a_5
1	1	0	a_6
1	1	1	a_7

   Sol.)

   $a_3 = a_5 = a_6 = a_7 = 1$, since at least two people must insert their keys.

   (b) Express *F* as a minterm expansion.

   Sol.)

   $F = A'BC + AB'C + ABC' + ABC$

   (c) Simplify *F* using uniting and elimination theorems. (*Hint*: Remember Quiz Unit 2)

   Sol.)

   $F = (A'+A)BC + AB'C + ABC' = BC + AB'C + ABC' = C(B+B'A) + ABC'$

   $= C(B+A) + ABC' = BC + AC + ABC' = BC + A(C+C'B) = BC + A(C+B)$

   $= BC + AC + AB$