ITI1100A
Group Discussion 3

Discussion Objective

Some practice problems on Gate Level Minimization of Boolean Expression

Basic K-Map Representation

Two Variable K-Map

Three Variable K Map

Question 3.1

Simplify the following Boolean functions, using three-variable maps:
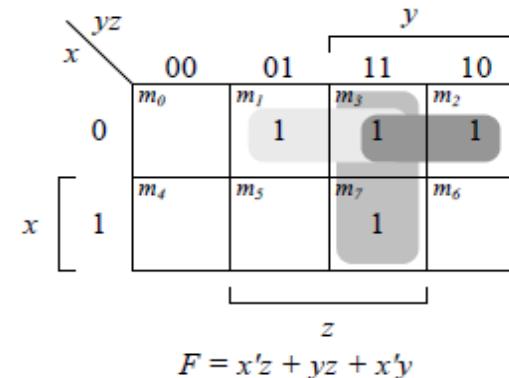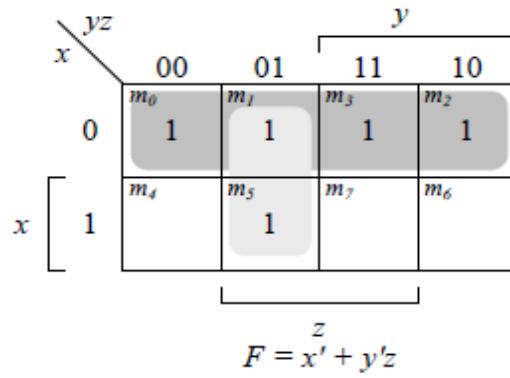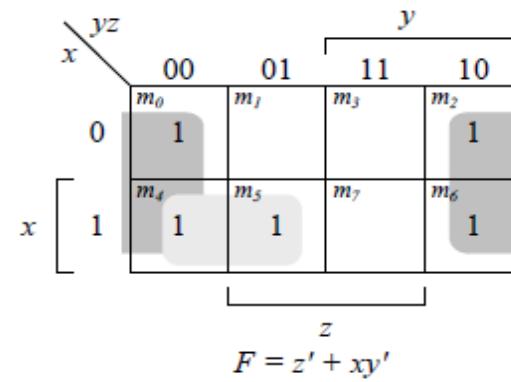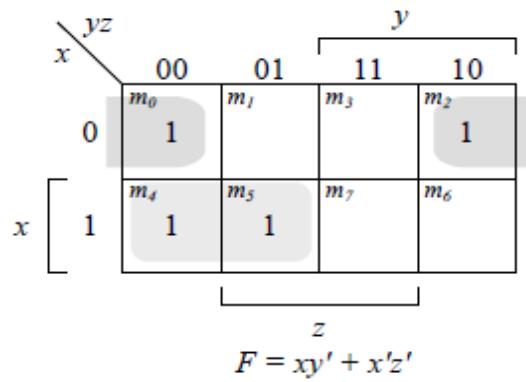
(a) $F(x, y, z) = (0, 2, 4, 5)$

(b) $F(x, y, z) = (0, 2, 4, 5, 6)$

(c) $F(x, y, z) = (0, 1, 2, 3, 5)$

(d) $F(x, y, z) = (1, 2, 3, 7)$

Solution 3.1

$$F = xy' + x'z'$$

$$F = z' + xy'$$

$$F = x' + y'z$$

$$F = x'z + yz + x'y$$

Question 3.3

Simplify the following Boolean expressions, using three-variable maps:
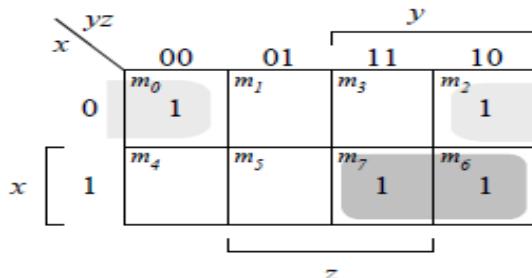
(a) $F(x, y, z)= xy + x'y'z' + x'yz'$

(b) $F(x, y, z)= x'y' + yz + x'yz'$
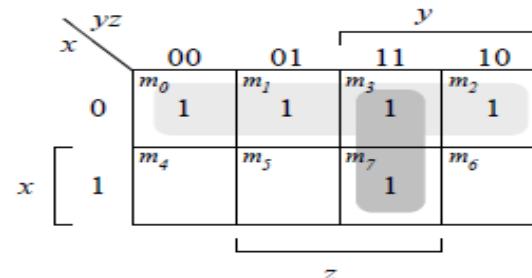
(c) $F(x, y, z)= x'y + yz' + y'z'$

(d) $F(x, y, z) = x'yz + xy'z' + xy'z$
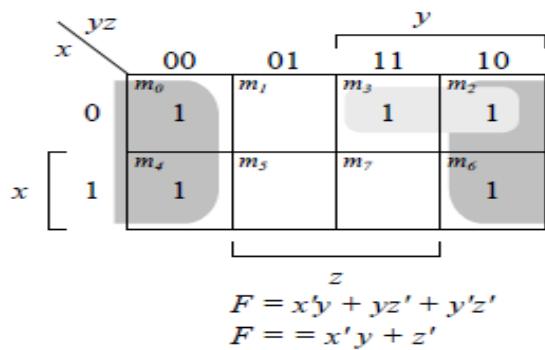
Solution 3.3
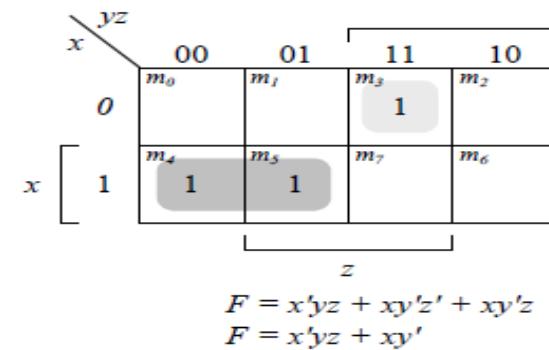
(a) $F = xy + x'y'z' + x'yz'$
$F = xy + x'z'$

(b) $F = x'y' + yz + x'yz'$
$F = x' + yz$

(c) $F = x'y + yz' + y'z'$
$F = = x'y + z'$

(d) $F = x'yz + xy'z' + xy'z$
$F = x'yz + xy'$

Question 3.6

Simplify the following Boolean expressions, using four-variable maps:
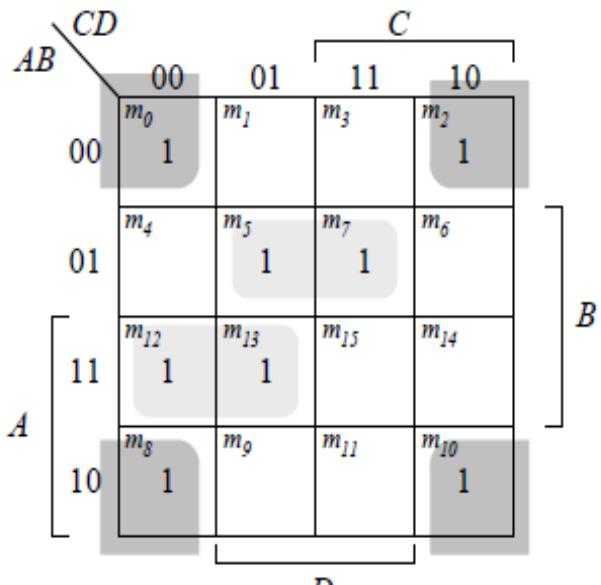
(a) $A'B'C'D' + AC'D' + B'CD' + A'BCD + BC'D$

(b) $x'z + w' xy' + w(x'y + xy')$
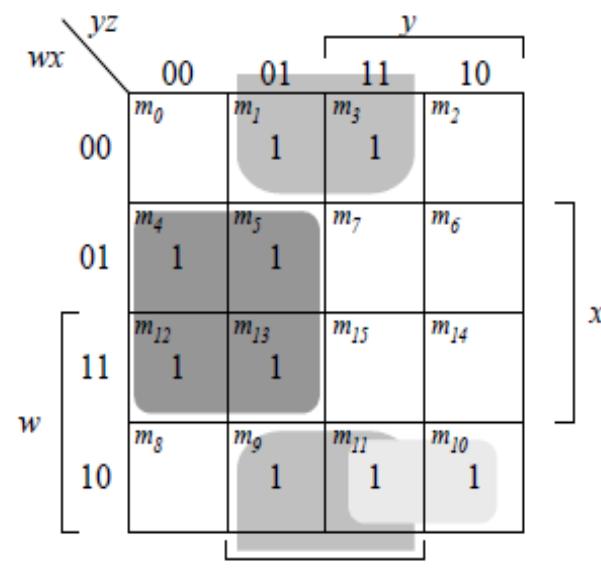
(c) $A'B'C'D + AB'D + A'BC' + ABCD + AB'C$

(d) $A'B'C'D' + BC'D + A'C'D + A'BCD + ACD'$

Solution 3.6
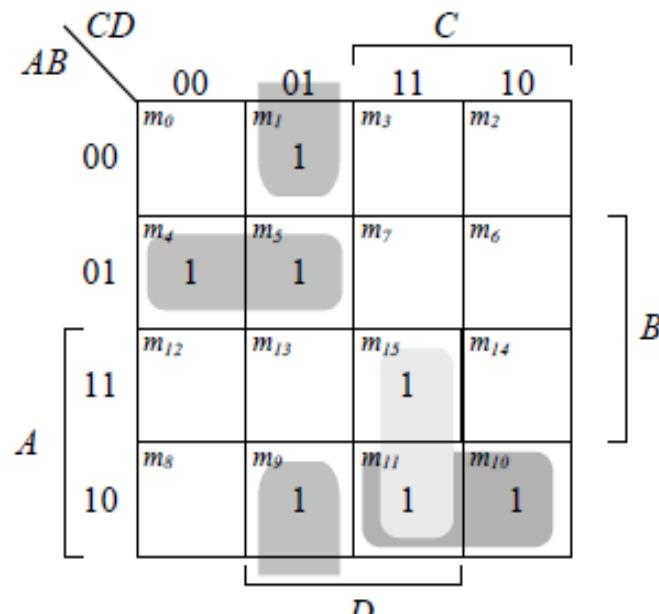
(a) $F = B'D' + A'BD + ABC'$
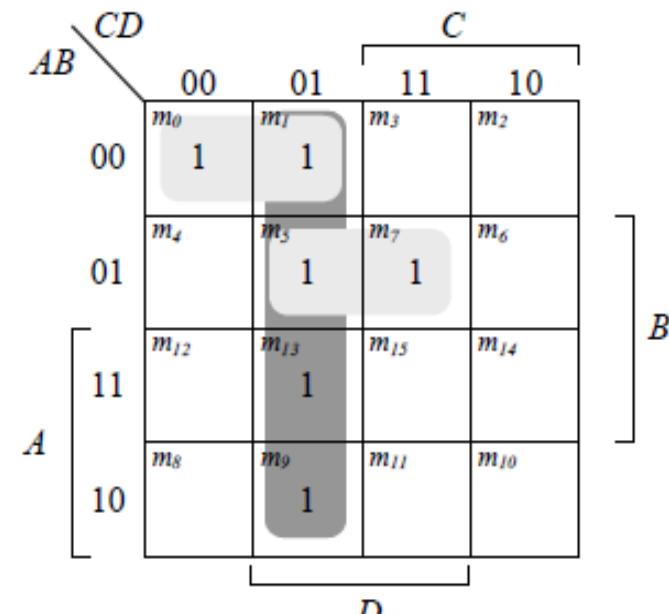
(b) $F = xy' + x'z + wx'y$

Solution 3.6 (Continuation)

(c) $F = A'BC' + B'C'D + ACD + AB'C$
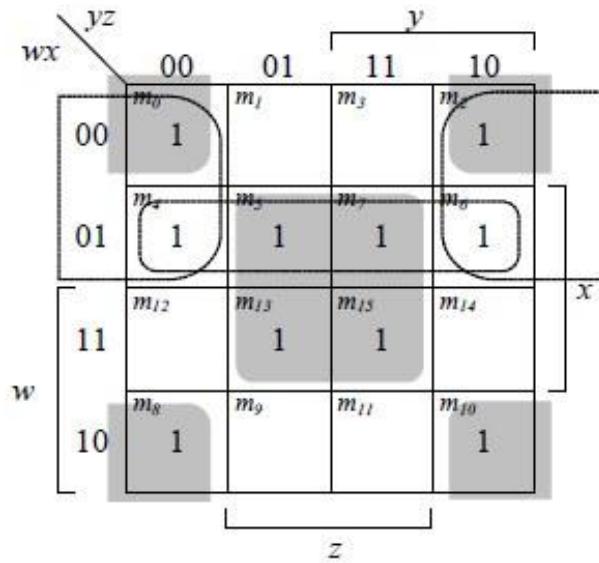
(d) $F = C'D + A'BD + A'B'C'$

Question 3.9

Find all the prime implicats for the following Boolean functions, and determine which are essential:

(a) *F* (*w*, *x*, *y*, *z*) = Σ(0, 2, 4, 5, 6, 7, 8, 10, 13, 15)

(b) *F* (*A*, *B*, *C*, *D*) = Σ (0, 2, 3, 5, 7, 8, 10, 11, 14, 15)

Solution 3.9

(a)

(b)
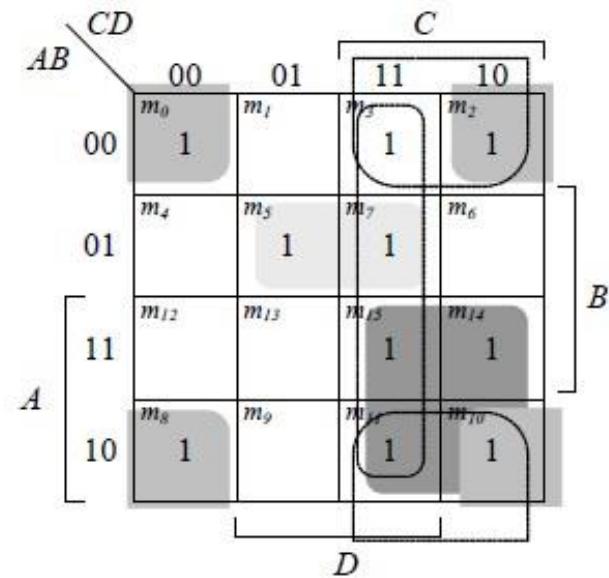
Essential: xz, $x'z'$
Non-essential: $w'x$, $w'z'$
$F = xz + x'z' + (w'x \text{ or } w'z')$

Essential: $B'D'$, AC, $A'BD$
Non-essential: CD, $B'C$
$F = B'D' + AC + A'BD + (CD \text{ OR } B'C)$

Question 3.13
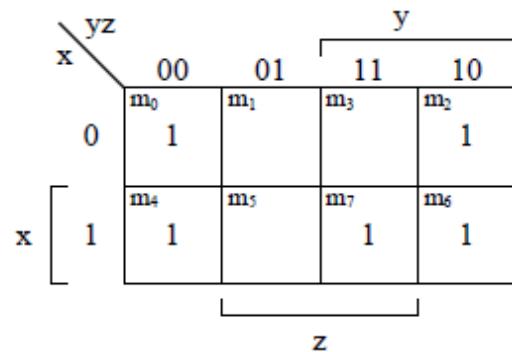
Simplify the following expressions to (1) sum-of-products and (2) products-of-sums:

(a) $x'z' + y'z' + yz' + xy$

(b) $ACD' + C'D + AB' + ABCD$

Solution 3.13
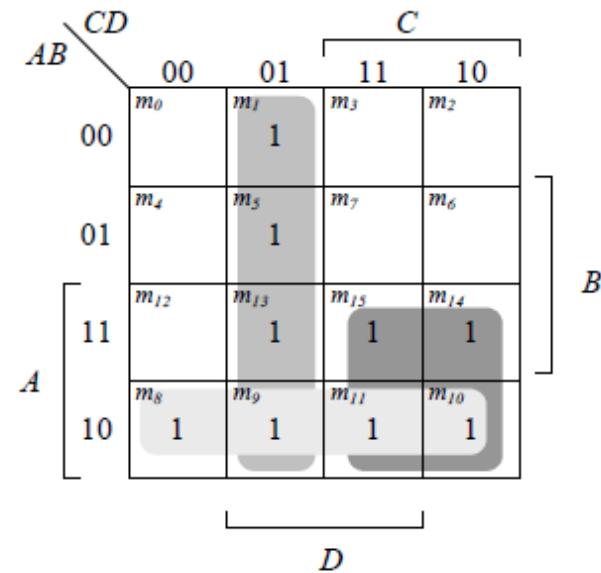
(a) $F = x'z' + y'z' + yz' + xy = x'z' + z' + xy = z' + xy$

(b) $F = ACD' + C'D + AB' + ABCD$

$F' = x'z + y'z$

$F = (x + z')(y + z')$

$F = AC + AB' + C'D$
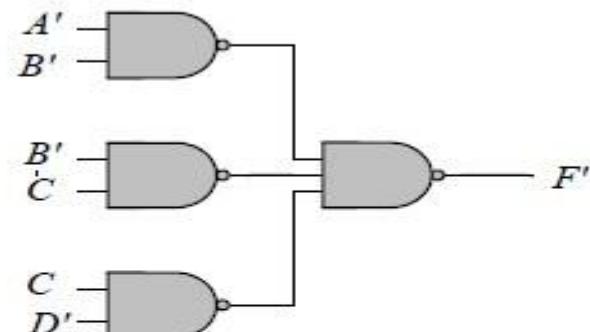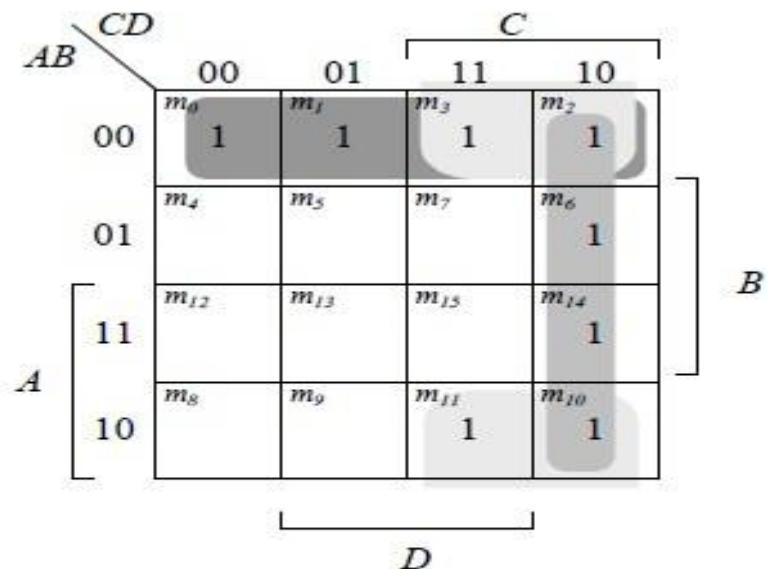
$F' = A'C + A'D' + BC'D'$

$F = (A + C')(A + D)(B' + C + D)$

Question 3.17

Draw a NAND logic diagram that implements the complement of the following function:

$F(A, B, C, D) = \Sigma(0, 1, 2, 3, 6, 10, 11, 14)$

Solution 3.17

$$F = A'B' + B'C + CD'$$
$$F = ((A + B)(B + C')(C' + D))'$$
$$F = ((A'B')'(B'C)'(CD')')'$$
$$F' = (A'B')'(B'C)'(CD')'$$

THANK YOU