Benha University
Faculty of Engineering (at Shoubra)
Electrical Engineering Department
2nd Year (Electronics and Communications Engineering**)**

Midterm Exam
Subject: Logic Circuits - ECE 224C
Date: Thu 26/03/2015
Duration: 1 hour

Attempt the following questions.

№ of Questions: 4 in 2 page(s)
Total Mark: 10

Question 1: **(4** Marks**)**

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

a) $(A' + B + D')(A' + B' + C')(A' + B' + C)(B' + C + D')$

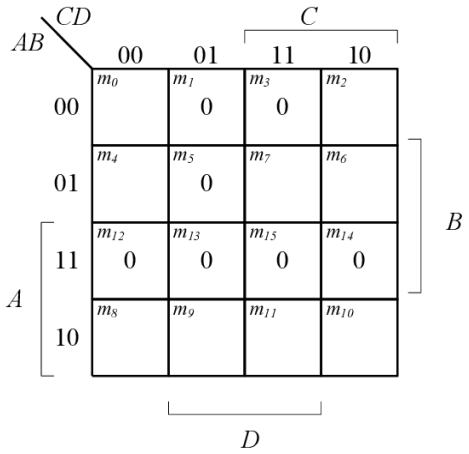
$F = (A' + B + D')(A' + B' + C')(A' + B' + C)(B' + C + D')$

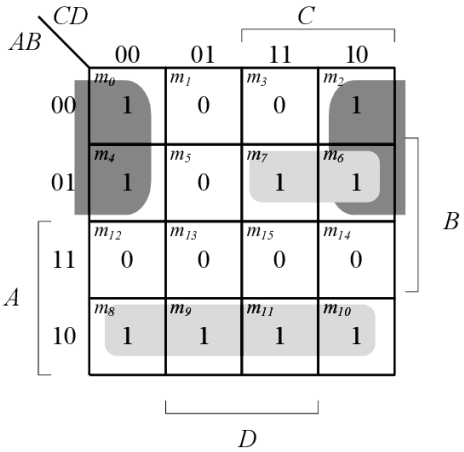
$F' = AB'D + ABC + ABC' + BC'D$

$F' = AB + BC'D$

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

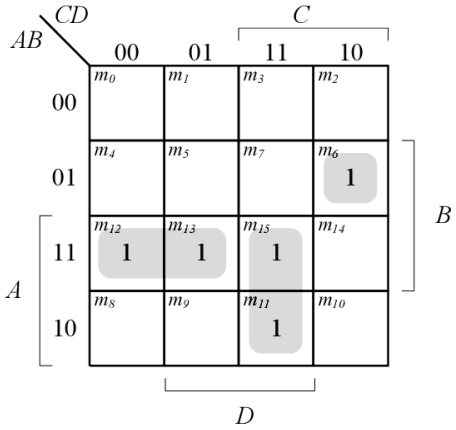
$F = A'D' + A'BC + AB'$

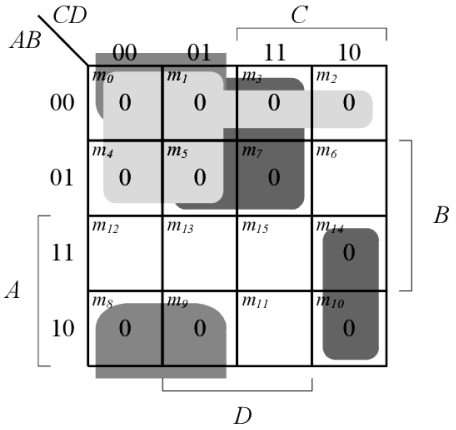




b) $BCD' + ABC' + ACD$

$F = BCD' + ABC' + ACD$





$F' = A'C' + A'D + B'C' + A'B' + ACD'$\

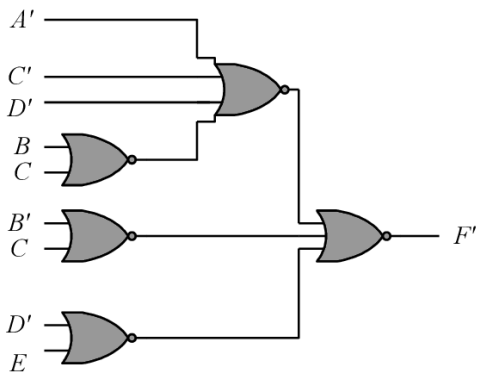
$F = (A + C)(A + D')\ (B + C)(A + B)(A' + C' + D)$

Question 2: **(2 Marks)**

Draw the multiple-level NOR circuit for the following expression:

$$CD(B+C)A+(BC'+DE')$$

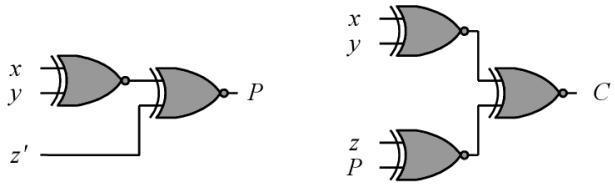
$F = ACD(B + C) + (BC' + DE')$
$F' = [ACD(B + C) + (BC' + DE')]'$
$F' = [(A' + C' + D')'(B + C) + (B' + C)' + (D' + E)']'$
$F' = [((A' + C' + D') + (B + C)')' + (B' + C)' + (D' + E)']'$
$F' = [(A' + C' + D' + (B + C)')' + (B' + C)' + (D' + E)']'$



Question 3: **(2 Marks)**

Derive the circuits for a three-bit parity generator and four-bit parity checker using an odd parity bit.

Beware that this is the final result not the systematic solution.



(a) 3-bit odd parity generator *(b) 4-bit odd parity generator*

Question 4: **(2 Marks)**

Show that the dual of the exclusive-OR is also its complement.

$$x \oplus y = x'y + xy'$$
$$Dual = (x' + y)(x + y')$$
$$Complement = (x'y + xy')'$$
$$= (x'y)'(xy')'$$
$$= (x + y')(x' + y)$$
$$= (x' + y)(x + y')$$
$$= Dual$$

Good Luck
Dr. Islam ElShaarawy