Logic Design – Assignment 04

#	Student ID	Student Name	Grade (10)
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Delivery Date	

١. يتم تسليم التمرين محلولا في خلال أسبوع من تاريخ التمرين، و يتم حذف درجتين من التمرين عن كل أسبوع تأخير
٢. يتم التسليم لمعيد المقرر مباشرة
٣. تتم أجابه التمرين في نفس ورق الأسئلة

Q 1

Demonstrate the validity of the following identities by means of truth tables:

(c) The distributive law: $x(y + z) = xy + xz$

(d) The associative law: $x + (y + z) = (x + y) + z$

(e) The associative law and $x(yz) = (xy)z$

Sol 1

(c)

$x\,y\,z$	$x(y+z)$	xy	xz	$xy+xz$
0 0 0	0	0	0	0
0 0 1	0	0	0	0
0 1 0	0	0	0	0
0 1 1	0	0	0	0
1 0 0	0	0	0	0
1 0 1	1	0	1	1
1 1 0	1	1	0	1
1 1 1	1	1	1	1

(c)

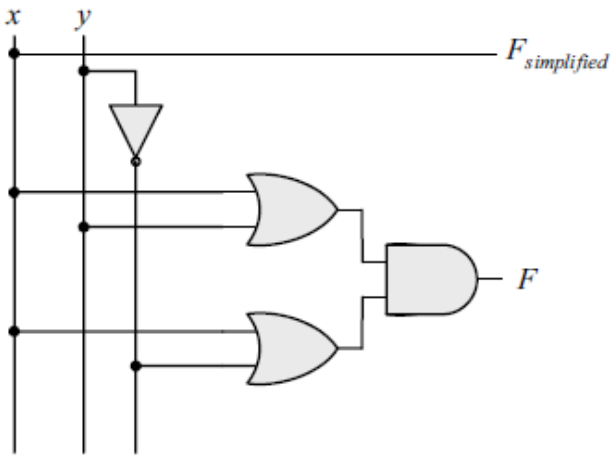
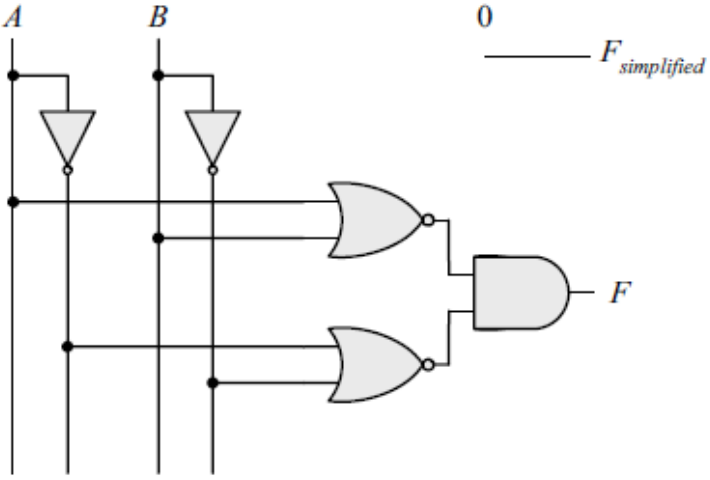
$x\,y\,z$	x	$y+z$	$x+(y+z)$	$(x+y)$	$(x+y)+z$
0 0 0	0	0	0	0	0
0 0 1	0	1	1	0	1
0 1 0	0	1	1	1	1
0 1 1	0	1	1	1	1
1 0 0	1	0	1	1	1
1 0 1	1	1	1	1	1
1 1 0	1	1	1	1	1
1 1 1	1	1	1	1	1

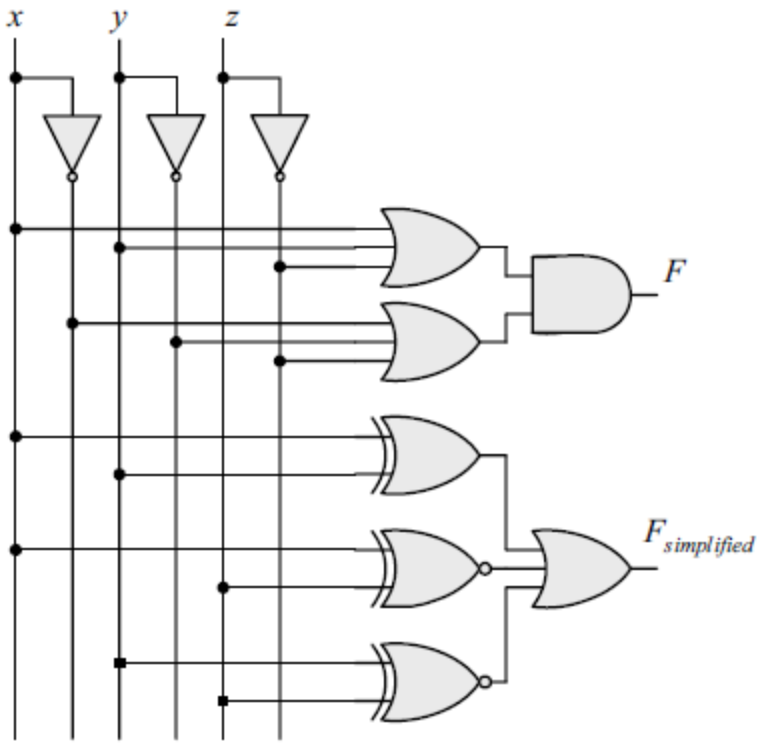
x y z	*yz*	*x(yz)*	*xy*	*(xy)z*
0 0 0	0	0	0	0
0 0 1	0	0	0	0
0 1 0	0	0	0	0
0 1 1	1	0	0	0
1 0 0	0	0	0	0
1 0 1	0	0	0	0
1 1 0	0	0	1	0
1 1 1	1	1	1	1

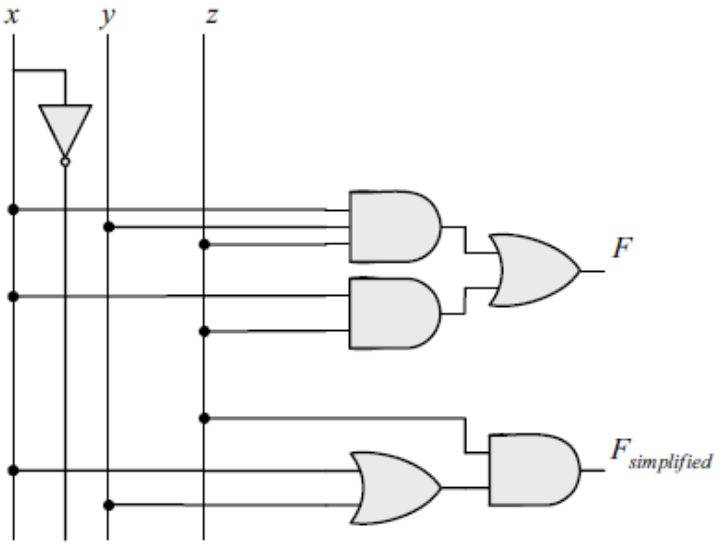
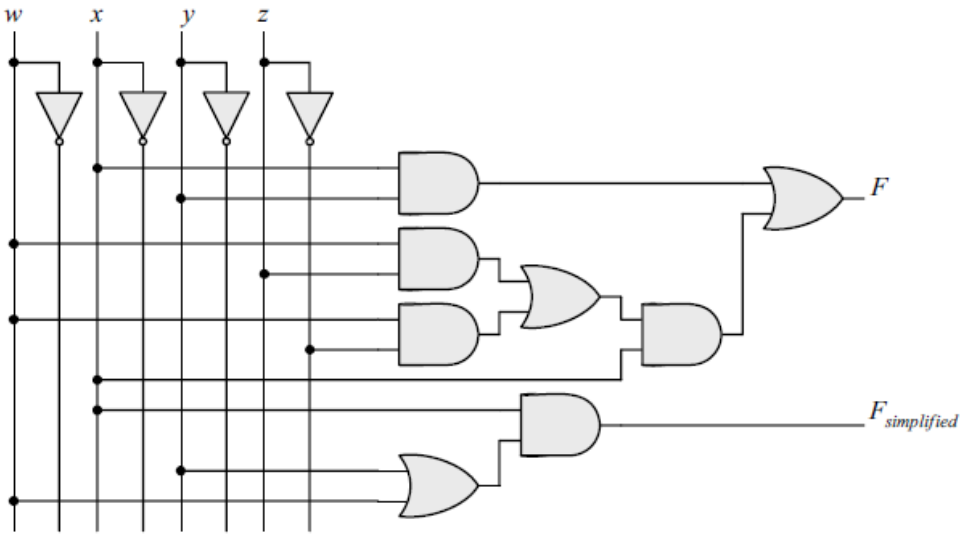
Q2	Simplify the following Boolean expressions to a minimum number of literals: (b)* $(x + y)(x + y')$ (d)* $(A + B)'(A' + B')'$ (f) $(x + y + z')(x' + y' + z)$
Sol 2	…… …… **(b)** $(x + y)(x + y') = x + yy' = x(x + y') + y(x + y') = xx + xy' + xy + yy' = x$ **(d)** $(A + B)'(A' + B') = (A'B')(A\ B) = (A'B')(BA) = A'(B'BA) = 0$ **(f)** $(x + y + z')(x' + y' + z) = xx' + xy' + xz + x'y + yy' + yz + x'z' + y'z' + zz' =$ $= xy' + xz + x'y + yz + x'z' + y'z' = x \oplus y + (x \oplus z)' + (y \oplus z)'$ ……

Q3	Simplify the following Boolean expressions to a minimum number of literals: (b)* $x'yz + xz$ (d)* $xy + x(wz + wz')$ (f) $(x + y' + z')(x' + z')$
Sol 3	**(b)** x'yz + xz = (x'y + x)z = z(x + x')(x + y) = z(x + y) **(d)** $xy + x(wz + wz') = x(y + wz + wz') = x(w + y)$ **(f)** $(x + y' + z')(x' + z') = xx' + xz' + x'y' + y'z' + x'z' + z'z' = z' + y'(x' + z') = z' + x'y'$

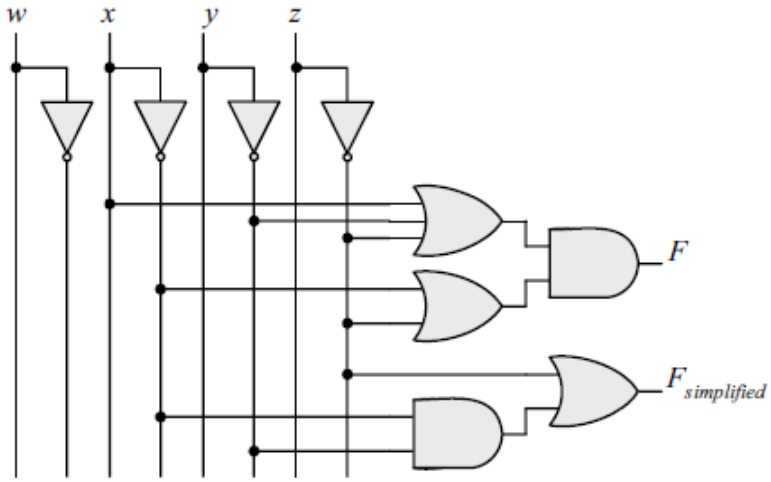
Q4	Reduce the following Boolean expressions to the indicated number of literals: (c)* $A'B(D' + C'D) + B(A + A'CD)$ to one literal (d)* $(A' + C)(A' + C')(A + B + C'D)$ to four literals (e) $ABCD + A'BD + ABC'D$ to two literals
Sol 4	…… …… **(c)** $A'B(D' + C'D) + B(A + A'CD) = B(A'D' + A'C'D + A + A'CD)$ $= B(A'D' + A + A'D(C + C') = B(A + A'(D' + D)) = B(A + A') = B$ **(d)** $(A' + C)(A' + C')(A + B + C'D) = (A' + CC')(A + B + C'D) = A'(A + B + C'D)$ $= AA' + A'B + A'C'D = A'(B + C'D)$ **(e)** $ABCD + A'BD + ABC'D = ABD + A'BD = BD$ …… …… …… …… …… …… …… …… …… …… …… …… …… …… ……

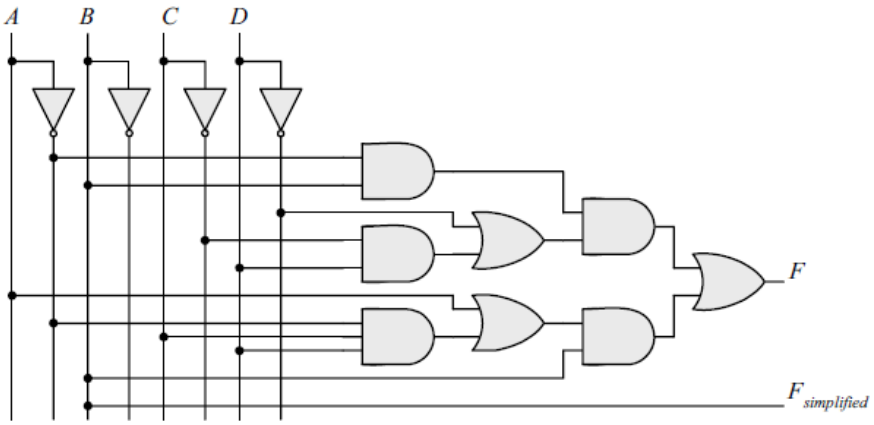
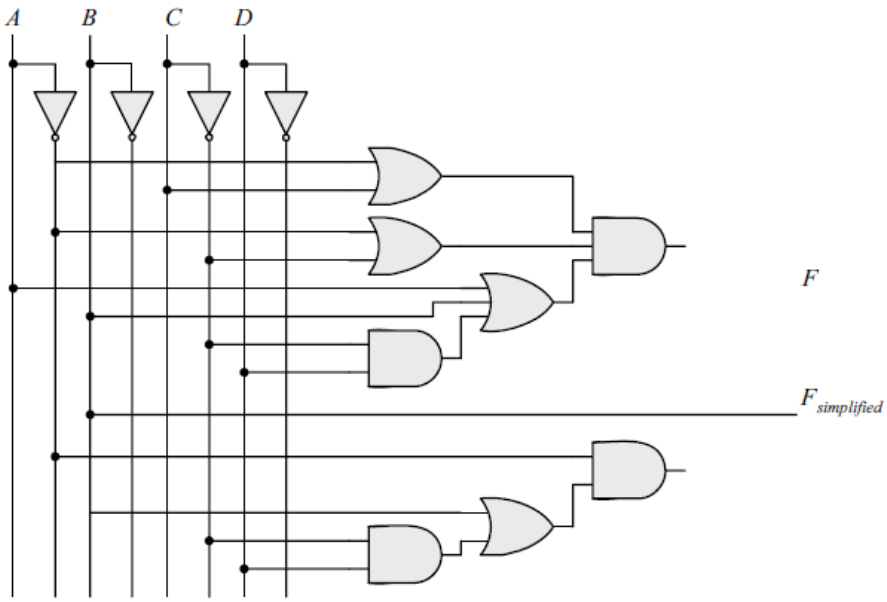
Q5	Draw logic diagrams of the circuits that implement the original and simplified expressions in Q2 (b)* $(x + y)(x + y')$ (d)* $(A + B)'(A' + B')'$ (f) $(x + y + z')(x' + y' + z)$
Sol 5	**(b)**  **(d)** 


x
y
z
F
F simplified

Q6	Draw logic diagrams of the circuits that implement the original and simplified expressions in Q3 (b)* $x'yz + xz$ (d)* $xy + x(wz + wz')$ (f) $(x + y' + z')(x' + z')$
Sol 6	.... **(b)**  **(d)**  .....

(f)



Q7	Draw logic diagrams of the circuits that implement the original and simplified expressions in Q4 (c)* $A'B(D' + C'D) + B(A + A'CD)$ to one literal (d)* $(A' + C)(A' + C')(A + B + C'D)$ to four literals (e) $ABCD + A'BD + ABC'D$ to two literals
Sol 7	.... **(c)**  **(d)**  ....

(e)