

Logic Design – Assignment 04

#	Student ID	Student Name	Grade (10)
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Delivery Date	
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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



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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 $x(yz) = (xy)z$

So
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... (c)

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xyz	$x(y + z)$	xy	xz	$xy + xz$
000	0	0	0	0
001	0	0	0	0
010	0	0	0	0
011	0	0	0	0
100	0	0	0	0
101	1	0	1	1
110	1	1	0	1
111	1	1	1	1

..... (c)

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xyz	x	$y + z$	$x + (y + z)$	$(x + y)$	$(x + y) + z$
000	0	0	0	0	0
001	0	1	1	0	1
010	0	1	1	1	1
011	0	1	1	1	1
100	1	0	1	1	1
101	1	1	1	1	1
110	1	1	1	1	1
111	1	1	1	1	1

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$x y z$	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



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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

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(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) $(x + y + z')(x' + y' + z) = xx' + xy' + xz + x'y + yy' + yz + x'z' + y'z' + zz' =$
 $= xy' + xz + x'y + yz + x'z' + y'z' = x \oplus y + (x \oplus z)' + (y \oplus z)'$

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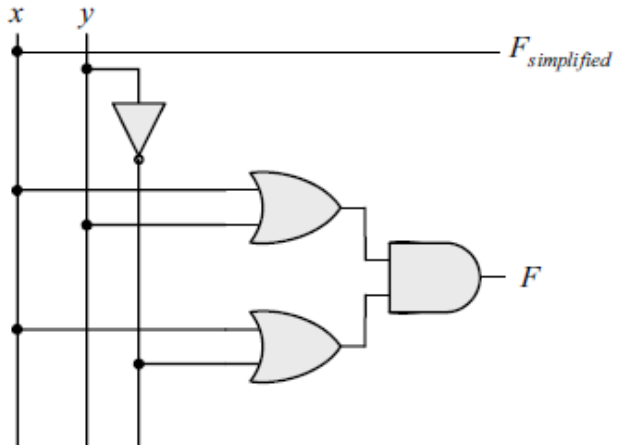
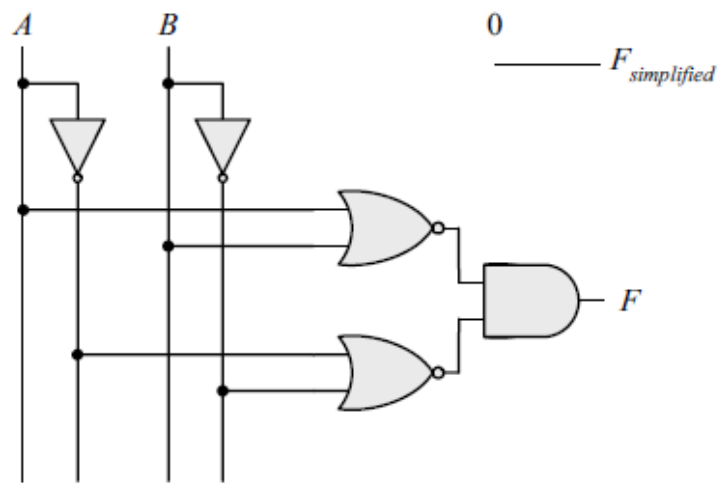
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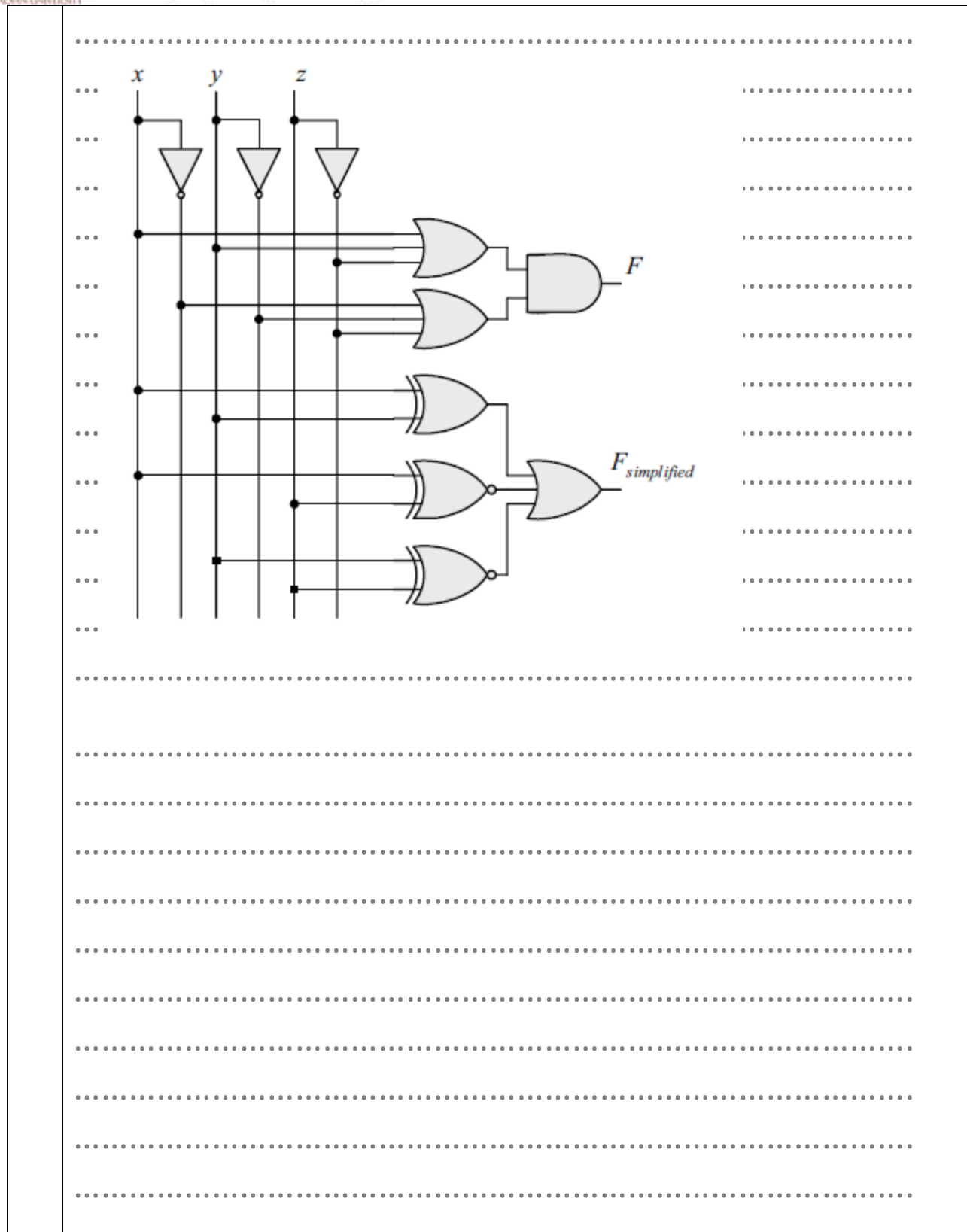
Q3	<p>Simplify the following Boolean expressions to a minimum number of literals:</p> <p>(b)* $x'yz + xz$</p> <p>(d)* $xy + x(wz + wz')$</p> <p>(f) $(x + y' + z')(x' + z')$</p>
Sol 3	<p>.....</p> <p>.....</p> <p>(b) $x'yz + xz = (x'y + x)z = z(x + x')(x + y) = z(x + y)$</p> <p>(d) $xy + x(wz + wz') =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



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

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



The diagram shows a logic circuit with three inputs: x , y , and z . Each input line has a NOT gate connected to it. There are two AND gates: the first takes inputs x , y , and z ; the second takes inputs x , y , and \overline{z} . There are three OR gates: the first takes inputs x , y , and z ; the second takes inputs x , y , and \overline{z} ; the third takes inputs \overline{x} , \overline{y} , and \overline{z} . The output of the first AND gate is labeled F . The outputs of the three OR gates are connected to a final OR gate, whose output is labeled $F_{simplified}$.

Q6

Draw logic diagrams of the circuits that implement the original and simplified expressions in

Q3

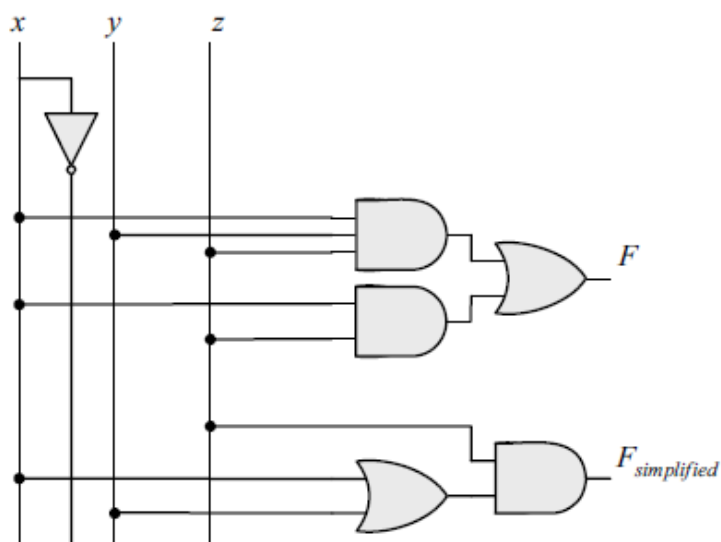
(b)* $x'yz + xz$

(d)* $xy + x(wz + wz')$

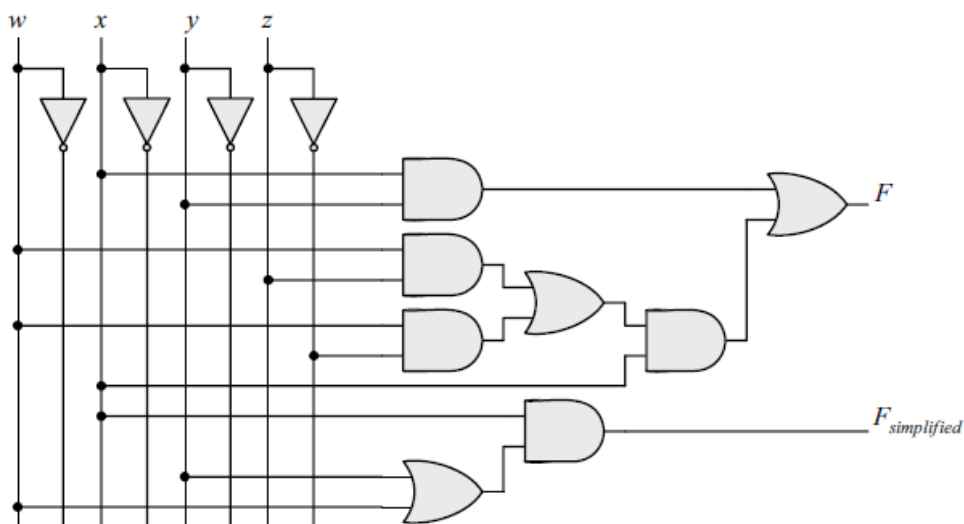
(f) $(x + y' + z')(x' + z')$

Sol
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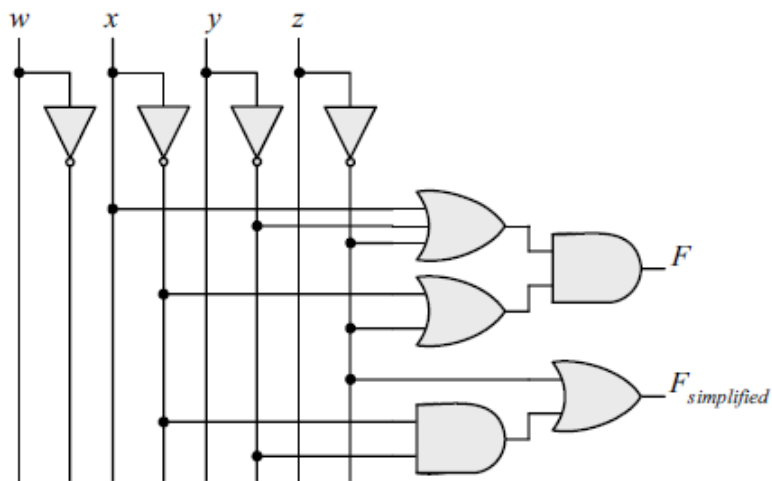
(b)



(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

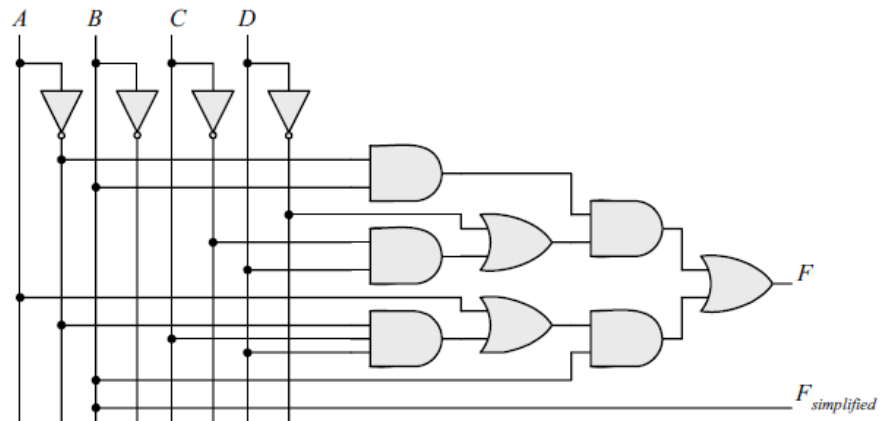
(e) $ABCD + A'BD + ABC'D$

to two literals

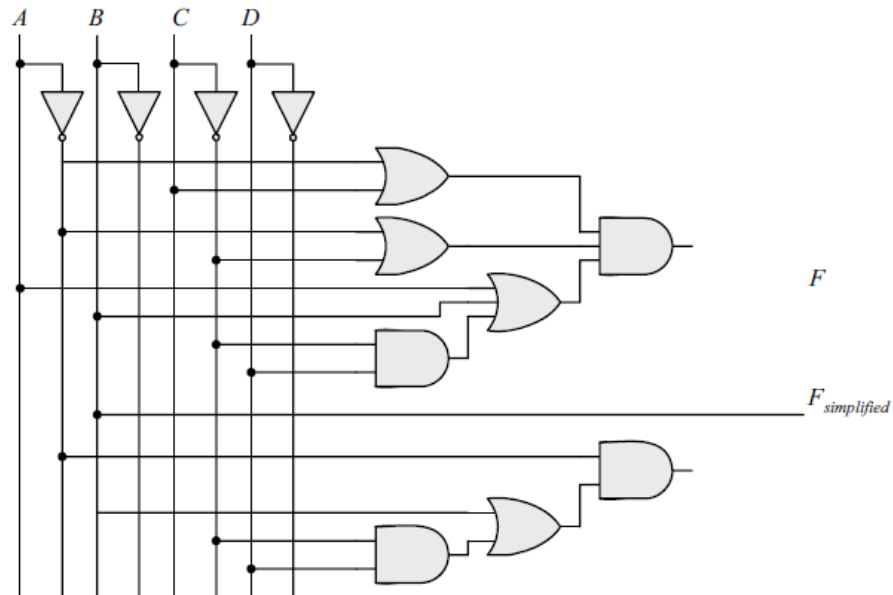
Sol

7

(c)



(d)



(e)

