INF1400- Uke 02 - FASIT

1. Simplify the following Boolean expressions to a minimum number of literals:

(a) xyz + xy' + xyz'

= xy' + xyz + xyz'
= xy' + xy(z + z')
= xy' + xy
= x(y + y')
= x

(b) (xy + z)(x + y')

= xy + xz + xyy' + y'z
= xy + y'z + xz
= xy + y'z + xz(y + y')
= xy + y'z + xyz + xy'z
= xy + xyz + y'z + xy'z
= xy(1 + z) + y'z(1 + x)
= xy + y'z

(c) A'C' + A(BC + C')

= A'C' + ABC + AC'
= A'C' + AC' + ABC
= C'(A + A') + ABC
= C' + ABC
= (C' + AB)(C' + C)
= C' + AB

2. Find the complement of the following expressions:

(a) (D(AC + B') + BC)'

= (D(AC + B'))'(BC)'
= (D' + (AC + B')')(B' + C')
= (D' + ((AC)'B))(B' + C')
= (D' + ((A' + C')B))(B' + C')

This problem can also have different answers than given above. You can open braces and also multiply all terms and expand the equation.
The shortest answer can also be: B'D' + BC'

(b)((A + B' + C)(A' + B + D)(B + C + D'))'

= (A + B' + C)' + (A' + B + D)' + (B + C + D')'
= A'BC' + AB'D' + B'C'D

3. Simplyfy the following Boolean expressions to a minimum number of literals:

(a) ABC + A'B + ABC'

= AB(C+C') + A'B
= AB*1 + A'B
= AB + A'B
= B(A+A')
= B

(b) (x+y)'(x'+y')

= ((x+y)'(x'+y'))' ' **OBS! Dobbel invertering**
= ((x+y) + (x'+y')')' **DeMorgans**
= (x + y + (x''y''))'
= (x + y + (xy))'
= (x +y + xy)'
= (x(1+y) +y)'
= (x + y)'
= x'y'

(c) (BC' + A'D)(AB'+CD')

= 0 fordi alle leddene er komplementære med bruk av AND

4. Reduce the following Boolean expressions to the indicated number of literals:

(a) A'B' + ABC + AC' to three literals

= AB + C'

(b) A'B(D' + C'D) + B(A+A'CD) to one literal

= B

5. Find the complement of the following expression:

(a) xy' + x'y

= xy + x'y'

6. List the truth table of the function:

(a) F = xy + xy' + y'z

=> F(x,y,z) = Σ(1,4,5,6,7)

7. Simplify the following Boolean functions T1 and T2 to a minimum number of literals

A	B	C	T1	T2
0	0	0	1	0
0	0	1	1	0
0	1	0	1	0
0	1	1	0	1
1	0	0	0	1
1	0	1	0	1
1	1	0	0	1
1	1	1	0	1

T1 = A'(B'+C')
T2 = A+BC = T1'

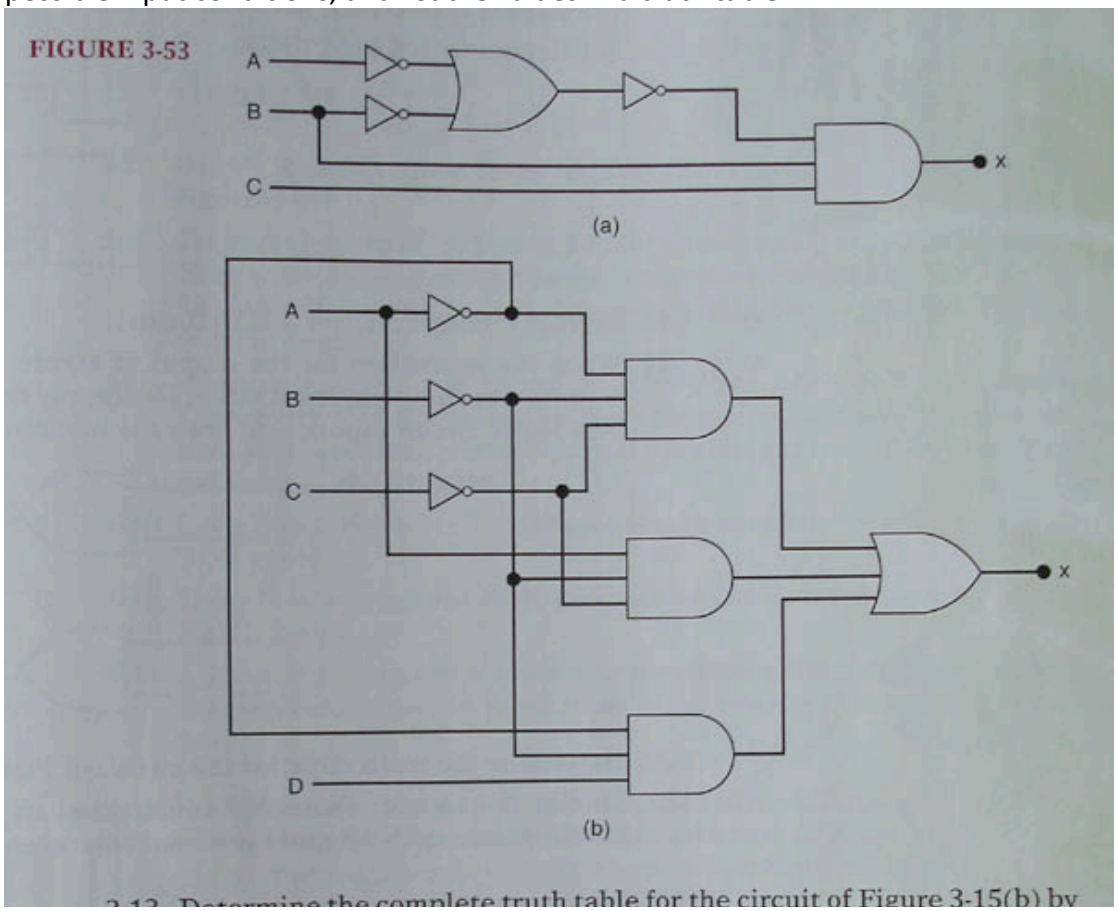
8. Obtain the truth table of the following functions and express each function in sum-of-minterms and product-of-maxterms form:
(a) (xy + z)(y+xz)
=> Σ(3,5,6,7) = Π(0,1,2,4)

9. Convert the following into sum-of-products and product-of-sums forms:
a): (D + B'A + A'Y)(B + EF)
= DB + DEF + B'AB + B'AEF + A'Y B + A'YEF ***(by distributive law)***
= (D' + B')(D' + E' + F')(B + A' + E' + F')(A + Y' + B')(B + Y' + E' + F').

b): (D' + B'A)(B + A'D')
= (D' + B')(D' + A)(B + A')(B + D')
= DB + DA' + B'A + B'D

c): (B' + A')D'(D' + B) + D
= BA + D + DB' + D
= BA + D
= (B+D)(A+D)

10. Write the Boolean expression for output x in figures below. Determine the value of x for all possible input conditions, and list the values in a truth table.



(a) **F = (A' + B')' BC**
= A'' B'' B C
= ABBC
= ABC

(b) **F = A'B'C' + AB'C' + A'B'D**
= B'C'(A' + A) + A'B'D
= B'C' + A'B'D

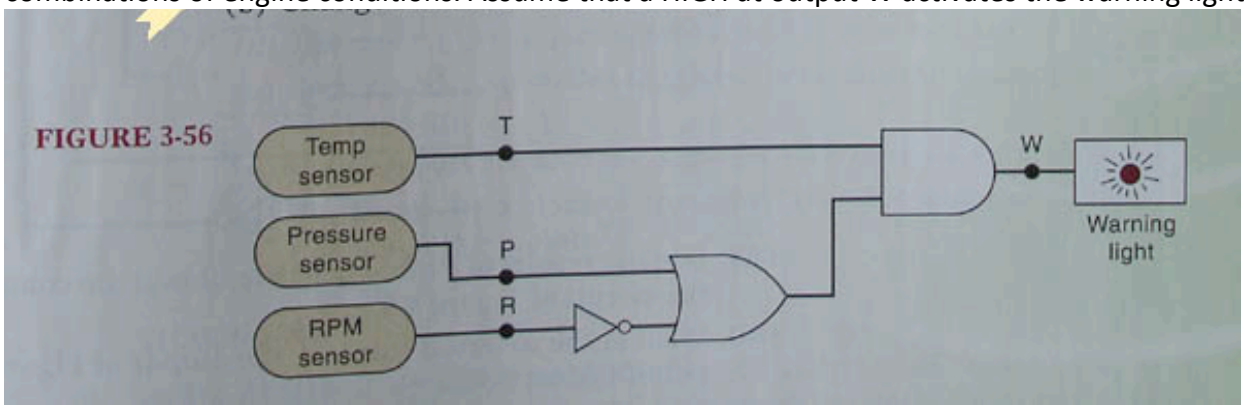
11. A jet aircraft employs a system for monitoring the rpm, pressure and temperature values of its engines using sensors that operate as follows:

RPM sensor output = 0 only when speed < 4800 rpm

P sensor output = 0 only when pressure < 220 psi

T sensor output = 0 only when temperature < 200 F

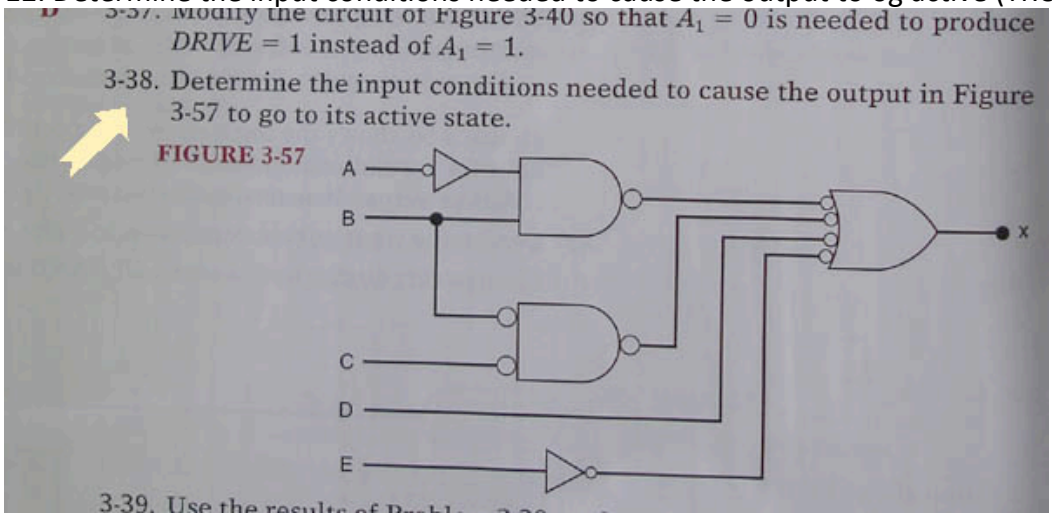
The Figure below shows the logical circuit that controls a cockpit warning light for certain combinations of engine conditions. Assume that a HIGH at output W activates the warning light.



Determine what engine conditions will give a warning to the pilot.

SVAR: T(P+R')

12. Determine the input conditions needed to cause the output to og active (TRUE).



SVAR: X will go TRUE when E=1, or D=0, or B=C=0 or when B=1 and A=0.

13. (MORO) Simplify the following expression

F = ((xy)'(xy')' + z'z)'
= ((xy)'(xy')')'(z'z)'
= ((xy)'' + (xy')'')(z'' + z')
= (xy + xy')(z+z')
= (xy+xy')(1)
= **xy+xy'**
= x(y+y')
= x

Alternativt:

F = ((xy)'(xy')' + z'z)'
= ((xy)'(xy')' + 0)'
= ((xy)'(xy')')'
= ((xy)'' + (xy')'')
= (xy + xy')
= x (y + y')
= x