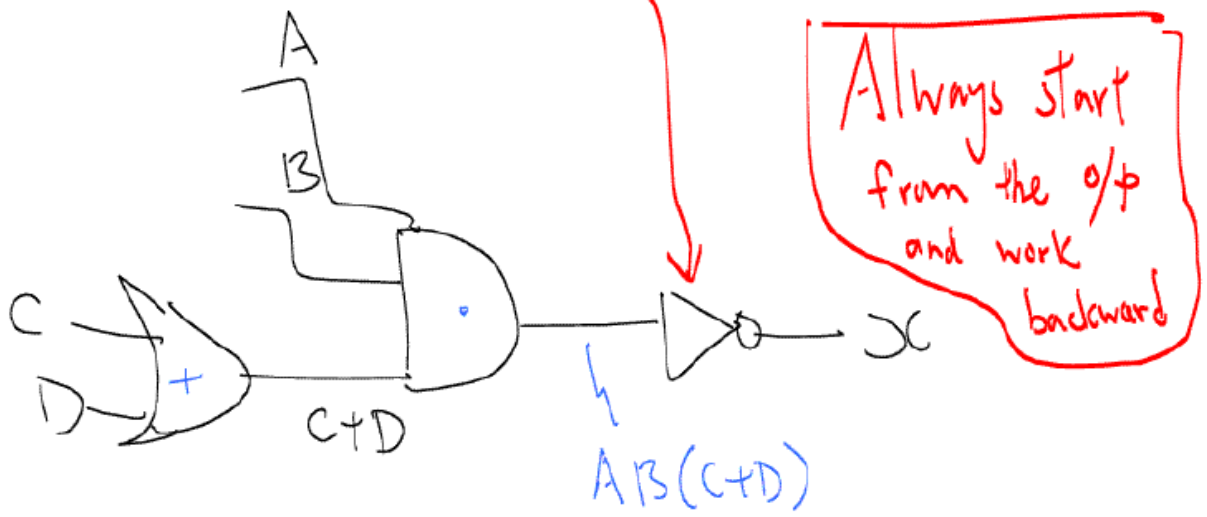
(without simplification)

B→3-16. For each of the following expressions, construct the corresponding logic circuit, using AND and OR gates and INVERTERs.

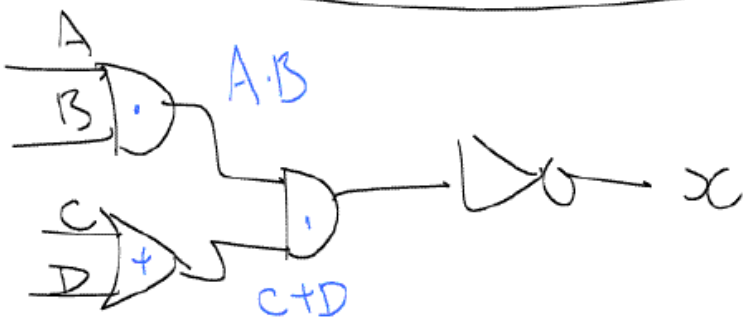
(a) $x = \overline{AB(C + D)}$

NOT gates



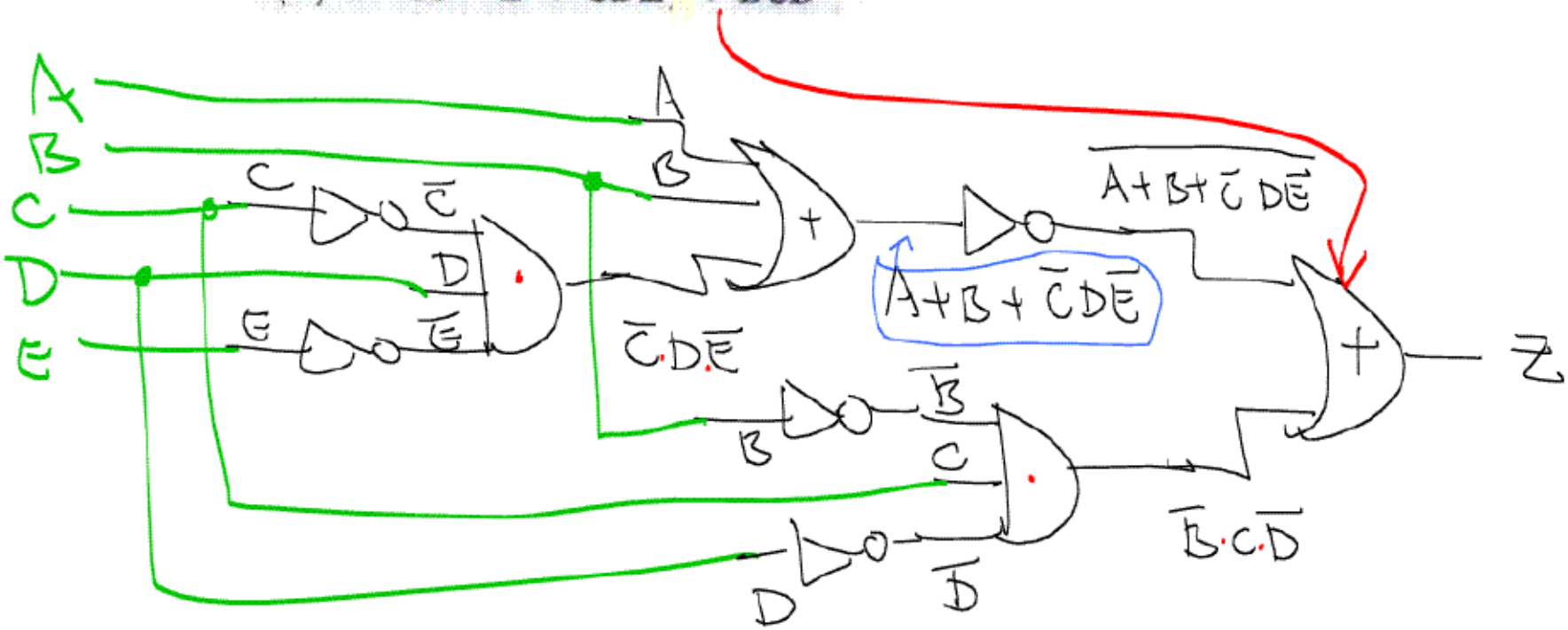
Always start from the o/p and work backward

Alt.



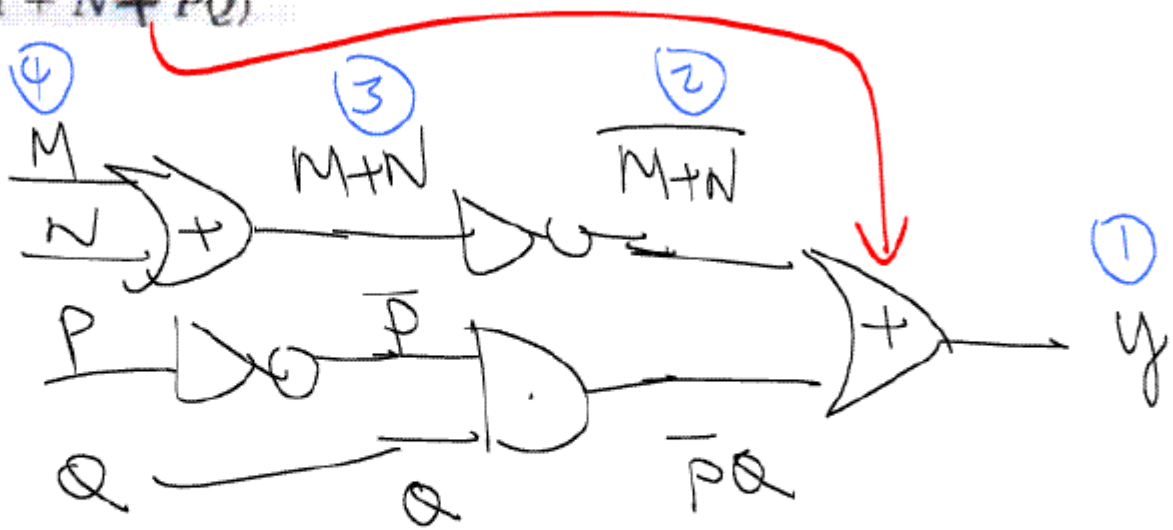
B→3-16. For each of the following expressions, construct the corresponding logic circuit, using AND and OR gates and INVERTERs.

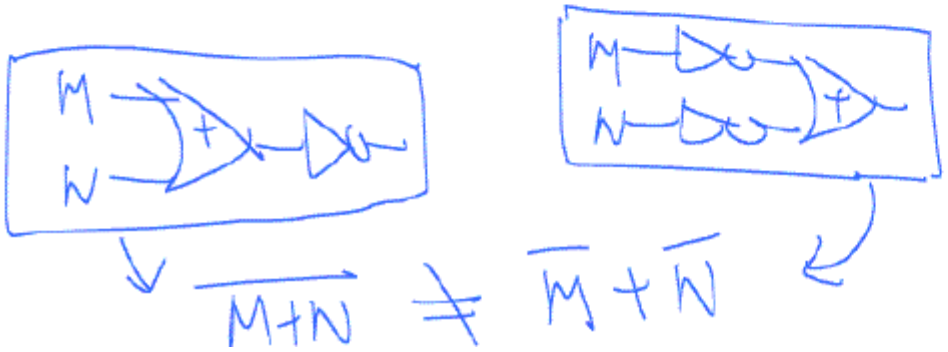
(b) $z = A + B + \overline{C}D\overline{E} + \overline{B}C\overline{D}$



B→3-16. For each of the following expressions, construct the corresponding logic circuit, using AND and OR gates and INVERTERs.

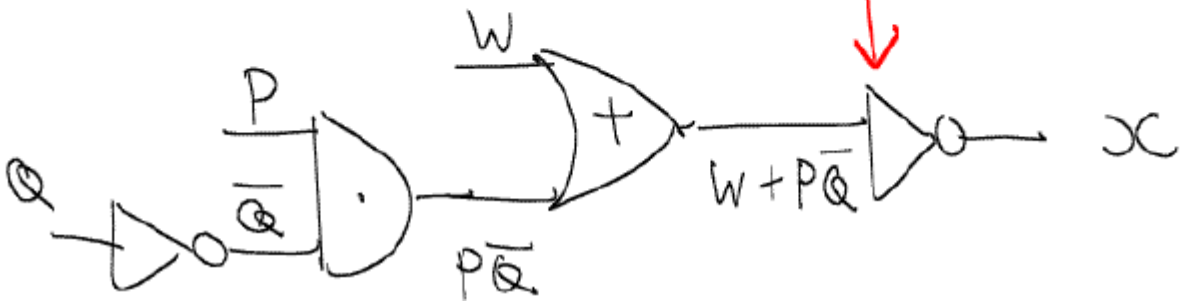
(c) $y = (\overline{M + N} + \bar{P}Q)$





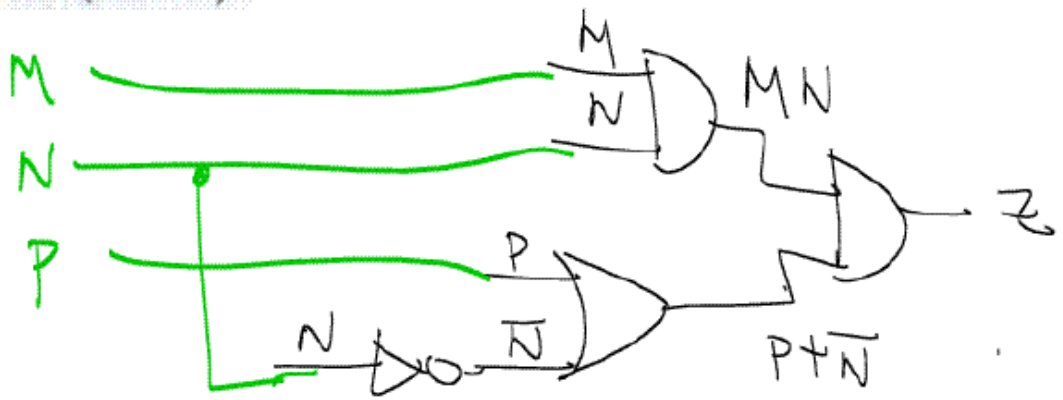
B→3-16. For each of the following expressions, construct the correspondi logic circuit, using AND and OR gates and INVERTERs.

(d) $x = \overline{W + P\bar{Q}}$

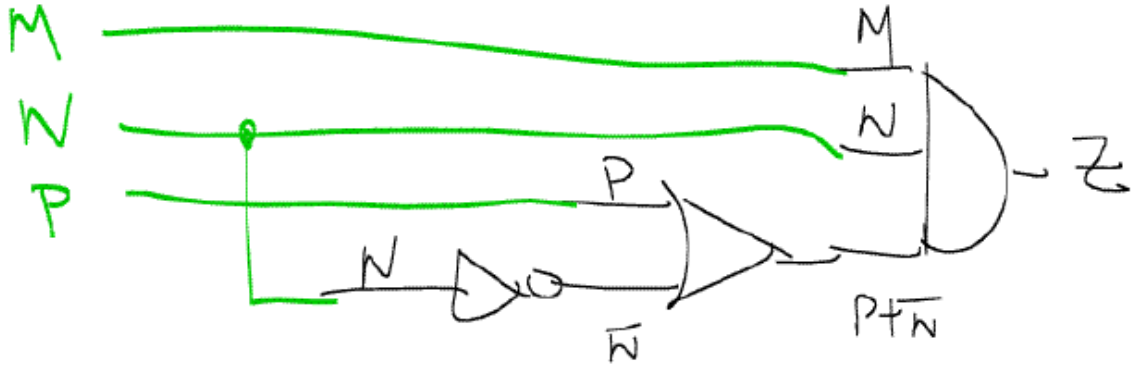


B→3-16. For each of the following expressions, construct the correspondi
logic circuit, using AND and OR gates and INVERTERs.

(e) $z = MN(P + \overline{N})$

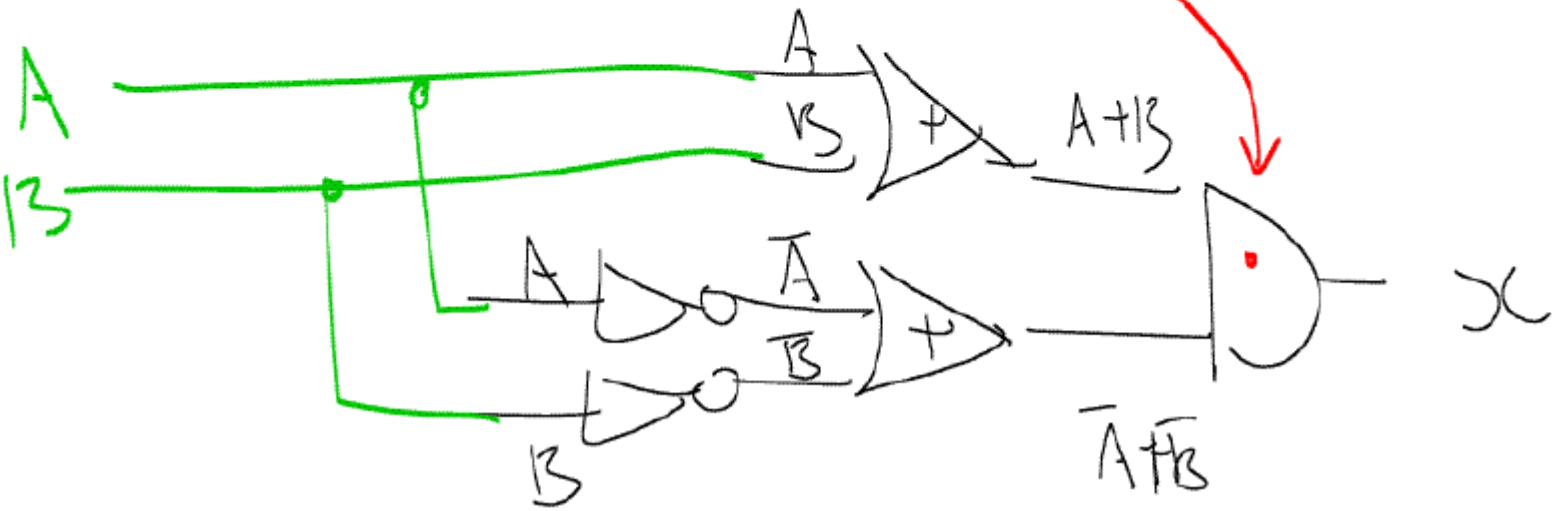


Alt.



B→3-16. For each of the following expressions, construct the correspondi logic circuit, using AND and OR gates and INVERTERs.

(f) $x = (A + B)(\overline{A} + \overline{B})$



3-22. DRILL QUESTION

Complete each expression.

(a) $A + 1 =$ 1

(b) $A \cdot A =$ A

(c) $B \cdot \overline{B} =$ 0

(d) $C + C =$ C

(e) $x \cdot 0 =$ 0

(f) $D \cdot 1 =$ D

(g) $D + 0 =$ D

(h) $C + \overline{C} =$ 1

(i) $G + GF =$ $G(1+F) = G$

(j) $y + \overline{w}y =$ $y(1+\overline{w}) = y$

Further exercise:

$(ABC) + \overline{(ABC)} = 1$

3-24. (a) Simplify the following expression using theorems (13b), (3), and (4):

$$x = (M + N)(\overline{M} + P)(\overline{N} + \overline{P})$$

$$= (M\overline{M} + MP + N\overline{M} + NP)(\overline{N} + \overline{P})$$

$$= MP\overline{N} + MP\overline{P} + N\overline{M}\,\overline{N} + N\overline{M}\,\overline{P} + NP\overline{N} + NP\overline{P}$$

$$= MP\overline{N} + N\overline{M}\,\overline{P}$$

Tidy-up

$$x = M\overline{N}P + \overline{M}N\overline{P}$$

3-24

(b) Simplify the following expression using theorems (13a), (8), and (6):

$$z = \bar{A}B\bar{C} + AB\bar{C} + B\bar{C}D$$

$$= (\bar{A} + A)\, B\bar{C} + B\bar{C}D$$

$$= B\bar{C}\,(1 + D)$$

$$= B\bar{C}$$

→3-26. Simplify each of the following expressions using DeMorgan's the

(a) $\overline{\overline{A}B\overline{C}}$

$= \overline{\overline{A}} + \overline{B} + \overline{\overline{C}}$

$= A + \overline{B} + C$

(d) $\overline{A + \overline{B}}$

$= \overline{A} \cdot \overline{\overline{B}}$

$= \overline{A} \cdot B$

(g) $\overline{A(B + \overline{C})D}$

$= \overline{A} + \overline{(B + \overline{C})} + \overline{D}$

$= \overline{A} + (B + \overline{C}) + \overline{D}$

$= \overline{A} + B + \overline{C} + \overline{D}$

Recap:

$\overline{x + y + z}$

$= \overline{x} \cdot \overline{y} \cdot \overline{z}$

$\overline{x \cdot y \cdot z}$

$= \overline{x} + \overline{y} + \overline{z}$

→3-26. Simplify each of the following expressions using DeMorgan's the

(b) $\overline{\overline{A} + \overline{B}C}$

$= \overline{\overline{A}} \cdot \overline{\overline{B}C}$

$= A \cdot (\overline{\overline{B}} + \overline{C})$

$= A(B + \overline{C})$

$= AB + A\overline{C}$

(e) $\overline{\overline{AB}}$

$= AB$

The ans. on P.557 is wrong:

$A + B$ ✗

(h) $\overline{(M + \overline{N})(\overline{M} + N)}$

$= \overline{(M + \overline{N})} + \overline{(\overline{M} + N)}$

$= (\overline{M} \cdot \overline{\overline{N}}) + (\overline{\overline{M}} \cdot \overline{N})$

$= (\overline{M}N) + (M\overline{N})$

$= \overline{M}N + M\overline{N}$

→3-26. Simplify each of the following expressions using DeMorgan's theo

(c) $\overline{ABCD}$

$= \bar{A} + \bar{B} + \overline{\overline{CD}}$

$= \bar{A} + \bar{B} + CD$

(f) $\overline{\bar{A} + \bar{C} + \bar{D}}$

$= \bar{A} \cdot \bar{C} \cdot \bar{D}$

$= A \cdot C \cdot D$

(i) $\overline{\overline{ABCD}}$

$= \overline{\overline{ABC}} + \overline{D}$

$= \overline{ABC} + \overline{D}$

$= (\bar{A} + \bar{B})C + \overline{D}$

$= \bar{A}C + \bar{B}C + \overline{D}$

In words : Warning light on when Temp $\geq$ 200°F and either pressure $\geq$ 220 psi or RPM $<$ 4800

→3-32. 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

Figure 3-56 shows the logic circuit that controls a cockpit warning light for certain combinations of engine conditions. Assume that a HIGH at output *W* activates the warning light.

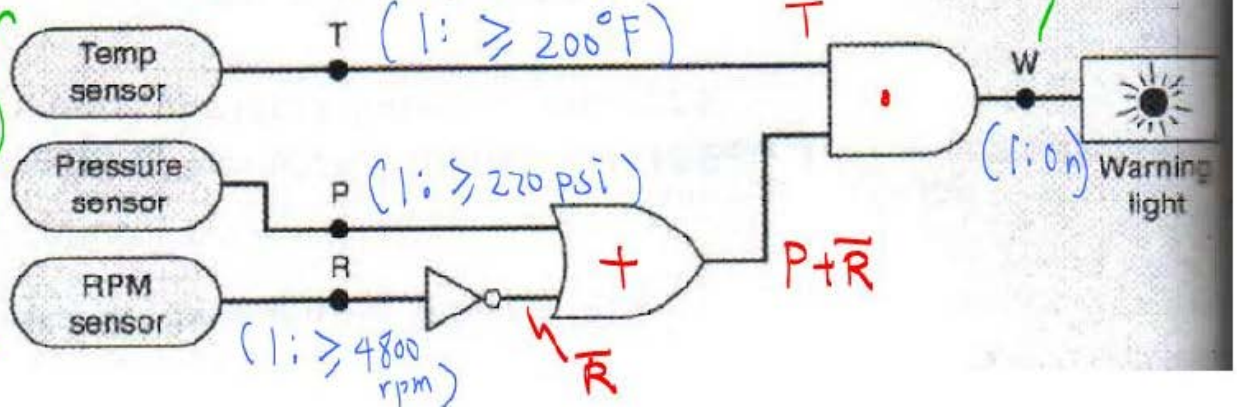
(a) Determine what engine conditions will give a warning to the pilot.

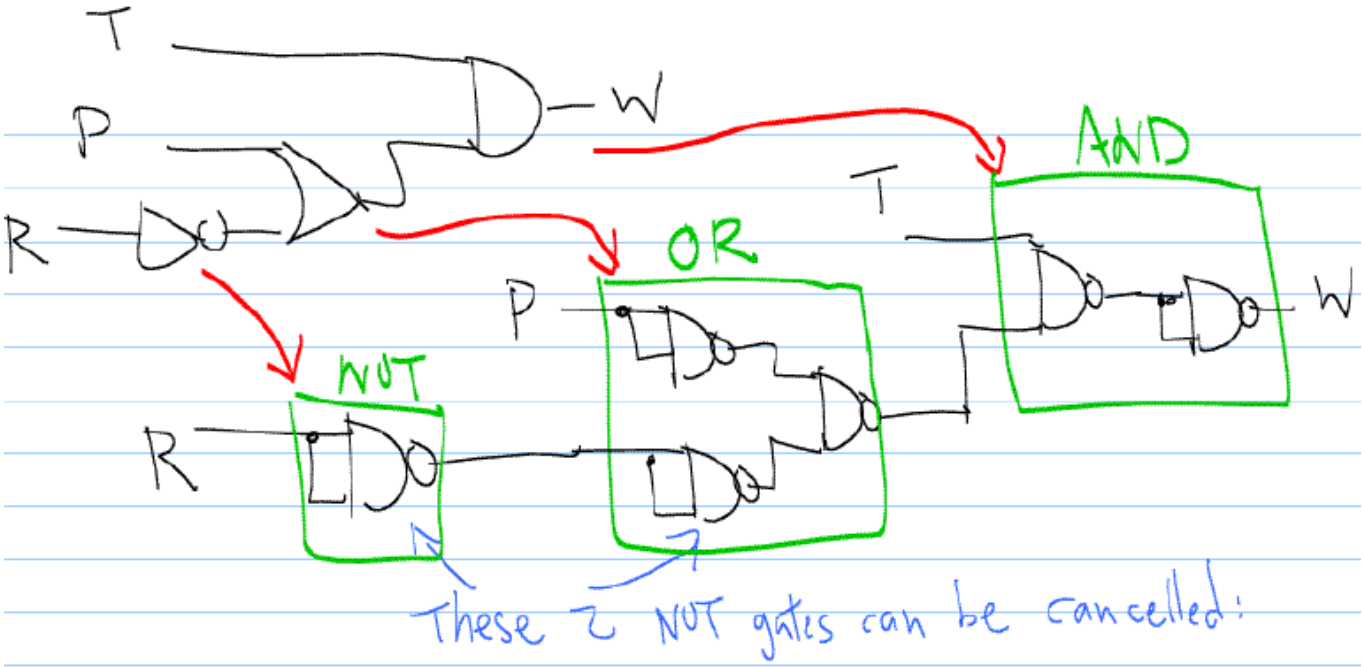
(b) Change this circuit to one using all NAND gates.

$W = T \cdot (P + \overline{R})$

ie W=1 when T=1 and either P=1 or R=0

URE 3-56





Ans. for (b)