1.5.7:

(a). Since this truth table has three entries of F,

$\psi_1 \stackrel{def}{=} \neg p \vee \neg q$

$\psi_2 = p \vee \neg q$

$\psi_3 = \neg p \vee p$

The resulting ϕ in CNF is therefore

$(\neg p \vee \neg q) \wedge (p \vee \neg q) \wedge (\neg p \vee q)$

(b)

$\psi_1 = \neg p \vee \neg q \vee r$

$\psi_2 = \neg p \vee q \vee \neg r$

$\psi_3 = \neg p \vee q \vee r$

$\psi_4 = p \vee \neg q \vee r$

$\psi_5 = p \vee q \vee r$

The resulting ϕ in CNF is therefore

$(\neg p \vee \neg q \vee r) \wedge (\neg p \vee q \vee \neg r) \wedge (\neg p \vee q \vee r) \wedge (p \vee \neg q \vee r)$
$\wedge (p \vee q \vee r)$

(c).

$\psi_1 = \neg p \vee \neg q \vee \neg r$

$\psi_2 = \neg p \vee q \vee \neg r$

$\psi_3 = p \vee \neg q \vee \neg r$

$\psi_4 = p \vee \neg q \vee r$

$\psi_5 = p \vee q \vee \neg r$

The resulting ϕ in CNF is therefore

$(\neg p \vee \neg q \vee \neg r) \wedge (\neg p \vee q \vee \neg r) \wedge (p \vee \neg q \vee \neg r) \wedge (p \vee \neg q \vee r) \wedge (p \vee q \vee \neg r)$

1.5.9

$$\text{IMPL\_FREE} = \neg(\neg p \vee (\neg(q \vee (p \vee q))))$$

$$\downarrow$$

NNF

$$\downarrow$$

$$\text{CNF} = p \wedge (q \wedge (p \vee q))$$