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Intro to Discrete Structures Assignment 1

1.

a) $p \rightarrow q$

b) $(s \wedge r) \rightarrow q$

c) $(\neg p \wedge r) \rightarrow q$

d) If I don't finish my computer project before lunch and the sun is not shining, then I shall not play tennis in the afternoon.

e) I shall play tennis in the afternoon if and only if the sun is shining.

2.

a) $p \rightarrow (p \wedge q)$

p	q	$p \rightarrow (p \wedge q)$
T	T	T
T	F	F
F	T	T
F	F	T

3.

a) Tautology

b) Contradiction

c) Contingency (neither)

$p \vee q \rightarrow p$

p	q	$p \vee q$	$p \vee q \rightarrow p$
T	T	T	T
T	F	T	T
F	T	T	F
F	F	F	T

4.

a) Prove that $(p \rightarrow q) \wedge (\neg q \wedge (r \vee \neg q)) = \neg(q \vee p)$

$(p \rightarrow q) \wedge (\neg q \wedge (r \vee \neg q))$	
$(\neg p \vee q) \wedge \neg q$	Absorption Laws
$(\neg q \wedge \neg p) \vee (\neg q \wedge q)$	Distributive
$\neg q \wedge \neg p$	Contradiction
$\neg(q \vee p)$	De Morgan's

b) Prove that $p \vee (p \wedge (p \vee q)) = p$

$p \vee (p \wedge (p \vee q))$	
$p \vee ((p \wedge p) \vee (p \wedge q))$	Distributive
$p \vee (p \vee (p \wedge q))$	Idempotency
$p \vee p$	Absorption
p	Idempotency