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1. No.1Which of these sentences are propositions? What are the truth values of those that are propositions?

   i. Nanjing is the capital of Jiangsu .

   ii. Chongqing is the capital of Sichuan .

   iii. $2+3=5$

   iv. $5+7=10.$

   v. $x+2=11.$

   vi. Answer this question.

   vii. $x+y=y+x$ for every pair of real number x and y.

   [Sol.] The propositions are:

   i. ii. iii. iv. vii

   Truth value:

   i. iii. vii.

2. No.4(Rosen, 2003, pp.26-28:1) Use truth tables to verify these equivalences.

   i. $p \wedge T \equiv p$

p	$p \wedge T$
T	T
F	F

ii. $p \vee F \equiv p$

p	$p \vee F$
T	T
F	F

iii. $p \wedge F \equiv F$

p	$p \wedge F$
T	F
F	F

iv. $p \vee T \equiv T$

p	$p \vee T$
T	T
F	T

v. $p \vee p \equiv p$

p	$p \vee p$
T	T
F	F

vi. $p \wedge p \equiv p$

p	$p \wedge p$
T	T
F	F

3. No.7 (Rosen, 2003, pp.26-28:4) Use truth table to verify the associative laws
   i. $(p \vee q) \vee r \equiv p \vee (q \vee r)$

p	q	r	$(p \vee q) \vee r$	$p \vee (q \vee r)$
T	T	T	T	T
T	F	T	T	T
F	T	T	T	T
F	F	T	T	T
T	T	F	T	T
T	F	F	T	T
F	T	F	T	T
F	F	F	F	F

   ii. $(p \wedge q) \wedge r \equiv p \wedge (q \wedge r)$

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

4. No.10 Show that each of these implications is a tautology by using truth tables.
   i. $(p \wedge q) \rightarrow q$

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

ii. $p \rightarrow (p \vee q)$

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

iii. $\neg p \rightarrow (p \rightarrow q)$

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

iv. $(p \wedge q) \rightarrow (p \rightarrow q)$

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

v. $\neg(p \rightarrow q) \rightarrow p$

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

vi. $\neg(p \rightarrow q) \rightarrow \neg q$

p	q	$p \to q$	$\neg(p \to q)$	$\neg(p \to q) \to \neg q$
T	T	T	F	T
T	F	F	T	T
F	T	T	F	T
F	F	T	F	T