Homework 1

MATH 301
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1. (a) This is a false statement, because all square matrices are not invertible.
   (b) This is a false statement, as the $\det$ is zero.
   (c) This is not a valid statement, since the qualifier of "happy" isn't well-defined. Also, "clap your hands" is not really a conclusion.
   (d) This is not a valid statement, as "today" is ambiguous.

2. (a) P : The number 25 is even
   Q : The number 25 is a power of 3
   $\boxed{P \wedge Q}$
   (b) P : 14 is a prime number
   $\boxed{\neg P}$
   (c) P : A number is even
   Q : A number is odd
   $\boxed{P \vee Q}$
   (d) P : I am not here
   Q : I am probably somewhere else
   $\boxed{P \implies Q}$

3. If $(P \implies Q) = 1$ and $\neg Q = 1$, then $Q = 0$ and $P = 0$,
   (a) P is false.
   (b) $P \vee Q = (0 \vee 0)$ is false.
   (c) $P \wedge Q = (0 \wedge 0)$ is also false.

4. (a)

P	Q	R	$Q \implies R$	$P \vee (Q \implies R)$
1	1	1	1	1
1	1	0	0	1
1	0	1	1	1
1	0	0	1	1
0	1	1	1	1
0	1	0	0	0
0	0	1	1	1
0	0	0	1	1

   (b)

P	Q	$\neg P$	$(P \wedge \neg P)$	$(P \wedge \neg P) \vee Q$
1	1	0	0	1
1	0	0	0	0
0	1	1	0	1
0	0	1	0	0

   The statement reduces to Q.

(c)

P	Q	$\neg P$	$(P \vee \neg P)$	$(P \vee \neg P) \wedge Q$
1	1	0	1	1
1	0	0	1	0
0	1	1	1	1
0	0	1	1	0

The statement reduces to Q again.