

# Quiz 0

Engineering 3422, 2004

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**Q0.** [6] True or false in each case. For propositional expressions  $A$ ,  $B$ , and  $C$  and variable  $V$ :

- $A \leftrightarrow B$  is a contradiction if and only if  $A$  and  $B$  are not equivalent. \_\_\_\_\_
- If  $A \leftrightarrow B$  is a tautology then  $A[V := C] \leftrightarrow B[V := C]$ . \_\_\_\_\_
- If  $A \leftrightarrow B$  then  $C[V := A] \leftrightarrow C[V := B]$ . \_\_\_\_\_

**Q1.** [8] Classify each of the following sentences as a “tautology”, “contradiction”, or a “conditional sentence”. No proof is required

- $(P \vee Q) \wedge \neg P$  is a \_\_\_\_\_
- $P \wedge (P \rightarrow \neg P)$  is a \_\_\_\_\_
- $P \leftrightarrow \neg P$  is a \_\_\_\_\_
- $(P \rightarrow Q) \wedge (Q \rightarrow P)$  is a \_\_\_\_\_

**Q2. [10]** Give an algebraic proof of the following laws. Give a hint (the name of the law applied) for each step and underline to indicate the location of each use of the principle of substitution.

(a)

$$(P \rightarrow Q) \vee (R \rightarrow Q) \Leftrightarrow P \wedge R \rightarrow Q$$

(b)

$$(\neg P \vee Q) \wedge (P \vee \neg Q) \Leftrightarrow P \leftrightarrow Q$$

