Homework #6, CS-271, Intro to AI, Spring Quarter 2010

Your Name and ID# _____

Corrected By Name and ID# _____

1. (5 pts each, 30 pts total) Mark the following reasoning patterns as S (= sound, carries true premises to true conclusions) or U (= unsound, may carry true premises to false conclusions). Premises are shown above the line, conclusions below the line. Here, " $\Rightarrow$ " means "implies" and " $\neg$ " means "not." The first one is done for you as an example.

a. __S__
$$P \Rightarrow Q$$
$$\underline{P}$$
$$Q$$

b. _____
$$P \Rightarrow Q$$
$$\underline{Q}$$
$$P$$

c. _____
$$P \Rightarrow Q$$
$$\overline{P \text{ or } \neg Q}$$

d. _____
$$P \Rightarrow \neg Q$$
$$\underline{Q}$$
$$\neg P$$

e. _____
$$P \Rightarrow Q$$
$$\underline{\neg Q}$$
$$\neg P$$

f. _____
$$P \Rightarrow Q$$
$$\overline{\neg P \text{ or } Q}$$

g. _____
$$\neg P \Rightarrow Q$$
$$\underline{P}$$
$$\neg Q$$

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2. (5 pts each, 40 pts total) In each of the following, *KB* is a set of sentences, $\{\}$ is the empty set of sentences, and *S* is a single sentence. Recall |= means "entails" and |- means "derives," where |-i means "inference procedure i derives." Use these keys:

Snd = Sound.
Unsnd = Unsound.
C = Complete.
I = Incomplete.
V = Valid.
Sat = Satisfiable.
Unsat = Unsatisfiable.
N = None of the above.

For each blank below, write in the key above that best corresponds to the correct term.

(a) Suppose some inference procedure i has the property, that for some *KB* and some *S*, *KB* |= *S* but not *KB* |-i *S*. Then the inference procedure i is_____.

(b) Let *S* be given in advance. Suppose that for some *KB₁*, *KB₁* |= *S*; but that for some other *KB₂*, *KB₂* |= ¬*S*. Then *S* is _____.

(c) Suppose some inference procedure i has the property, that for any *KB* and any *S*, whenever *KB* |= *S* then *KB* |-i *S*. Then the inference procedure i is _____.

(d) Suppose inference procedure i has the property, that for some *KB* and some *S*, *KB* |-i *S* but not *KB* |= *S*. Then the inference procedure i is _____.

(e) Let *S* be given in advance. Suppose that $\{\}$ |= *S*. Then *S* is _____.

(f) Suppose some inference procedure i has the property, that for any *KB* and any *S*, whenever *KB* |-i *S* then *KB* |= *S*. Then the inference procedure i is _____.

(g) Suppose that *KB* |= *S*, then the sentence (*KB* ⇒ *S*) is _____.

(h) Suppose that *KB* |= *S*, then the sentence (*KB* and ¬*S*) is _____.

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3. Consider the KB shown below.

a. (5 pts each, 15 pts total) Translate the following *KB* into Conjunctive Normal Form. The first one is done for you as an example (it was already in Conjunctive Normal Form ;-)).

A. $P \lor R$.   _____$P \lor R$_____

B. $Q \Rightarrow S$.   _____

C. $P \Rightarrow Q$.   _____

D. $R \Rightarrow S$.   _____

b. (15 pts total, -5 for each wrong step, but not negative. The order may vary, if proof is correct.) Write a complete resolution proof that *KB* $\models$ *S*. Show the two clauses that you resolve in front of the symbol |-, and the resulting clause after |-. You may not require all of the lines provided. The sentence labeled "E." adds the negated goal. The first one is done for you as an example.

E. $\neg S$

(a) _____$\neg S$_____ , _____$\neg Q \lor S$_____ , |- _____$\neg Q$_____ .

(b) _____ , _____ , |- _____ .

(c) _____ , _____ , |- _____ .

(d) _____ , _____ , |- _____ .

(e) _____ , _____ , |- _____ .

(f) _____ , _____ , |- _____ .

(g) _____ , _____ , |- _____ .

(h) _____ , _____ , |- _____ .

(i) _____ , _____ , |- _____ .

(add additional lines if you need them)