1. Consider this propositional logic. Assume that ~ is negation.

$$\sim y \vee \sim u \vee \sim s \vee q$$

Select all true statements.

a) The statement is a Horn clause T

b) The statement is a definite clause T

c) The statement is logically equivalent to $\sim y \vee \sim u \vee \sim s \rightarrow q$ F

d) The statement is logically equivalent to $\sim y \wedge \sim u \wedge \sim s \rightarrow q$ F

e) The statement is logically equivalent to $y \wedge u \wedge s \rightarrow q$ T

f) The statement is logically equivalent to $\sim q \wedge u \wedge s \rightarrow \sim y$ T

2. Select all inferences that are valid logical inferences. That is, the clause below the line logically follows from (i.e., $\vdash$ *or* $\models$) the clause(s) above the line.

F a) $\dfrac{p \vee \sim q \vee s,\ \sim p \vee q \vee \sim s}{\{\}}$

T b) $\dfrac{p,\ \sim p \vee q \vee r}{q \vee r}$

T c) $\dfrac{p \wedge \sim q \rightarrow s,\ p \wedge \sim q}{s \vee r}$

T d) $\dfrac{p \wedge \sim q \rightarrow s,\ p \wedge \sim q}{s}$

T e) $\dfrac{p \vee q \vee s,\ \sim p \vee q \vee r}{q \vee s \vee r}$

T f) $\dfrac{p \wedge \sim q \wedge r}{p \wedge r}$

3. Consider the propositional knowledge base, KB. Prove **(t ∧ p)** by contradiction using resolution (resolution refutation) with a set-of-support strategy.

p ∨ ~q ∨ ~r

~y ∨ ~u ∨ ~s ∨ q

~x ∨r

~q ∨ t ∨~x

u ∨ ~w

z ∨ ~m

~w ∨ y ∨ ~x

s

w

x

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(3) Prove $t \wedge P$.

apply Resolution

$p \vee \sim q \vee \sim r$ (A) $\sim r \vee t$

$\sim y \vee \sim u \vee \sim s \vee q$ $\equiv$ (B) $\sim y \vee \sim u \vee \sim s$

$\sim x \vee r$ (K) $\sim r \vee t$ $\equiv$ (E) $\sim x \vee t$

$\sim q \vee t \vee \sim x$

$u \vee \sim w$ (B) $\sim y \vee \sim u \vee \sim s$ $\equiv$ (B) $\sim y \vee \sim s$

$z \vee \sim m$

$\sim w \vee y \vee \sim x$ $\equiv$ (F) $y \vee \sim x$

s (D) $\sim y \vee \sim s$ $\equiv$ (E) $\sim y$

w

X (E) $\sim y \equiv \sim(\sim t \vee \sim p)$

is false

therefore $t \vee p$

is True

4. Select all statements that are true.

F a) Creating a machine that thinks like a human is definitional of the field of artificial intelligence

T b) Anytime search continues to search for solutions after finding the first solution

F c) The most challenging task environments for AI are fully observable, single agent, deterministic, episodic, and discrete.

T d) The runtime cost of a depth-bounded depth-first search is O(B*D), where B is the branching factor and D is the depth bound

F e) Macro operators are guaranteed of reducing search costs because their use reduces the effective depth of search.

T f) Increased heuristic accuracy effects search costs by reducing the effective branching factor of search.

T g) Logical state estimation is the process of updating the belief state as new percepts arrive

5. Select all statements that are true.

Fa) WalkSAT conducts an iterative deepening depth first search in pursuit of a proof of satisfiability

Fb) Modus Ponens is the sole basis of a complete inference algorithm when paired with iterative deepening

Tc) The path between a start state and a descendant state M can be recovered through M's SearchNode parent link, and subsequent ancestor links -- this mitigates redundancy in path storage

Td) Nondeterministic algorithms can be slow due to search, but they can be elegant and simply stated too, and machine learning can speed them up

Fe) Heuristic admissibility applies straightforwardly to utility-driven search

Ff) The generalized arc consistency (GAC) procedure is guaranteed to find one or more solutions to any n-ary constraint satisfaction problems

Tg) In contrast to offline search, online search interleaves computation and action