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**Registration# SP20-BCS-044**

**Question 1)**

Imagine a wumpus world described by the following rules,

R1: ￢ P1, 1

R2: B1, 1 ⇔ (P1, 2 ∨ P2, 1)

R3: B2, 1 ⇔ (P1, 1 ∨ P2, 2 ∨ P3, 1)

R4: ￢ B1, 1

R5: B2, 1

R6: ￢B1, 2

R7: B1, 2 ⇔ (P1, 1 ∨ P2, 2 ∨ P1, 3)

Prove that there is no pit in (2, 2) and there is no pit in (1, 2) i.e.

R\_: ￢P2, 2

R\_: ￢P1, 2

**Question 2)**

Consider the following statements:

1. 0 ≤ 2
2. 5 ≤ 6
3. ∀x; x ≤ x
4. ∀x; x ≤ x + 0
5. ∀x; x + 0 ≤ x
6. ∀x; y; x + y ≤ y + x
7. ∀w; x; y; z; w ≤ y ^ x ≤ z => w + x ≤ y + z
8. ∀x; y; z; x ≤ y ^ y ≤ z => x ≤ z
9. Proof by forward chaining (create and tree and give small explanation to the steps to create the tree as well as the tree itself) that 5 ≤ 2 + 6.
10. Proof by backward chaining (create and tree and give small explanation to the steps to create the tree as well as the tree itself) that 5 ≤ 2 + 6.

**Question 3)**

1. Not all students take both History and Biology.

¬∀X (student(X) ⇒ [takes(X, history) ^ takes(X, biology)])

1. Only one student failed History.

ƎX student(X) ^ (∀Y student(Y) ⇒ equal(X, Y)) ^ failed(X, history)

1. Only one student failed both History and Biology.

ƎX student(X) ^ (∀Y student(Y) ⇒ equal(X, Y)) ^ failed(X, history) ^ failed(X, biology)

1. The best score in History was better than the best score in Biology.

∀X ∀Y (bestScore (history, X) ^ bestScore (biology, Y)) ⇒ better(X, Y))

1. Every person who dislikes all vegetarians is smart.

∀X (person(X) ^ ∀Y [vegetarian(Y) ⇒ ¬likes(X, Y)]) ⇒ smart(X)

1. No person likes a smart vegetarian.

∀X ∀Y (person(X) ^ vegetarian(Y) ^ smart(Y) ⇒ ¬likes(x, y))

1. There is a woman who likes all men who are not vegetarians.

ƎX woman(X) ^ (∀Y man(Y) ^ ¬vegetarian(Y) ⇒ likes(X, Y))

1. There is a barber who shaves all men in town who do not shave themselves.

ƎX barber(X) ^ (∀Y townMan(Y) ^ ¬shaves(Y, Y) ) ⇒ shaves(X, Y))

1. No person likes a professor unless the professor is smart.

∀X ∀Y [person(X) ^ professor(Y)] ⇒ [likes(X, Y)) ⇒ smart(y)]

1. Politicians can fool some of the people all of the time, and they can fool all of the people some of the time, but they can't fool all of the people all of the time.

∀X politician(X) ⇒ {

[ƎY people(Y) ^ (∀T time(T) ⇒ fool(X, Y, T))] ^

[ƎT time(T) ^ (∀Y people(Y) ⇒ fool(X, Y, T))] ^

¬ [∀Y ∀T people(Y) ^ time(T) ⇒ fool(X, Y, T)]

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