Homework 2

Assigned 1/31/17 Due 2/7/16

1. Suppose we could destroy any block in the otherwise traditional blocks world. The destruction is gentle with any supported blocks settling down on the support under the destroyed block.

a) Define the operator or operators needed to model this new world change. Explain your answer.

b) Suppose we have an admissible planner and that destroying a block costs 2, MoveToTable costs 3, MoveToBlock costs 4. Characterize which conditions (specify what kind of problems) would naturally and necessarily result in the destruction of one or more blocks. You may answer by giving distinct example problems in which destroyed blocks play different roles in the solution.

c) Repeat part (b) but with the costs reversed: MoveToBlock costs 2, MoveToTable costs 3, And destroying a block costs 4.

2. Give the most natural English sentence you can for the following first-order logic sentences. If it is ambiguous, give all the meanings. If it is not possible to translate into English, explain why.

a) $\forall x$ ([Human(x) $\wedge$ $\exists y$ (Tea(y) $\wedge$ Drinks(x,y))] $\Rightarrow$ $\exists y$ [Cup(y) $\wedge$ Owns(x,y)])

b) $\exists x$ Barber(x) $\wedge$ $\forall y$ ([~Shaves(y, y) $\Rightarrow$ Shaves(x, y)] $\wedge$ [Shaves(x, y) $\Rightarrow$ ~Shaves(y, y)])

c) $\exists x$ Barber(x) $\wedge$ [$\forall y$ ~Shaves(y, y) $\Rightarrow$ Shaves(x, y)] $\wedge$ Shaves(x, x)

3. Give a first-order logic sentence that best captures the meaning of the following English sentences. If the meaning of a predicate is not obvious, be sure to explain your intended semantics. (Note: English can be ambiguous and result in very different FOL statements. Any single acceptable answer will receive full credit.)

a) Not everyone likes onions.

b) Some cats would do anything to cause trouble

c) The road to hell is paved with good intentions

4. Give the most general unifier and a corresponding unification instance for each set of expressions below. If unification is not possible, write "No Unification" and briefly explain why. Single lower case letters prefaced with a “?” are universally quantified variables.

a) G(?x, F(?y), F(?y), ?x)

G(?z, ?z, ?u, ?u)

G(?v, F(?t), ?w, ?v)

i) MGU:

ii) Unification Instance:

b) Parents (?x, ?x, ?y, ?y)

Parents (Bob, ?w, ?w, ?z)

Parents (?u, ?v, ?u, ?v)

i) MGU:

ii) Unification Instance:

c) Knows (Sister-of(?u), Son-of(?v), Sister-of(?v), John)

Knows (?x, Son-of(?r), ?x, ?r)

(Note: William is the son of John, but John has no sisters at all)

i) MGU:

ii) Unification Instance:

d) And (Dog(?x), Likes (?x, Mary17))

And (Likes (?x, ?z), Dog (?x))

i) MGU:

ii) Unification Instance: