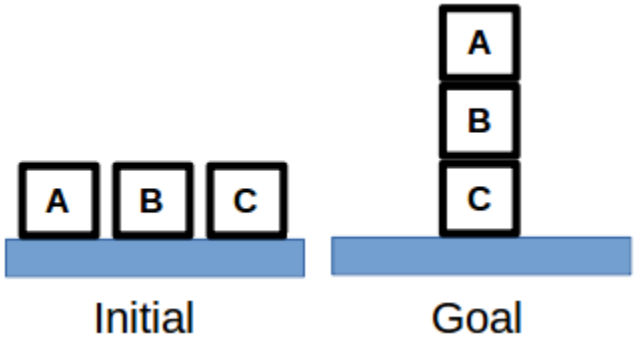
4511W, Fall-2019
ASSIGNMENT 6:
Assigned: 12/4/19 Due: 12/10/19 at 11:55 PM (submit via Canvas, you may take a picture of handwritten solutions, but you must put them in a pdf) Submit only pdf or txt files

Written/drawn:

Problem 1. (15 points)
Suppose you have three blocks "A", "B", and "C" that all start on the floor. The goal is to have all three blocks stacked on top of each other with "A" at the top and "C" at the bottom (see picture below). Formulate this problem in planning (PDDL), clearly defining the initial state, goal and action(s). Do this where:

(1) The action(s) only allow(s) you to move single blocks without any blocks on top (i.e. if you put "A" on "B", you cannot then move both on top of "C". You also cannot move just "B" on top of "C", as "B" has "A" on top.)

(2) The action(s) allow(s) you to move multiple blocks, but only whole stacks (i.e. if you have "A" on "B" you cannot move just "A" on top of "C")



Problem 2. (20 points)
Perform backwards search on the following problem:
Initial: $A(Water) \wedge A(Coke) \wedge A(Coffee) \wedge A(Beer) \wedge A(Milk) \wedge A(Tea) \wedge A(Juice)$
Goal: $C(Water) \wedge B(Tea)$

(Action: DoStuff(x,y),
Precondition: $A(x) \wedge A(y)$,
Effect: $\neg A(x) \wedge \neg A(y) \wedge B(x)$)

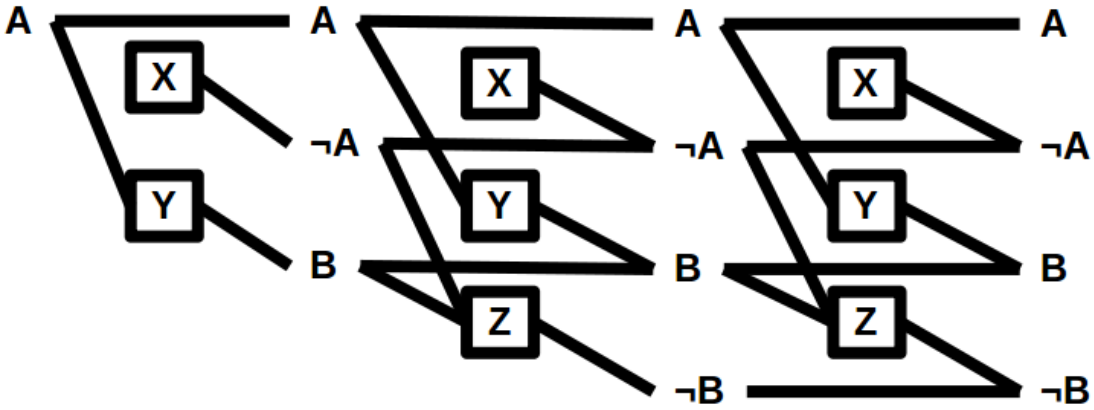
(Action: Thing-a-ma-jig(x,y),
Precondition: $B(x) \wedge B(y)$,
Effect: $\neg B(x) \wedge \neg B(y) \wedge C(x)$)

Problem 3. (20 points)
Suppose you had two actions: "Action1" and "Action2", and you want to create a combined action, "Action1+2". This combined action should be the same as if you had done "Action 1" first and then "Action 2" second.

(1) Describe under what conditions you cannot combine “Action1” and “Action2” together (i.e. when is it impossible to do these actions one after another).

(2) What are the preconditions and effects of the combined “Action1+2”?

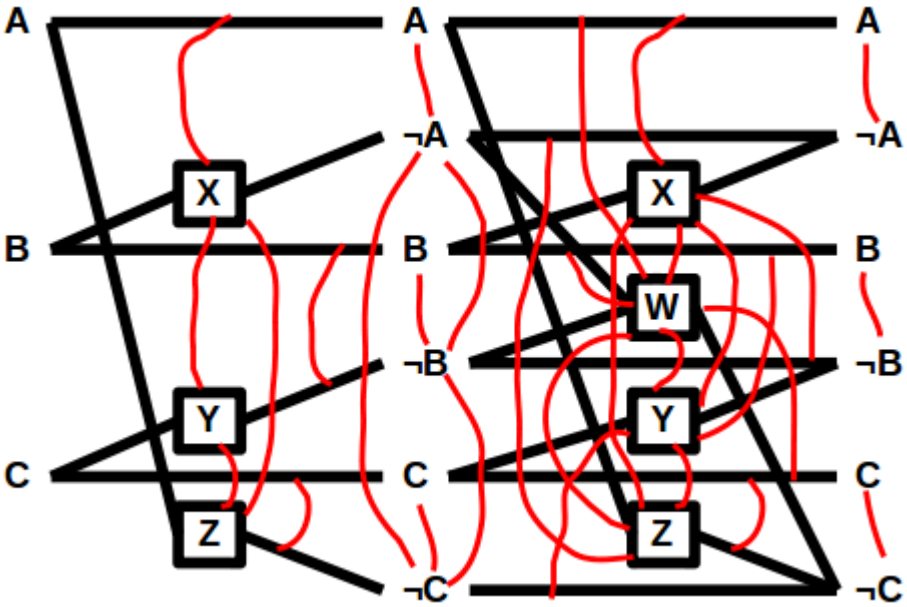
Problem 4. (20 points)
Below is a graphplan with all of the actions and state levels filled in. Clearly mark or list all mutexes (both action and state)



(Note: I had made a mistake where the middle row of actions had an “X” by accident... it should be “Y” as shown above)

Problem 5. (25 points)
Below is a graphplan with all mutexes marked. Given the goal below, provide:
(1) Provide a heuristic for the initial state
(2) Use graphplan to find a solution

Initial: $A \wedge B \wedge C$
Goal: $\neg A \wedge \neg B \wedge \neg C$



In case you have trouble following the mutexes in the above picture, I will list them here as well.

Action level 1:
(X, A)
(X, Y)
(X, Z)
(Y, B)
(Y, Z)
(Z, C)

State level 1:
(A, ¬A)
(¬A, ¬B)
(¬A, ¬C)
(B, ¬B)
(¬B, ¬C)
(C, ¬C)

Action level 2:
(X, A)
(X, ¬B)
(X, W)
(X, Y)
(X, Z)
(W, A)
(W, B)
(W, C)
(W, Y)
(W, Z)
(Y, B)
(Y, ¬C)
(Y, Z)
(Z, ¬A)
(Z, C)

State level 2:
(A, ¬A)
(B, ¬B)
(C, ¬C)