CPT302 Week 4 In-Class Exercises with Solutions

Name and Surname:_____

Student ID:_____

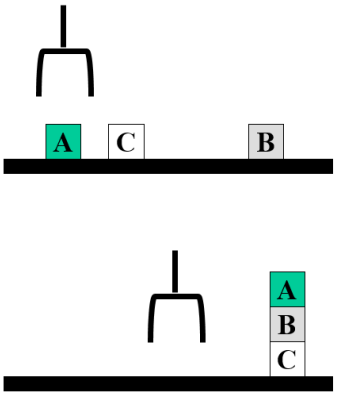
Q1. What is practical reasoning? What is means - end reasoning? Give examples of them (your own examples please).

Ans: Trivial. Please read the lecture note.

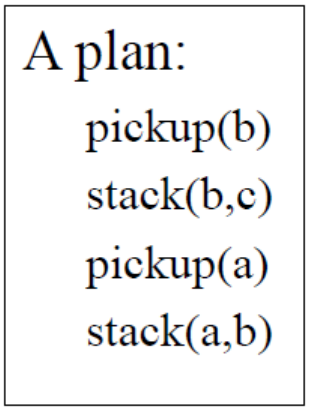
Q2. The Blocks World (BW): Consider the below figure. Make a *Plan* to reach the goal from the initial state using some basic actions (*available in the Blocks World*).

Initial state:
- clear(a)
- clear(b)
- clear(c)
- ontable(a)
- ontable(b)
- ontable(c)
- handempty

Goal:
- on(a,b)
- on(b,c)
- ontable(c)



Ans: A plan can be the following:



For the following questions, consider the predicates for describing the Blocks World (BW) and four basic actions / operations that are given in Table 1 and Table 2 respectively.

Table 1: Predicates for Blocks World

Predicate	Meaning
$On(x, y)$	block x is on top of block y
$OnTable(x)$	block x is on the table
$Clear(x)$	there is nothing on top of block x
$Holding(x)$	robot arm is holding block x
$ArmEmpty$	robot arm is not holding any block

Table 2: Stack Operations

Operation	Specification
$Stack(x, y)$	**pre** $\{Clear(y), Holding(x)\}$ **del** $\{Clear(y), Holding(x)\}$ **add** $\{ArmEmpty, On(x, y)\}$
$UnStack(x, y)$	**pre** $\{On(x, y), Clear(x), ArmEmpty\}$ **del** $\{On(x, y), ArmEmpty\}$ **add** $\{Holding(x), Clear(y)\}$
$PickUp(x)$	**pre** $\{Clear(x), OnTable(x), ArmEmpty\}$ **del** $\{OnTable(x), ArmEmpty\}$ **add** $\{Holding(x)\}$
$PutDown(x)$	**pre** $\{Holding(x)\}$ **del** $\{Holding(x)\}$ **add** $\{ArmEmpty, OnTable(x)\}$

Q3. The initial configuration of the environment is given below:

$$I_0 = \{Clear(A), On(A, B), OnTable(B), OnTable(C), Clear(C), Holding(D)\}.$$

Through a sequence of actions/operations, is it possible to achieve the following goal configuration of the environment:

$$g_0 = \{Clear(A), On(B, C), OnTable(A), OnTable(C), OnTable(D), Clear(B), Clear(D), ArmEmpty\}?$$

If you think that it is possible, then show it with a sequence of actions/operations. Otherwise, give a counterexample.

Ans:

Yes, it is possible. For example,
$\{PutDown(D) \rightarrow UnStack(A, B) \rightarrow PutDown(A) \rightarrow PickUp(B) \rightarrow Stack(B, C)\}$.

Q4. Start with the initial configuration I_0. State whether the following sequence of actions/operations can be potentially executed:

$$Stack(D, A) \rightarrow UnStack(D, A)$$

Ans:

No, it cannot be executed. The configuration after executing $Stack(D, A)$ is:

$$I_0' = \{ArmEmpty, On(D, A), On(A, B), OnTable(B), OnTable(C), Clear(C)\}$$

$Clear(D)$ must be true, but not reflected in I_0'.
The precondition for $UnStack(D, A)$ is not satisfied, because $Clear(D)$ is not in I_0'. Hence, the operation $UnStack(D, A)$ cannot be done.