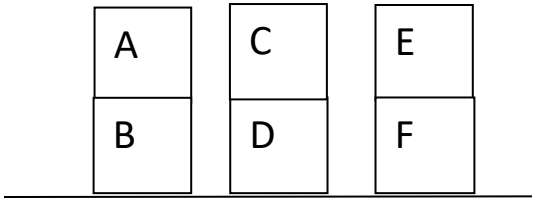
Topic 4.2. Tower Building Problem in a Blocks World

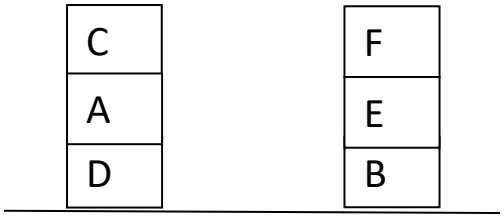
A) Representation of the problem

a) Initial State



Block(A) $\wedge$ Block(B) $\wedge$ Block(C) $\wedge$ Block(D) $\wedge$ Block(E) $\wedge$ Block(F) $\wedge$ On(Table, B) $\wedge$ On(Table, D) $\wedge$ On(Table, F) $\wedge$ On(B, A) $\wedge$ On(D, C) $\wedge$ On(F, E) $\wedge$ Clear(A) $\wedge$ Clear(C) $\wedge$ Clear(E)

b) Goal State



On(D, A) $\wedge$ On(A, C) $\wedge$ On(B, E) $\wedge$ On(E, F) $\wedge$ Clear(C) $\wedge$ Clear(F)

c) Action Schemas:

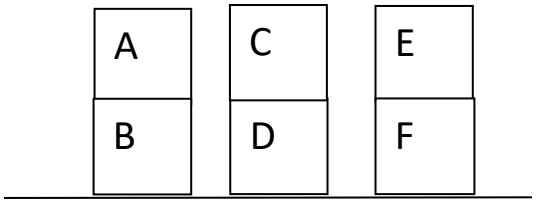
i) Action: Move(b1, x, b2)
Precondition: Block(b1) $\wedge$ Block(b2) $\wedge$ On(x, b1) $\wedge$ Clear(b1) $\wedge$ Clear(b2)
Effect: On(b2, b1) $\wedge \neg$On(x, b1) $\wedge$ Clear(x) $\wedge \neg$Clear(b2)

ii) Action: MoveToTable(b1, b2)
Precondition: Block(b1) $\wedge$ Block(b2) $\wedge$ On(b2, b1) $\wedge$ Clear(b1)
Effect: On(Table, b1) $\wedge \neg$On(b2, b1) $\wedge$ Clear(b2)

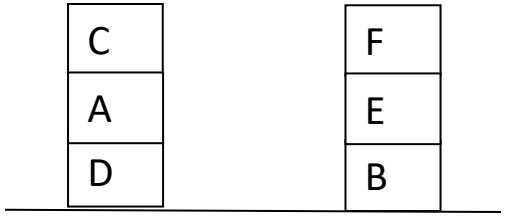
B) Construction of a plan through Forward State Space Search

Initial State — Action 1 — State 1, Goal test = False — ---------- — State n, Goal test = True

Action 1, Action 2, … are practically groups of actions that can be executed in parallel.



Initial State



Goal State

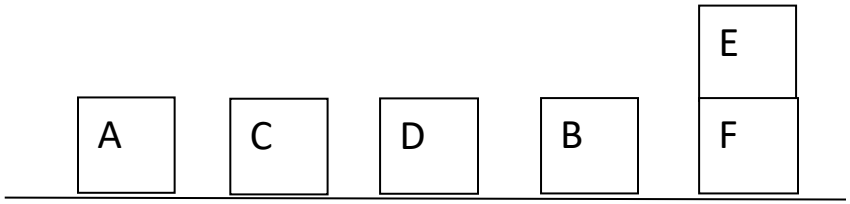
Action 1:

MoveToTable(A, B)

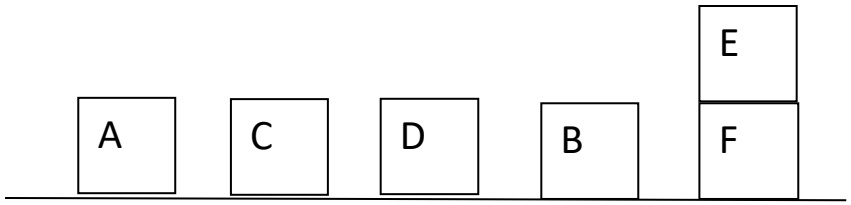
MoveToTable(C, D)

State 1: **[Predicate 'Block' has been omitted.]**

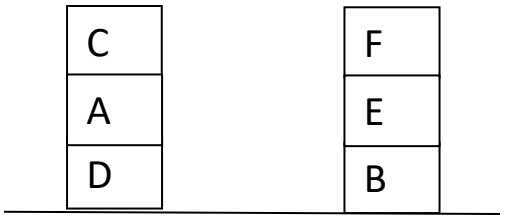
On(Table, B) $\wedge$ On(Table, D) $\wedge$ On(Table, F) $\wedge$ ~~**On(B, A)** $\wedge$ **On(D, C)** $\wedge$~~ On(F, E) $\wedge$ Clear(A) $\wedge$ Clear(C) $\wedge$ Clear(E) $\wedge$ **On(Table, A)** $\wedge$ **On(Table, C)** $\wedge$ **Clear(D)** $\wedge$ **Clear(B)**



Goal test: False



State 1



Goal State

State ----------: **[Predicate 'Block' has been omitted.]**

On(Table, B) $\wedge$ On(Table, D) $\wedge$ On(Table, F) $\wedge$ ~~**On(B, A) $\wedge$ On(D, C) $\wedge$**~~ On(F, E) $\wedge$ Clear(A) $\wedge$ Clear(C) $\wedge$ Clear(E) $\wedge$ **On(Table, A) $\wedge$ On(Table, C) $\wedge$ Clear(D) $\wedge$ Clear(B)**

Goal test:----------

Action 2:

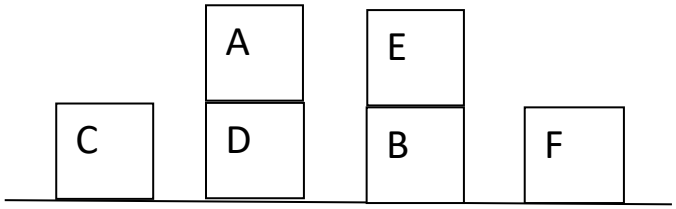
Move(A, Table, D)

Move(E, F, B)

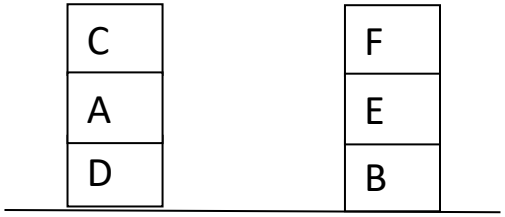
Action 3:

Move(C, Table, A)

Move(F, Table, E)



State 2



Plan: Action 1, Action 2, Action 3; **Is it optimal both in time and number of actions?**