KECERDASAN BUATAN

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S-1 Teknik Informatika

Insitut Teknologi Garut

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AGENDA

01 Kilas Balik Materi

02 Kelompok Belajar

03 L7: Mahasiswa mampu menjelaskan metode *planning* pada kecedasan buatan (C2, A3, P3)

KILAS BALIK MATERI

L1 - L6

KILAS BALIK MATERI: L1-L6

LO	Sub-Capaian Pembelajaran Mata Kuliah (Sub-CPMK)
L1	Mahasiswa mampu **menjelaskan definisi kecedasan buatan**, serta menunjukan pemanfaatannya pada berbagai bidang (C2, A3)
L2	Mahasiswa mampu **membedakan kinerja berbagai algoritma *searching*** baik blind seacrh maupun heuristic search (C2, A1)
L3	Mahasiswa mampu **menggunakan algoritma *searching*** untuk menyelesaian masalah pencarian pada model graph dan tree dengan tepat (C3,A2,P3)
L4	Mahasiswa mampu **menjelaskan aturan logika** pada konsep reasoning (C2,A1)
L5	Mahasiswa mampu **membedakan berbagai metode *reasoning*** dalam perancangan sistem cerdas (C2,A2)
L6	Mahasiswa mampu **menerapkan aturan logika dan teknik *reasoning*** untuk menyelesaikan masalah sederhana secara logis dan sistematis (C3,A4,P3)

SUB-CPMK SELANJUTNYA: L7-L13

LO	Sub-Capaian Pembelajaran Mata Kuliah (Sub-CPMK)
L7	Mahasiswa **mampu menjelaskan metode *planning*** pada kecedasan buatan (C2, A3,P3)
L8	Mahasiswa mampu **menjelaskan konsep *learning*** pada kecerdasan buatan (C2,A1)
L9	Mahasiswa mampu **menjelaskan berbagai algoritma metode *learning*** pada perancangan sistem cerdas dengan tepat (C2,A2)
L10	Mahasiswa mampu **menggunakan metode *learning*** dalam menyelesaikan masalah dengan tepat (C3,A4,P3)
L11	Mahasiswa mampu **menganalisis penerapan konsep kecerdasan buatan** dari hasil penelitian yang sudah ada secara sistematis (C4,A3)
L12	Mahasiswa mampu **mengevaluasi penerapan konsep kecerdasan buatan** dari hasil penelitian yang sudah ada dengan berpikir kritis (C5,A4)
L13	Mahasiswa mampu **merancang penerapan konsep kecerdasan buatan** dalam bentuk proposal penelitian secara sistematis dan inovatif (C6, A5,P3)

KONSEP *PLANNING*

L7

SUB-CPMK

L7: Mahasiswa mampu menjelaskan metode *planning* pada kecedasan buatan (C2, A3, P3)	Ketepatan **menerangkan metode *planning*** pada kecedasan buatan
	Ketepatan **menerangkan penerapan metode *planning*** pada suatu sistem cerdas

KONSEP "*PLANNING*" DALAM AI

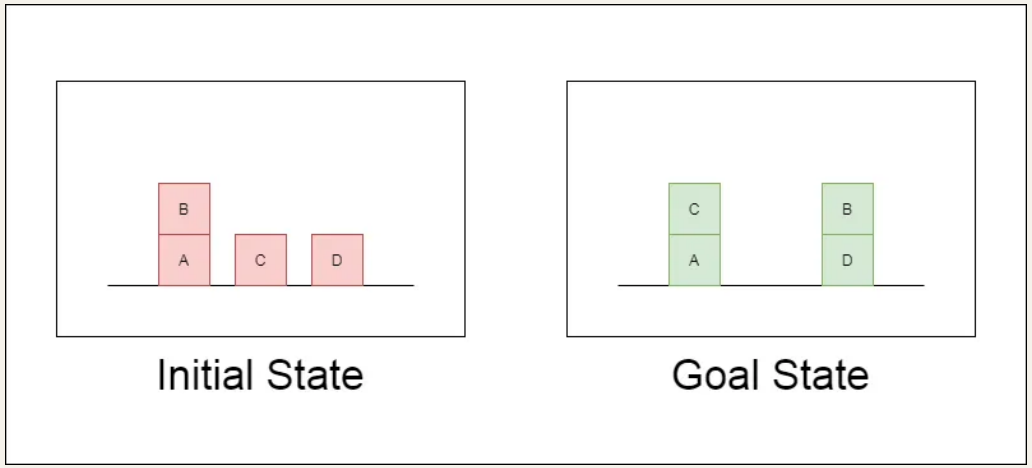
- "Plan", memiliki 4 definisi, yaitu:
  - Ide atau metode yang telah dipikirkan secara detail sebelum menyelesaikan suatu pekerjaan
  - Diagram atau peta detail tentang bagian-bagian penting suatu kta, Gedung, mesin, dsb
  - Cara penyusunan suatu benda, contoh susunan tempat duduk
  - Penyusunan keuangan sehingga seseorang bisa mendapatkan keuntungan
- "*Planning*", didefinisikan sebagai aksi atau proses membuat *plans* untuk sesuatu.
- "*Planning*" adalah suatu metode penyelesaian masalah dengan cara memecahkan masalah ke dalam sub-sub masalah yang lebih kecil, menyelesaikan sub-sub masalah satu demi satu, kemudian menggabungkan solusi-solusi dari sub-sub masalah tersebut menjadi sebuah solusi lengkap dengan tetap mengingat dan menangani interaksi yang terdapat pada sub-sub masalah tersebut.

IMPLEMENTASI PLANNING DALAM KECERDASAN BUATAN

- Link Video: https://www.youtube.com/watch?v=6Gfl77mb9TQ

MASALAH DUNIA BLOK

- Begini masalahnya :
  - Terdapat meja tempat beberapa blok ditempatkan.
  - Beberapa blok mungkin tertumpuk atau tidak ditumpuk di blok lain.
  - Terdapat lengan robot untuk mengambil atau meletakkan balok.
  - Lengan robot hanya dapat memindahkan satu balok pada satu waktu, dan tidak boleh ada balok lain yang ditumpuk di atas balok yang akan digerakkan oleh lengan robot.
- Tujuannya adalah mengubah konfigurasi blok dari **Kondisi Awal** ke **Kondisi Tujuan**, yang keduanya telah ditentukan dalam diagram di samping.
- Terdapat rangkaian operator yang dapat mengubah kondisi awal ke kondisi tujuan disebut **Rencana Penyelesaian**



METODE PENYELESAIAN DUNIA BALOK

Metode *Planning* yang popular dan sudah pernah diuji pada Dunia Balok adalah

- *Goal Stack Planning*
- *Constrait Posting*

Pemecahan masalah dengan menggunakan *planning* pada umumnya bersifat:

- *Goal directed*, yaitu pencarian solusi dilakukan dari *goal-state* sampai ke *initial-state* yang akan dicapai
- *Dependency Directed Backtracking*, ketika menemukan jalan buntu

Suatu sistem *planning* pada umumnya perlu memiliki kemampuan

- Memilih operator
- Mengaplikasikan operator
- Mendeteksi ketika suatu solusi telah tercapai
- Mendeteksi jalan-jalan buntu
- Mendeteksi ketika solusi yang hampir benar telah dicapai dan melakukan teknik khusus untuk membuat solusi tersebut menjadi benar

PENGAPLIKASIAN OPERATOR PADA *PLANNING*

Untuk menghindari pencatatan kondisi keseluruhan di setiap titik persimpangan dalam pencarian solusi, pengaplikasian operator memerlukan tiga daftar predikat untuk mendeskripsikan perubahan kondisi (**Daftar PAD**), yaitu:

Pre-condition

- Predikat-predikat yang harus bernilai benar sebelum pengaplikasian operator

Add

- Predikat-predikat yang bernilai benar setelah pengaplikasian suatu operator

Delete

- Predikat-predikat yang bernilai salah setelah pengaplikasian suatu operator

KARAKTERISTIK MASALAH DUNIA BALOK

1

Memiliki sebuah permukaan datar tempat menyimpan balok, umumnya disebut meja

2

Memiliki sejumlah balok kotak yang berukuran sama

3

Memiliki sebuah lengan robot yang dapat memanipulasi balok

PREDIKAT-PREDIKAT KONDISI BALOK

ON(A, B)

- Balok A menempel diatas Balok B
- $\forall x\ [\exists y\ ON(x,y)] \rightarrow \neg HOLDING(x) \wedge \neg HOLDING(y) \wedge \neg ON(y,x) \wedge [\neg \exists z\ ON(x,z) \vee ON(y,z)]$

ONTABLE(A)

- Balok A berada diatas permukaan meja
- $\forall x\ ONTABLE(x) \rightarrow \neg HOLDING(x) \wedge [\neg \exists y\ ON(x,y)]$

CLEAR(A)

- Tidak ada balok yang sedang menempel diatas Balok A
- $\forall \boldsymbol{x}\ \boldsymbol{CLEAR}(\boldsymbol{x}) \rightarrow \neg \exists y\ ON(y,x)$

PREDIKAT-PREDIKAT UNTUK LENGAN ROBOT

HOLDING(A)

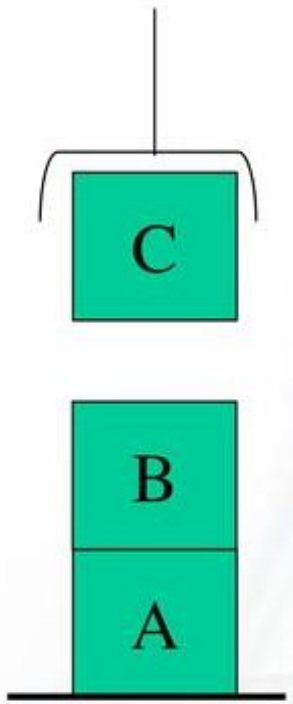
- Lengan robot sedang memegang balok A
- $\exists x\ HOLDING(x) \rightarrow \neg ARMEMPITY \wedge \neg ONTABLE(x) \wedge [\neg \exists y\ ON(x,y) \vee ON(y,x)]$

ARMEMPITY

- Lengan robot tidak sedang memegang balok
- $ARMEMPITY \rightarrow \neg \exists x\ HOLDING(x)$

CONTOH STATE

1



2

Gbr 1. Notasi FOL :

$ONTABLE(A) \wedge CLEAR(A) \wedge ARMEMPTY$

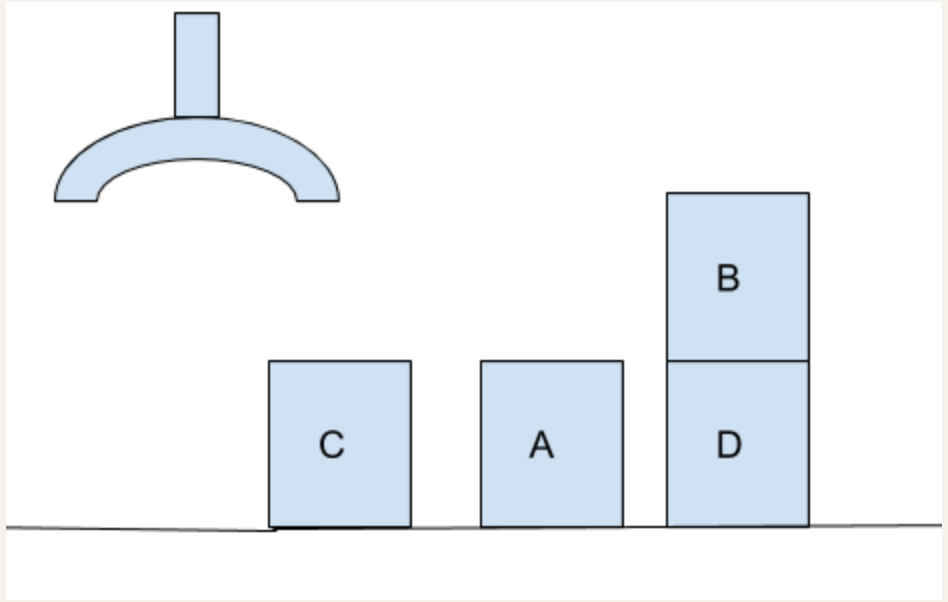
Gbr 2. Notasi FOL :

$ONTABLE(A) \wedge ON(B,A) \wedge CLEAR(B) \wedge HOLDING(C) \wedge CLEAR(C)$

OPERATOR UNTUK LENGAN ROBOT

Operator	Hal yang dilakukan	P	A	D
STACK(A, B)	Meletakan balok A pada balok B	$HOLDING(A)$ $\wedge CLEAR(B)$	$ON(A,B)$ $\wedge ARMEMPTY$	$HOLDING(A)$ $\wedge CLEAR(B)$
UNSTACK(A, B)	Mengangkat balok A yang menempel diatas balok B	$ON(A,B)$ $\wedge CLEAR(A)$ $\wedge ARMEMPTY$	$HOLDING(A)$ $\wedge CLEAR(B)$	$ON(A,B)$ $\wedge ARMEMPTY$
PICKUP(A)	Mengangkat balok A dari permukaan meja	$ONTABLE(A)$ $\wedge CLEAR(A)$ $\wedge ARMEMPTY$	$HOLDING(A)$	$ONTABLE(A)$ $\wedge ARMEMPTY$
PUTDOWN(A)	Meletakan balok A di permukaan meja	$HOLDING(A)$	$ONTABLE(A)$ $\wedge ARMEMPTY$	$HOLDING(A)$

GOAL STACK PLANNING (GSP)

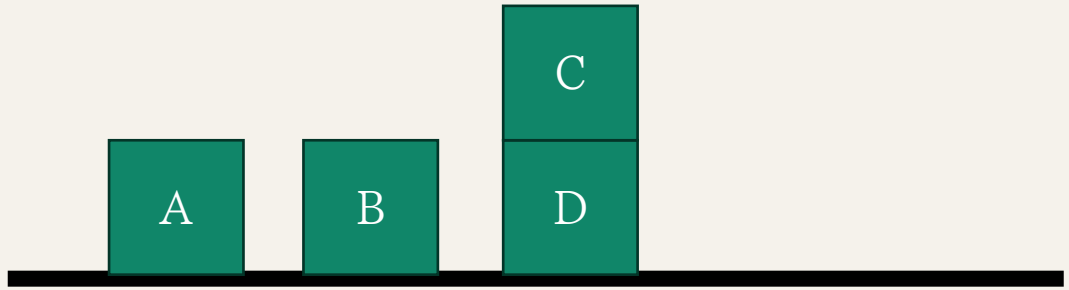


KARAKTERISTIK GSP

- Untuk menyelesaikan suatu masalah GSP menggunakan sebuah *stack* (tumpukan) untuk menampung keadaan-keadaan, baik *goal-state* maupun keadaan lainnya yang mungkin terjadi selama proses pencarian solusi, dan operator-operator yang telah diajukan untuk memenuhi keadaan-keadaan tersebut.
- Algoritma GSP:
    1. Tempatkan seluruh kondisi *goal-state* pada *stack* paling bawah
    2. Masukan setiap kondisi *goal-state* yang belum tercapai ke dalam sebuah *stack*
    3. *Loop*
        a) Keluarkan kondisi yang sudah tercapai dari dalam *stack*
        b) Ganti kondisi yang belum tercapai dengan operator sesuai
        c) Pindahkan operator yang bisa diaplikasikan ke dalam rencana penyelesaian
        d) Cek apakah *current-state* sama dengan *goal-state*
        e) IF current-state = goal-state THEN sukses ENDIF
    4. *END Loop*

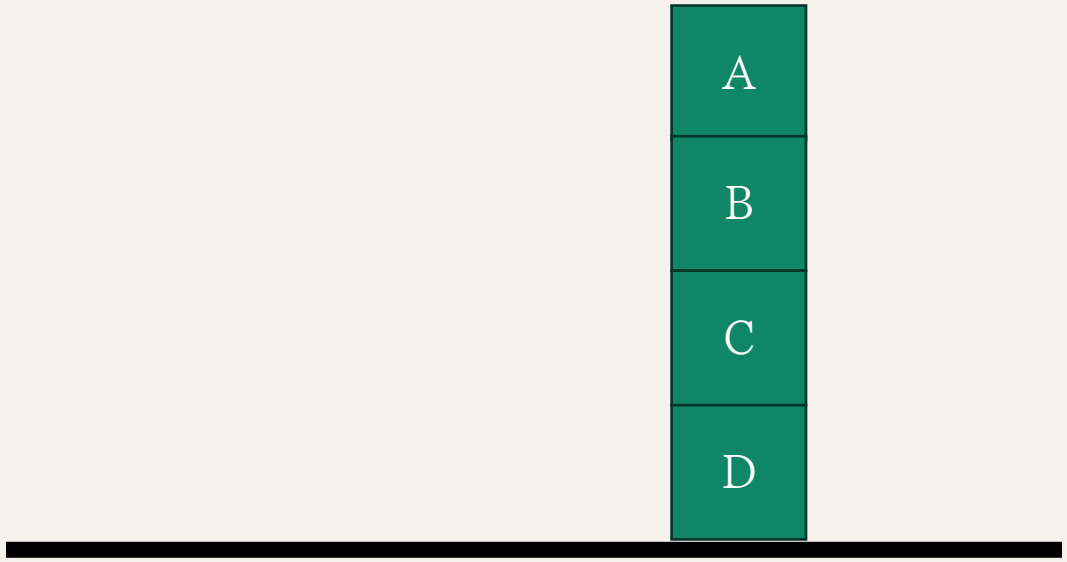
CONTOH 1

Initial State



- $onTable(A) \wedge onTable\ (B) \wedge on(C, D) \wedge onTable(D)$

Goal State

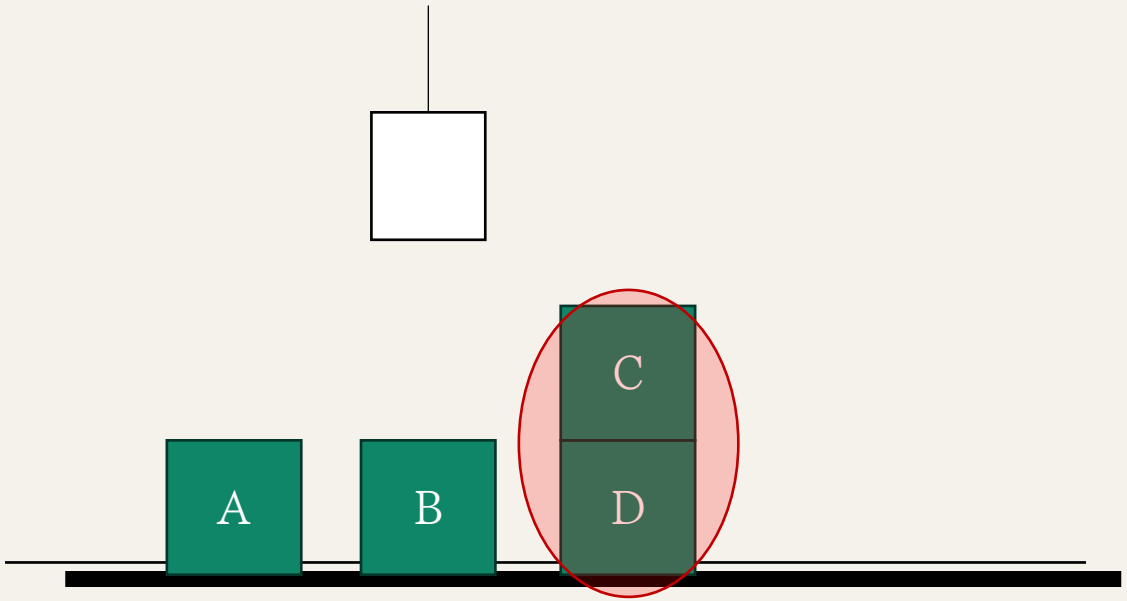


- $on(A, B) \wedge on(B, C) \wedge on(C, D) \wedge onTable(D)$

LANGKAH 1

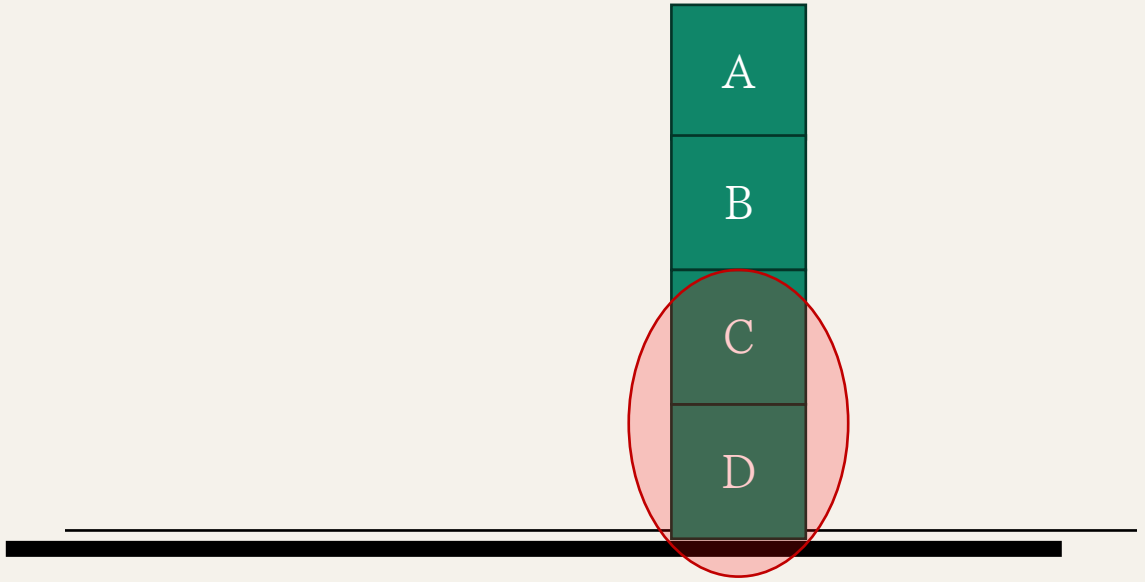
Current State

- $onTable(A) \wedge onTable\ (B) \wedge$ $\boldsymbol{on(C, D)} \wedge \boldsymbol{onTable(D)}$



STACK

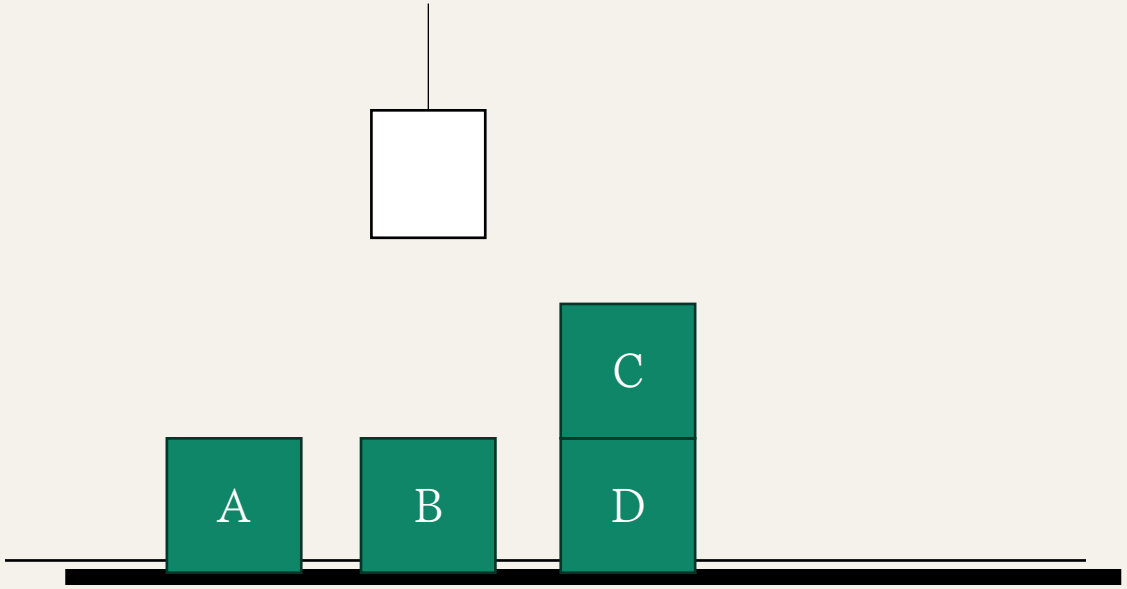
- $on(A, B) \wedge on(B, C) \wedge$ $on(C, D) \wedge onTable(D)$



LANGKAH 2

Current State

- $onTable(A) \wedge onTable\ (B) \wedge on(C, D) \wedge onTable(D)$



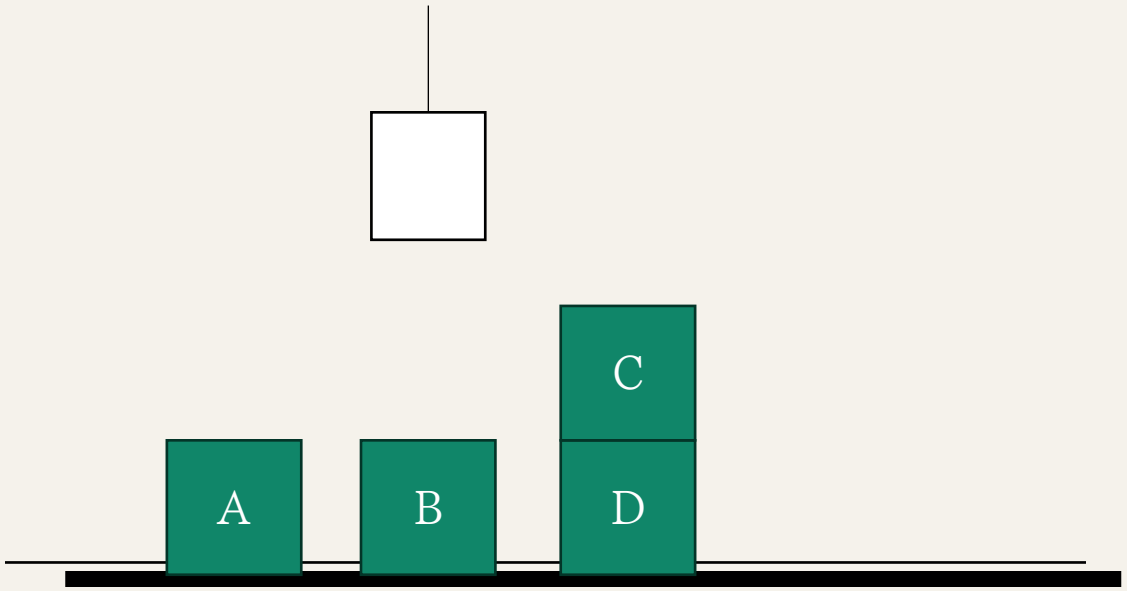
STACK

- $\boldsymbol{on(A, B)}$
- $on(B, C)$
- $on(A, B) \wedge on(B, C) \wedge on(C, D) \wedge onTable(D)$

LANGKAH 3

Current State

- $onTable(A) \wedge onTable\ (B) \wedge on(C, D) \wedge onTable(D)$



STACK

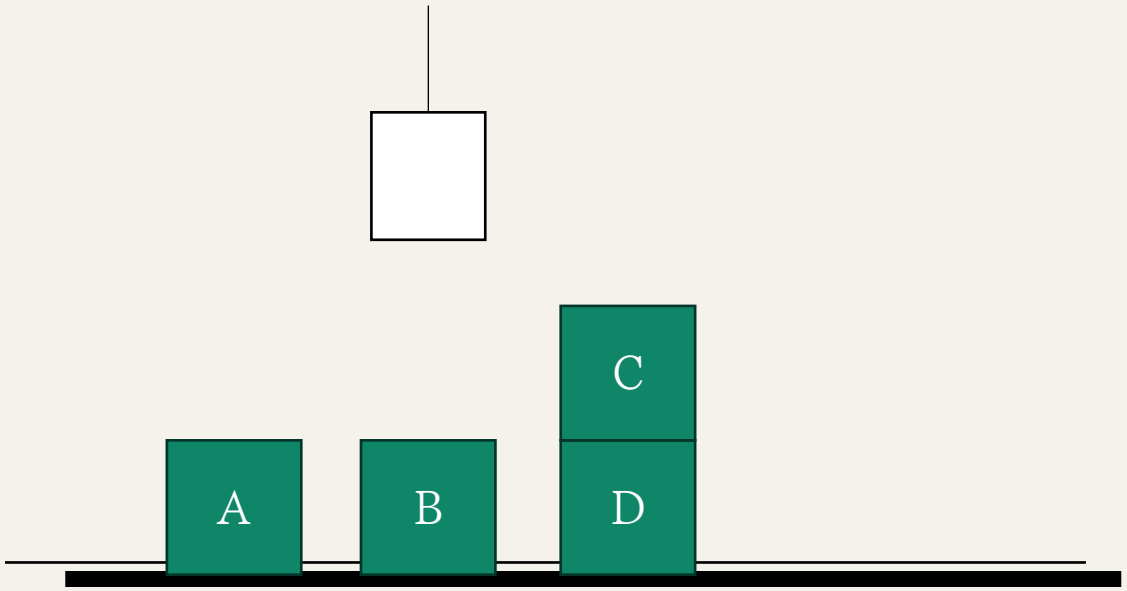
- $onTable(A)$
- $clear(A)$
- $armEmpty$
- $onTable(A) \wedge clear(A) \wedge armEmpty$
- $\boldsymbol{pickUp(A)}$
- $clear(B)$
- $clear(B) \wedge holding(A)$
- ***stack(A,B)***
- $on(B, C)$
- $on(A, B) \wedge on(B, C) \wedge on(C, D) \wedge onTable(D)$

$\boldsymbol{on(A, B)}$

LANGKAH 3

Current State

- $onTable(A) \wedge onTable\ (B) \wedge on(C, D) \wedge onTable(D)$



STACK

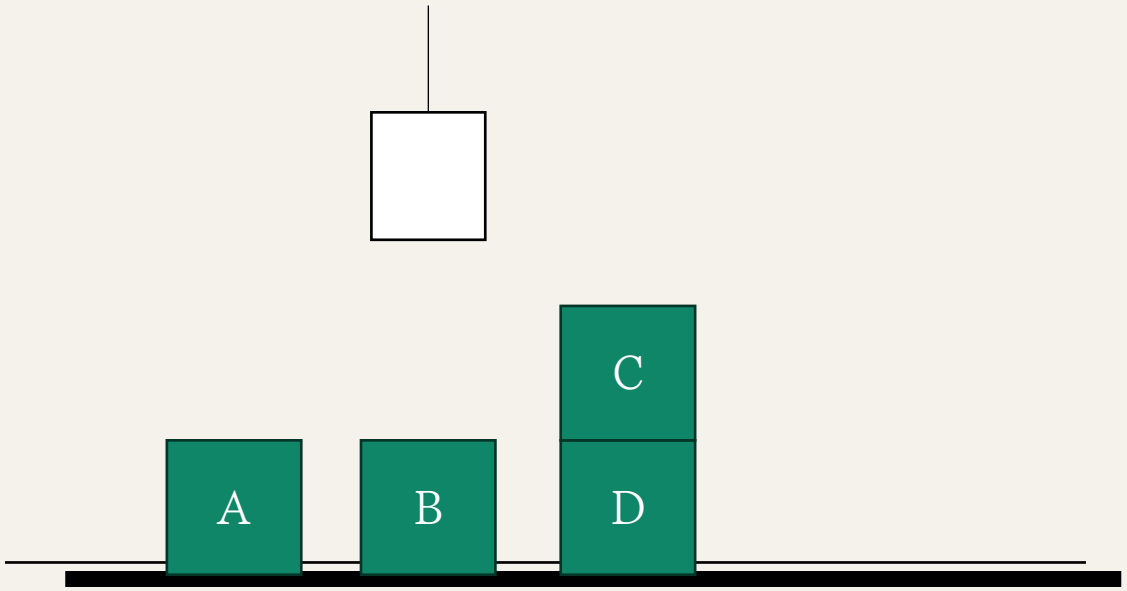
- $clear(A)$
- $armEmpty$
- $onTable(A)\ \wedge clear(A) \wedge armEmpty$
- $\boldsymbol{pickUp(A)}$
- $clear(B)$
- $clear(B) \wedge holding(A)$
- $\boldsymbol{stack(A,B)}$
- $on(B, C)$
- $on(A, B) \wedge on(B, C) \wedge on(C, D) \wedge onTable(D)$

$\boldsymbol{on(A, B)}$

LANGKAH 3

Current State

- $onTable(A) \wedge onTable\ (B) \wedge on(C, D) \wedge onTable(D)$



STACK

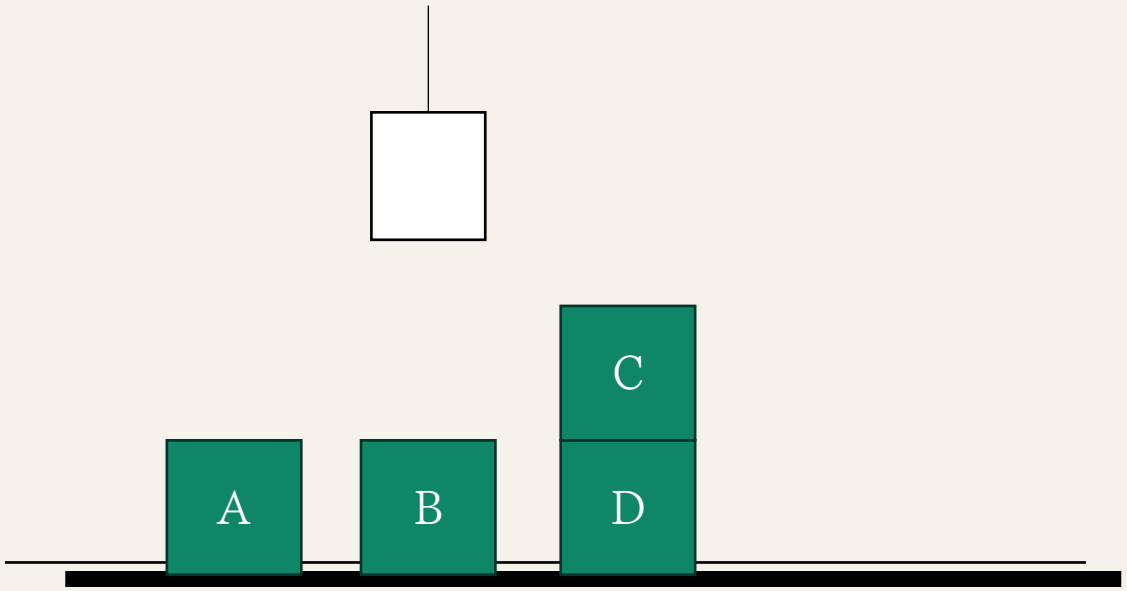
- $armEmpty$
- $onTable(A)\ \wedge clear(A) \wedge armEmpty$
- $\boldsymbol{pickUp(A)}$
- $clear(B)$
- $clear(B) \wedge holding(A)$
- $\boldsymbol{stack(A,B)}$
- $on(B, C)$
- $on(A, B) \wedge on(B, C) \wedge on(C, D) \wedge onTable(D)$

$\boldsymbol{on(A, B)}$

LANGKAH 3

Current State

- $onTable(A) \wedge onTable\ (B) \wedge on(C, D) \wedge onTable(D)$



STACK

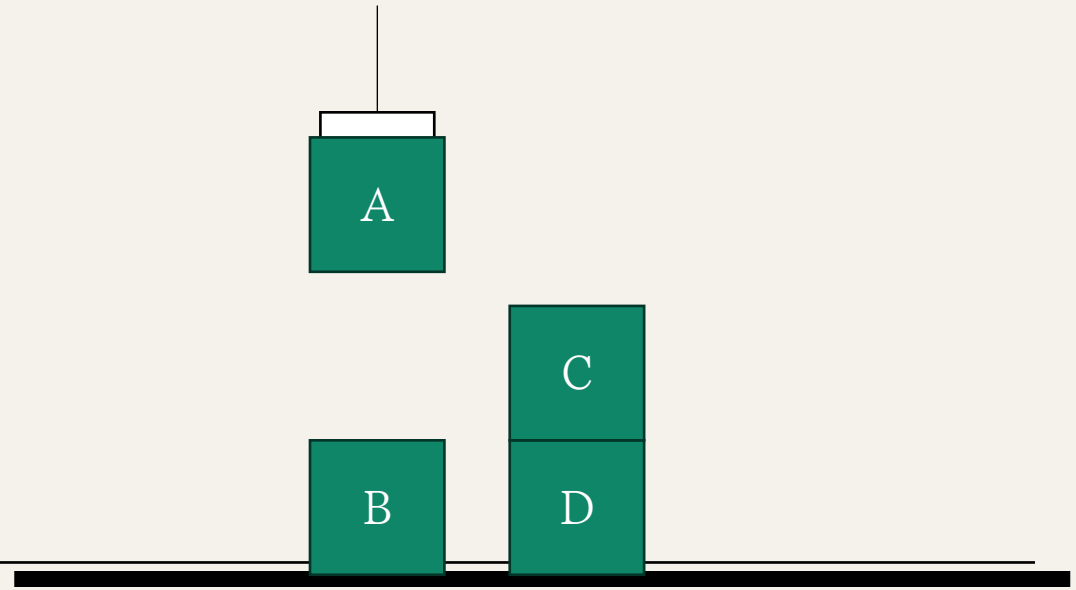
- $onTable(A) \wedge clear(A) \wedge armEmpty$
- $\boldsymbol{pickUp(A)}$
- $clear(B)$
- $clear(B) \wedge holding(A)$
- ***stack(A,B)***
- $on(B, C)$
- $on(A, B) \wedge on(B, C) \wedge on(C, D) \wedge onTable(D)$

$\boldsymbol{on(A, B)}$

LANGKAH 3

Current State

- $onTable\ (B) \wedge on(C, D) \wedge onTable(D)$



STACK

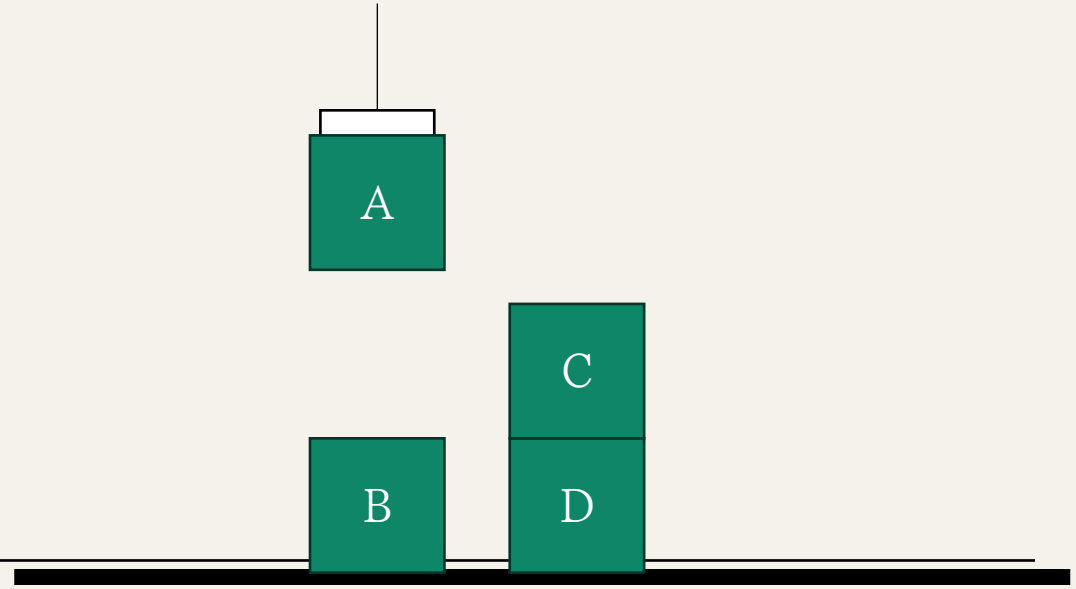
- $\boldsymbol{pickUp(A)}$
- $clear(B)$
- $clear(B) \wedge holding(A)$
- ***stack(A,B)***
- $on(B, C)$
- $on(A, B) \wedge on(B, C) \wedge on(C, D) \wedge onTable(D)$

$\boldsymbol{on(A, B)}$

LANGKAH 3

Current State

- $holding(A) \wedge onTable\ (B) \wedge on(C, D) \wedge onTable(D)$



STACK

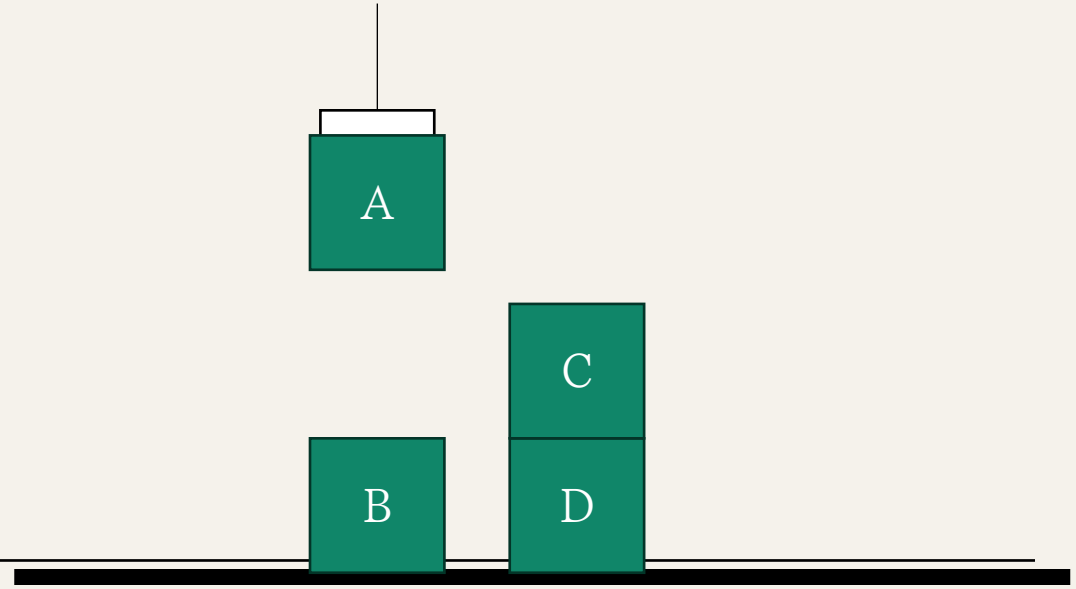
- $clear(B)$
- $clear(B) \wedge holding(A)$
- ***stack(A,B)***
- $on(B, C)$
- $on(A, B) \wedge on(B, C) \wedge on(C, D) \wedge onTable(D)$

on(A, B)

LANGKAH 3

Current State

- $holding(A) \wedge onTable\ (B) \wedge on(C, D) \wedge onTable(D)$



STACK

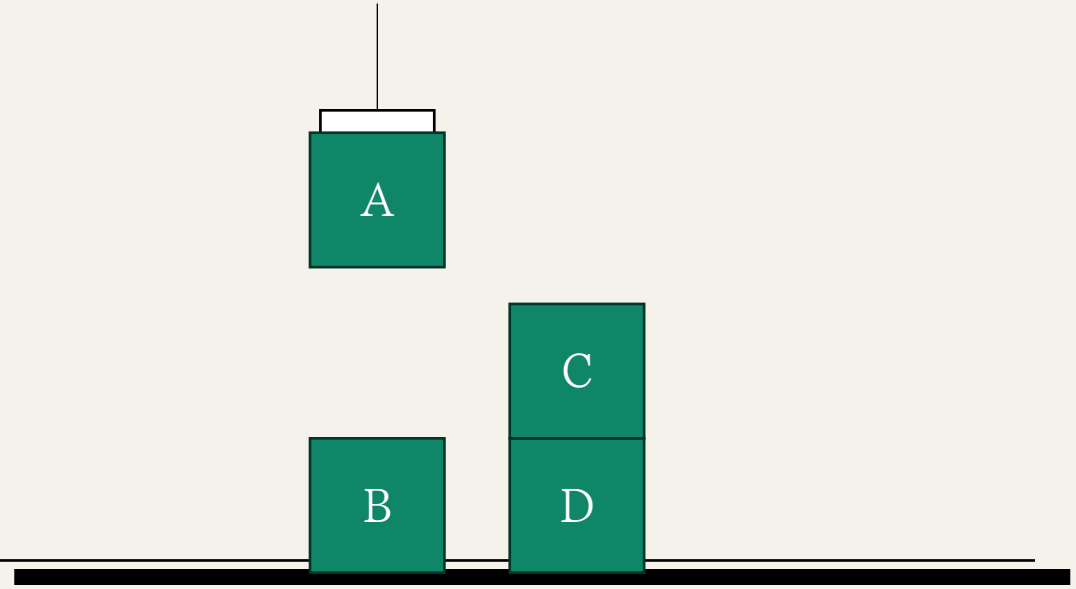
- *clear(B)*
- $clear(B) \wedge holding(A)$
- ***stack(A,B)***
- $on(B, C)$
- $on(A, B) \wedge on(B, C) \wedge on(C, D) \wedge onTable(D)$

$\boldsymbol{on(A, B)}$

LANGKAH 3

Current State

- $holding(A) \wedge onTable\ (B) \wedge on(C, D) \wedge onTable(D)$



STACK

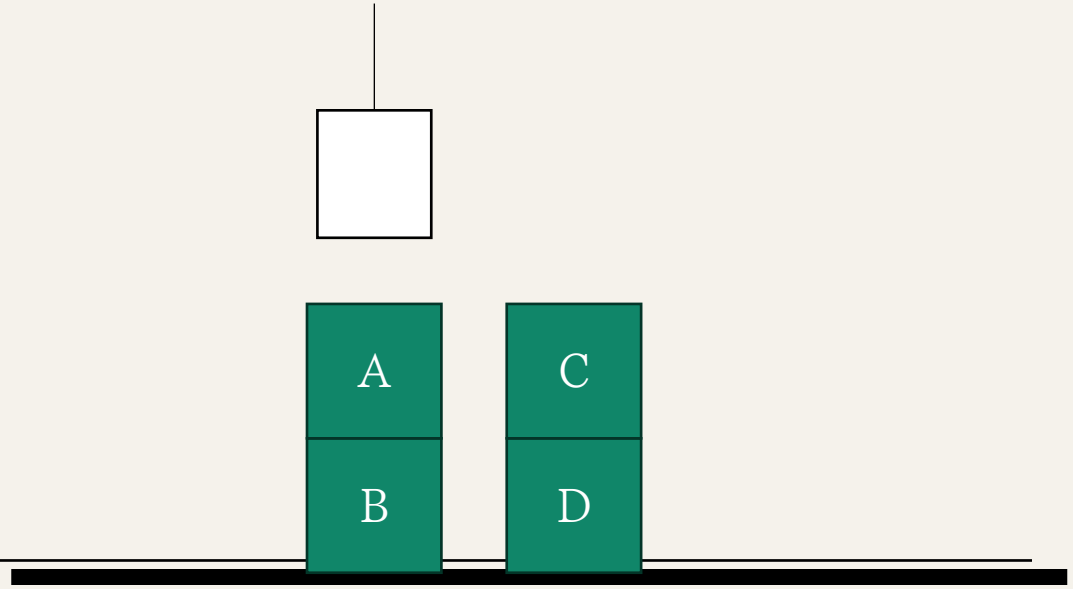
- $clear(B) \wedge holding(A)$
- ***stack(A,B)***
- $on(B, C)$
- $on(A, B) \wedge on(B, C) \wedge on(C, D) \wedge onTable(D)$

$\boldsymbol{on(A, B)}$

LANGKAH 3

Current State

- $on(A,B) \wedge onTable\ (B) \wedge on(C,D) \wedge onTable(D)$



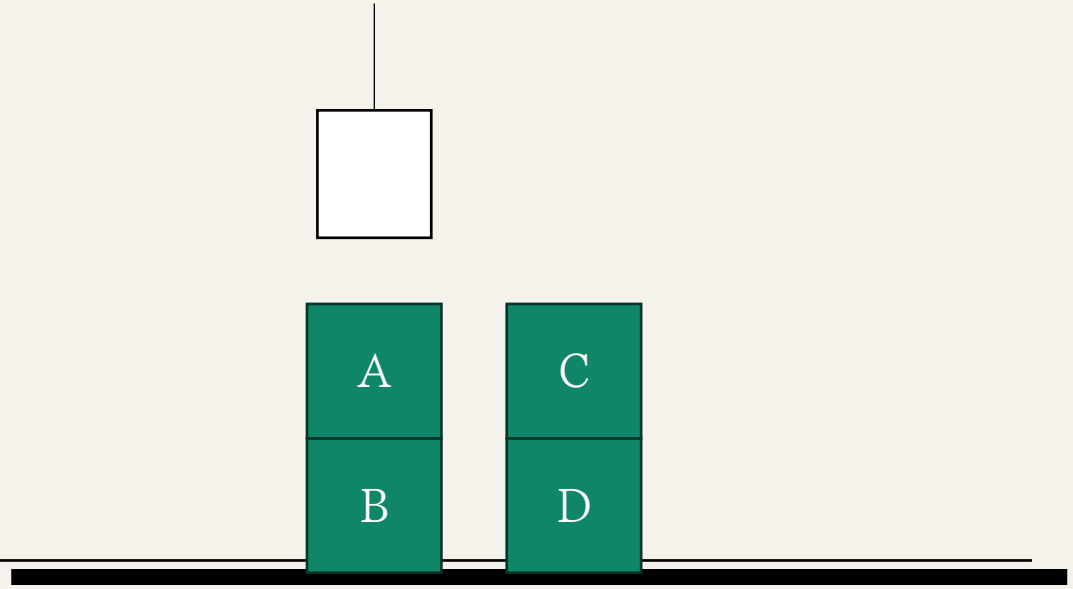
STACK

- *stack(A,B)*
- $on(B,C)$
- $on(A,B) \wedge on(B,C) \wedge on(C,D) \wedge onTable(D)$

LANGKAH 4

Current State

- $on(A, B) \wedge onTable\ (B) \wedge on(C, D) \wedge onTable(D)$



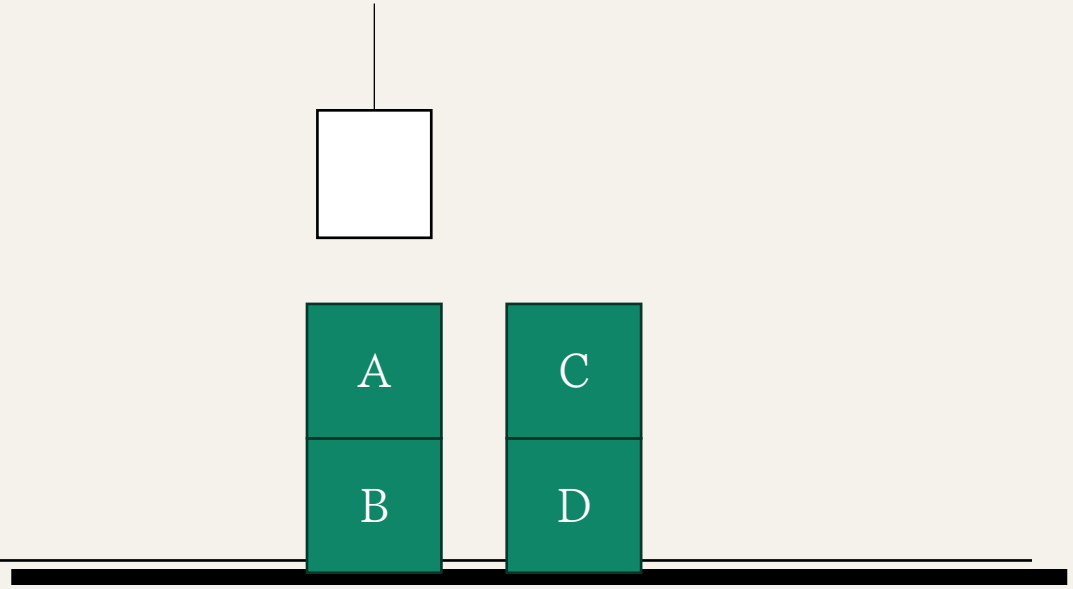
STACK

- $\boldsymbol{on(B, C)}$
- $on(A, B) \wedge on(B, C) \wedge on(C, D) \wedge onTable(D)$

LANGKAH 4

Current State

- $on(A, B) \wedge onTable\ (B) \wedge on(C, D) \wedge onTable(D)$



STACK

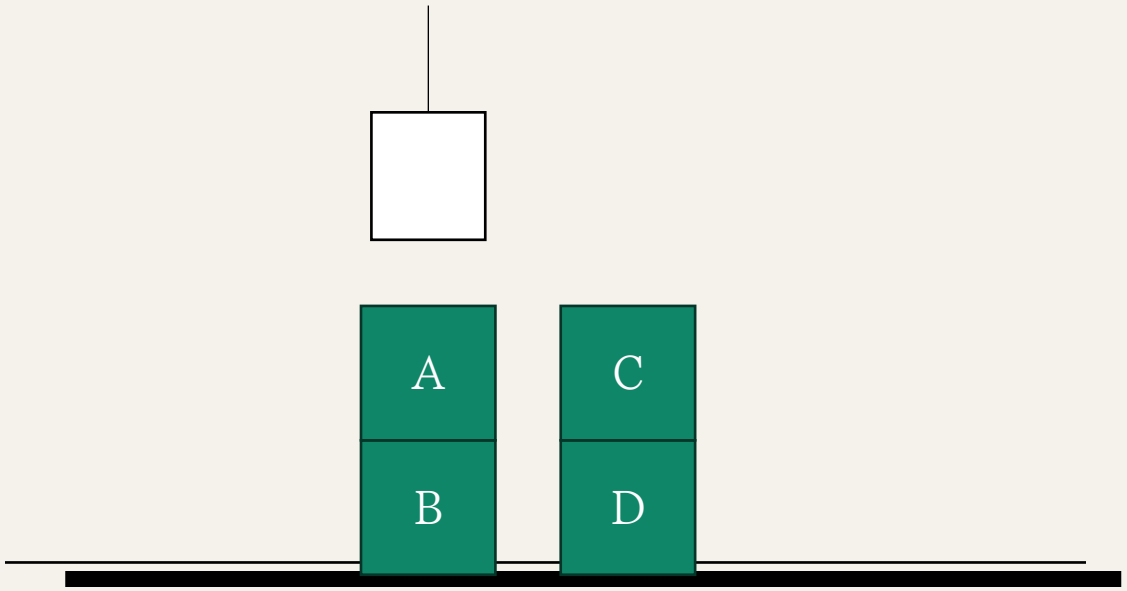
- *holding(B)*
- $clear(C)$
- $clear(C) \wedge holding(B)$
- ***stack(B,C)***
- $on(A, B) \wedge on(B, C) \wedge on(C, D) \wedge onTable(D)$

$\boldsymbol{on(B, C)}$

LANGKAH 4

Current State

- $on(A, B) \wedge onTable\ (B) \wedge on(C, D) \wedge onTable(D)$



STACK

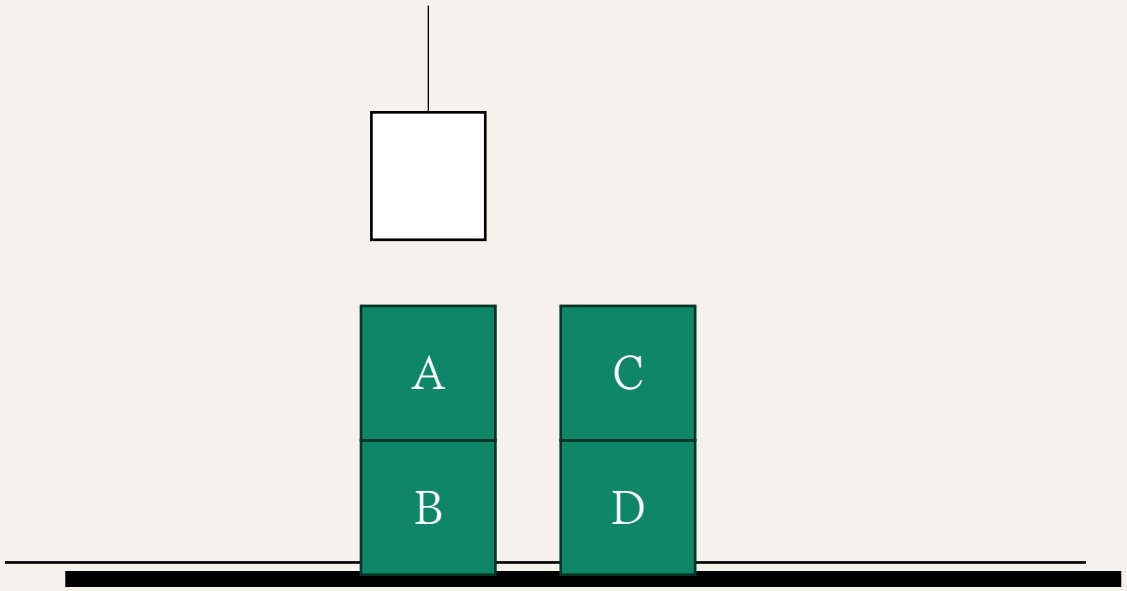
- $onTable(B)$
- $clear(B)$
- $armEmpty$
- $onTable(B) \wedge clear(B) \wedge armEmpty$
- ***pickUp(B)***
- $clear(C)$
- $clear(C) \wedge holding(B)$
- ***stack(B,C)***
- $on(A, B) \wedge on(B, C) \wedge on(C, D) \wedge onTable(D)$

$\boldsymbol{on(B, C)}$

LANGKAH 4

Current State

- $on(A, B) \wedge onTable\ (B) \wedge on(C, D) \wedge onTable(D)$



STACK

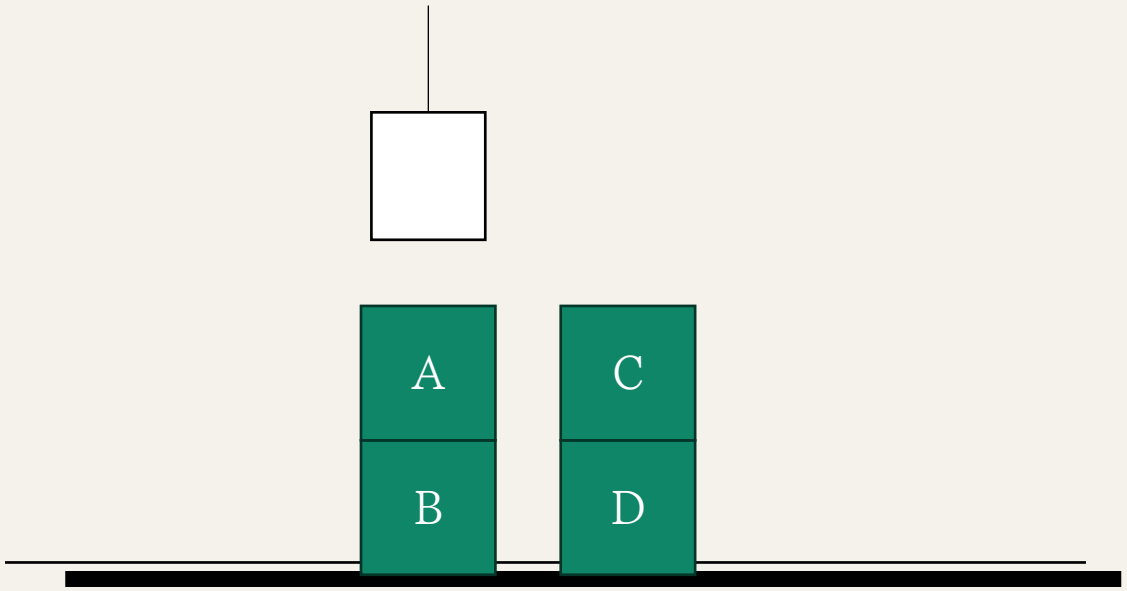
- *clear(B)*
- *armEmpty*
- $onTable(B) \wedge clear(B) \wedge armEmpty$
- ***pickUp(B)***
- $clear(C)$
- $clear(C) \wedge holding(B)$
- ***stack(B,C)***
- $on(A, B) \wedge on(B, C) \wedge on(C, D) \wedge onTable(D)$

$\boldsymbol{on(B, C)}$

LANGKAH 4

Current State

- $on(A, B) \wedge onTable\ (B) \wedge on(C, D) \wedge onTable(D)$



STACK

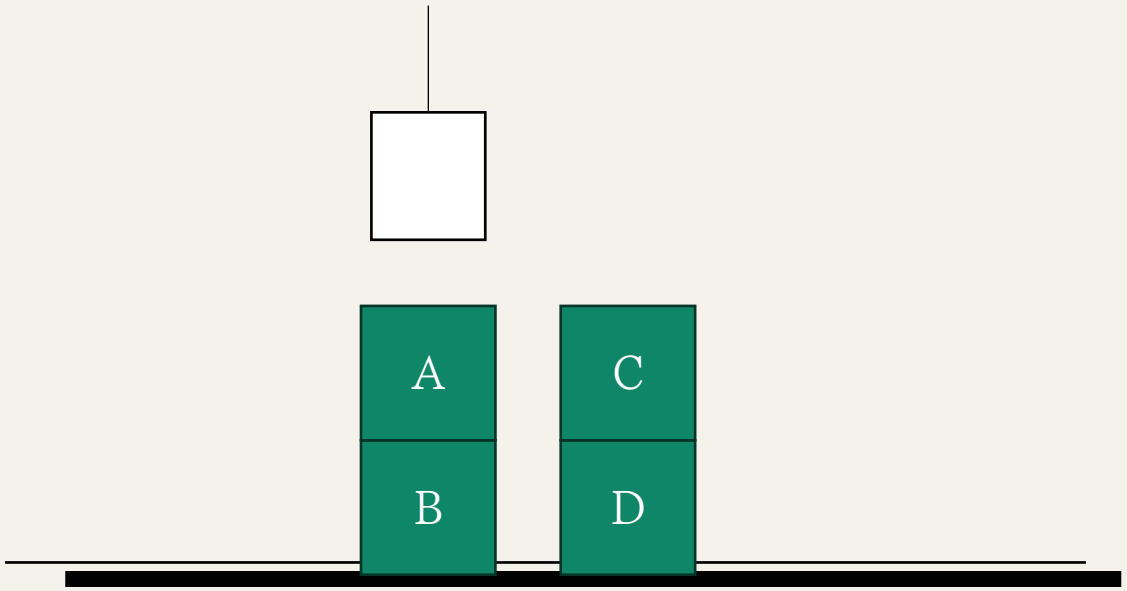
- $on(A, B)$
- $clear(A)$
- $armEmpty$
- $on(A, B)\ \wedge clear(A)\ \wedge armEmpty$
- ***unstack(A,B)***
- $armEmpty$
- $onTable(B) \wedge clear(B) \wedge armEmpty$
- ***pickUp(B)***
- $clear(C)$
- $clear(C) \wedge holding(B)$
- ***stack(B,C)***
- $on(A, B) \wedge on(B, C) \wedge on(C, D) \wedge onTable(D)$

$\boldsymbol{on(B, C)}$

LANGKAH 4

Current State

- $on(A,B) \wedge onTable\ (B) \wedge on(C,D) \wedge onTable(D)$



STACK

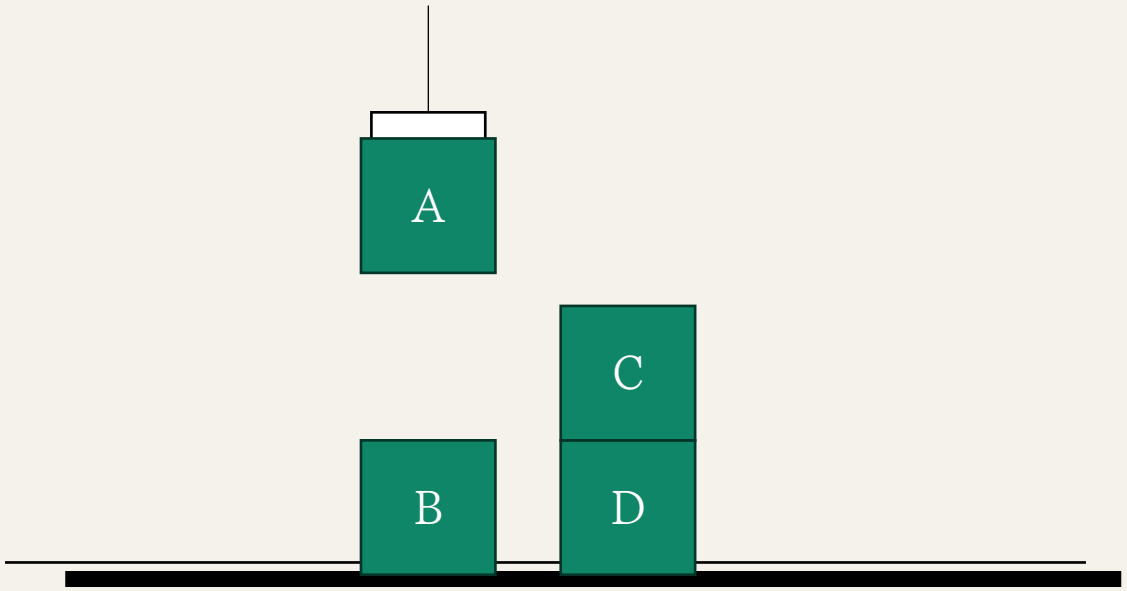
- $on(A,B)\ \wedge clear(A)\ \wedge armEmpty$
- ***unstack(A,B)***
- $armEmpty$
- $onTable(B) \wedge clear(B) \wedge armEmpty$
- ***pickUp(B)***
- $clear(C)$
- $clear(C) \wedge holding(B)$
- ***stack(B,C)***
- $on(A,B) \wedge on(B,C) \wedge on(C,D) \wedge onTable(D)$

on(B, C)

LANGKAH 4

Current State

- $holding(A) \wedge clear(B) \wedge onTable\ (B) \wedge on(C, D) \wedge onTable(D)$



STACK

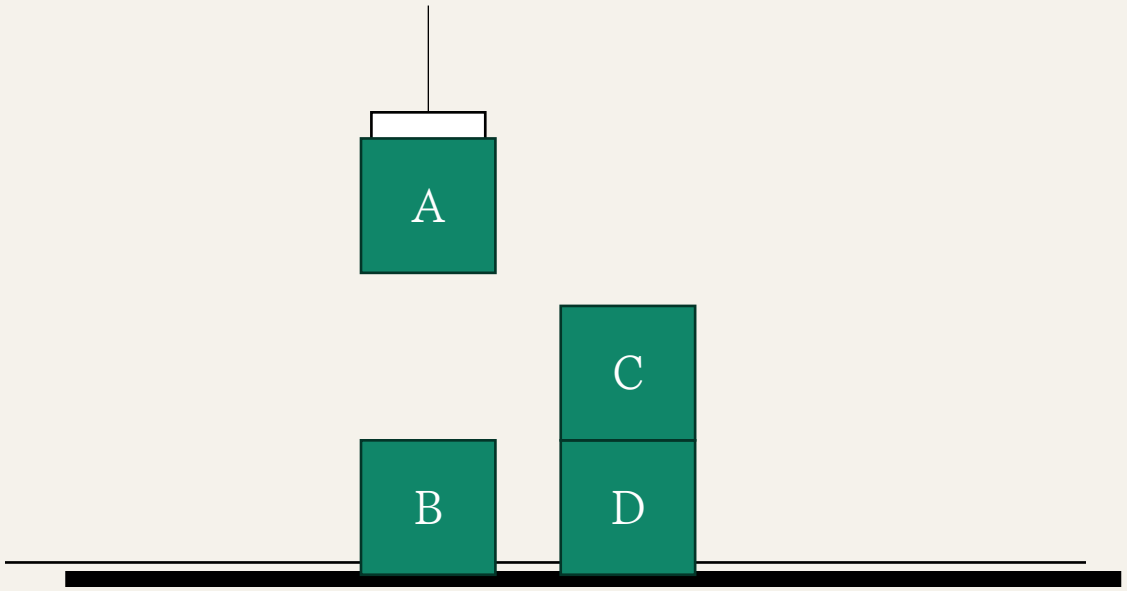
- ***unstack(A,B)***
- $armEmpty$
- $onTable(B) \wedge clear(B) \wedge armEmpty$
- ***pickUp(B)***
- $clear(C)$
- $clear(C) \wedge holding(B)$
- ***stack(B,C)***
- $on(A, B) \wedge on(B, C) \wedge on(C, D) \wedge onTable(D)$

$\boldsymbol{on(B, C)}$

LANGKAH 4

Current State

- $holding(A) \wedge clear(B) \wedge onTable\ (B) \wedge on(C, D) \wedge onTable(D)$



STACK

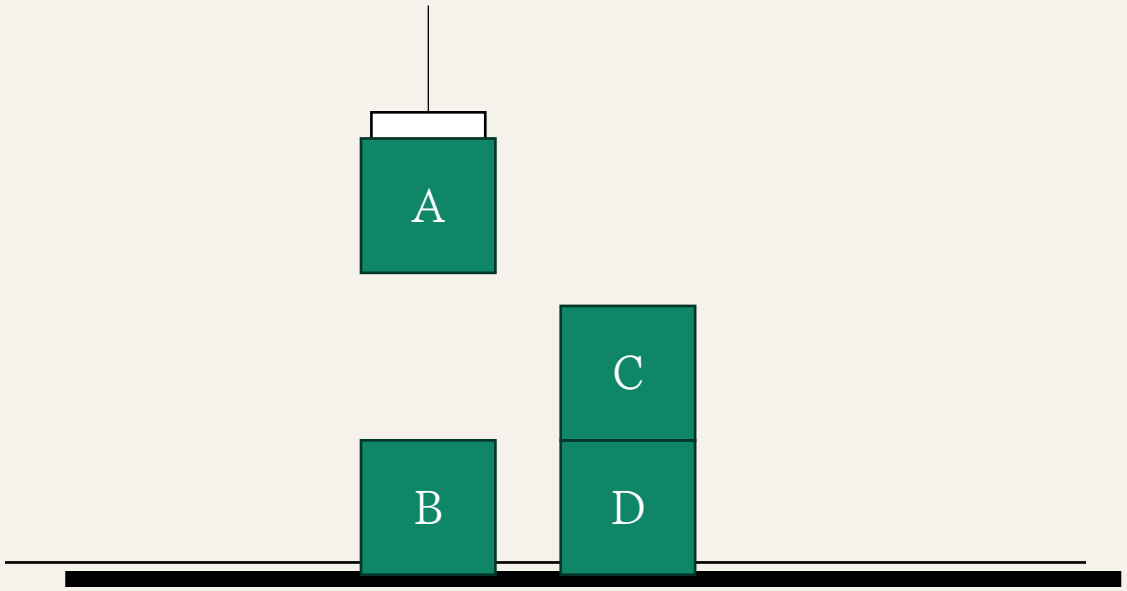
- *armEmpty*
- $onTable(B) \wedge clear(B) \wedge armEmpty$
- ***pickUp(B)***
- $clear(C)$
- $clear(C) \wedge holding(B)$
- ***stack(B,C)***
- $on(A, B) \wedge on(B, C) \wedge on(C, D) \wedge onTable(D)$

$\boldsymbol{on(B, C)}$

LANGKAH 4

Current State

- $holding(A) \wedge clear(B) \wedge onTable\ (B) \wedge on(C, D) \wedge onTable(D)$



STACK

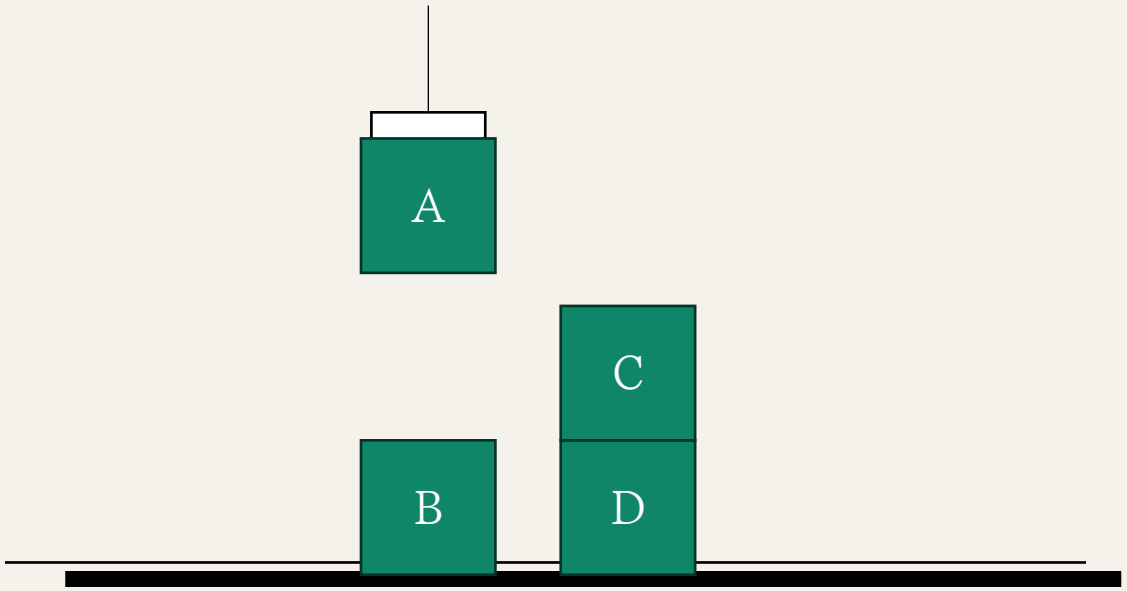
- *armEmpty*
- $onTable(B) \wedge clear(B) \wedge armEmpty$
- ***pickUp(B)***
- $clear(C)$
- $clear(C) \wedge holding(B)$
- ***stack(B,C)***
- $on(A, B) \wedge on(B, C) \wedge on(C, D) \wedge onTable(D)$

$\boldsymbol{on(B, C)}$

LANGKAH 4

Current State

- $holding(A) \wedge clear(B) \wedge onTable\ (B) \wedge on(C, D) \wedge onTable(D)$



STACK

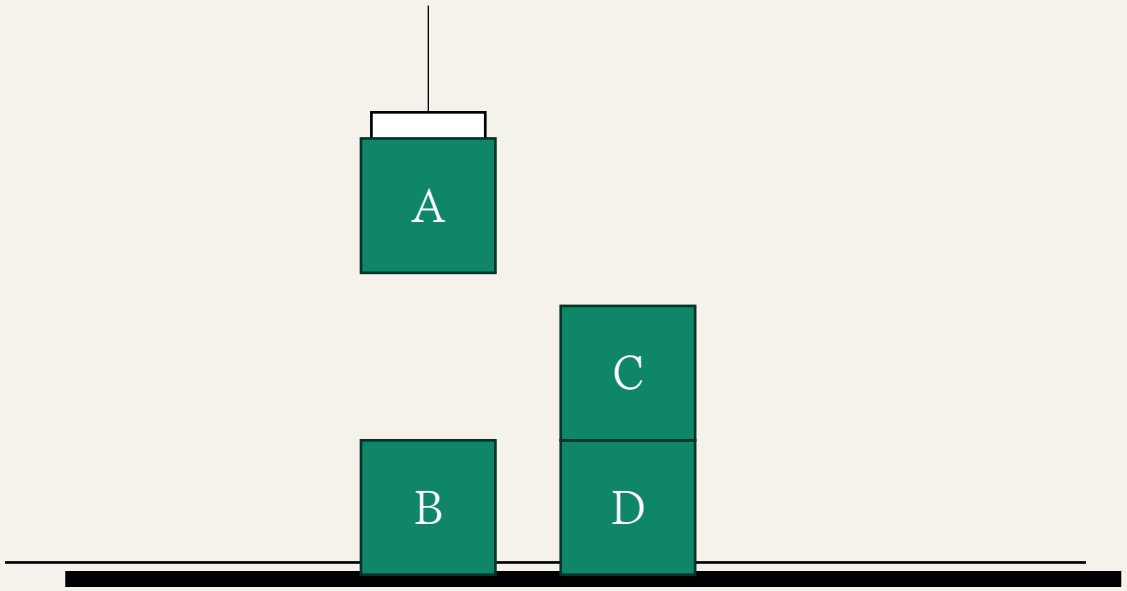
- $holding(A)$
- ***putDown(A)***
- $onTable(B) \wedge clear(B) \wedge armEmpty$
- ***pickUp(B)***
- $clear(C)$
- $clear(C) \wedge holding(B)$
- ***stack(B,C)***
- $on(A, B) \wedge on(B, C) \wedge on(C, D) \wedge onTable(D)$

$\boldsymbol{on(B, C)}$

LANGKAH 4

Current State

- $holding(A) \wedge clear(B) \wedge onTable\ (B) \wedge on(C, D) \wedge onTable(D)$



STACK

- ***putDown(A)***
- $onTable(B) \wedge clear(B) \wedge armEmpty$
- ***pickUp(B)***
- $clear(C)$
- $clear(C) \wedge holding(B)$

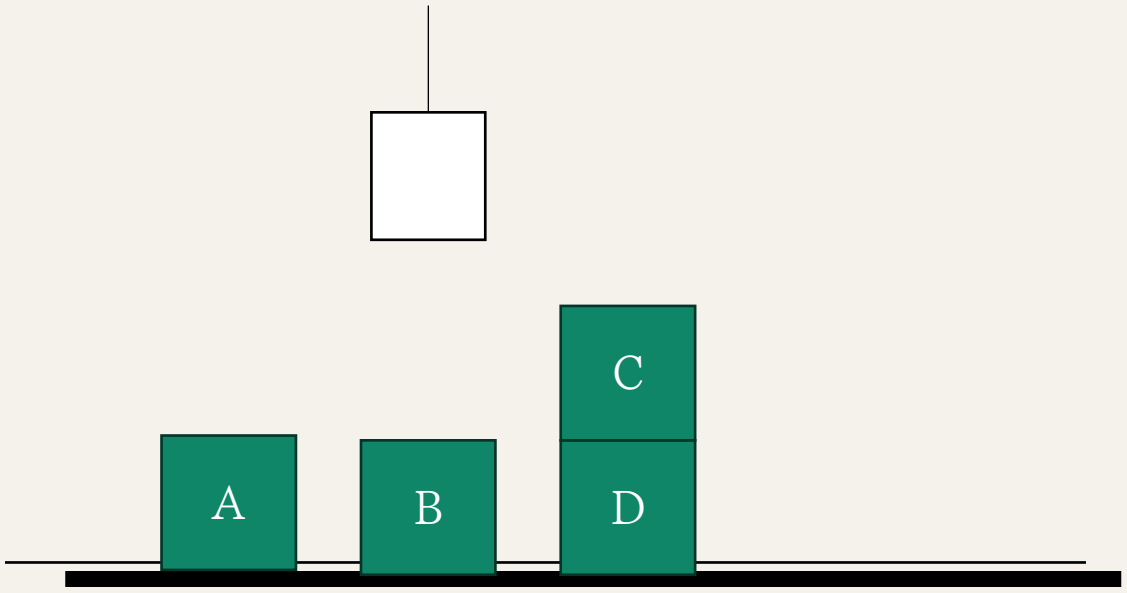
$\boldsymbol{on(B, C)}$

- ***stack(B,C)***
- $on(A, B) \wedge on(B, C) \wedge on(C, D) \wedge onTable(D)$

LANGKAH 4

Current State

- $onTable(A) \wedge armEmpty \wedge clear(B) \wedge onTable\ (B) \wedge on(C, D) \wedge onTable(D)$



STACK

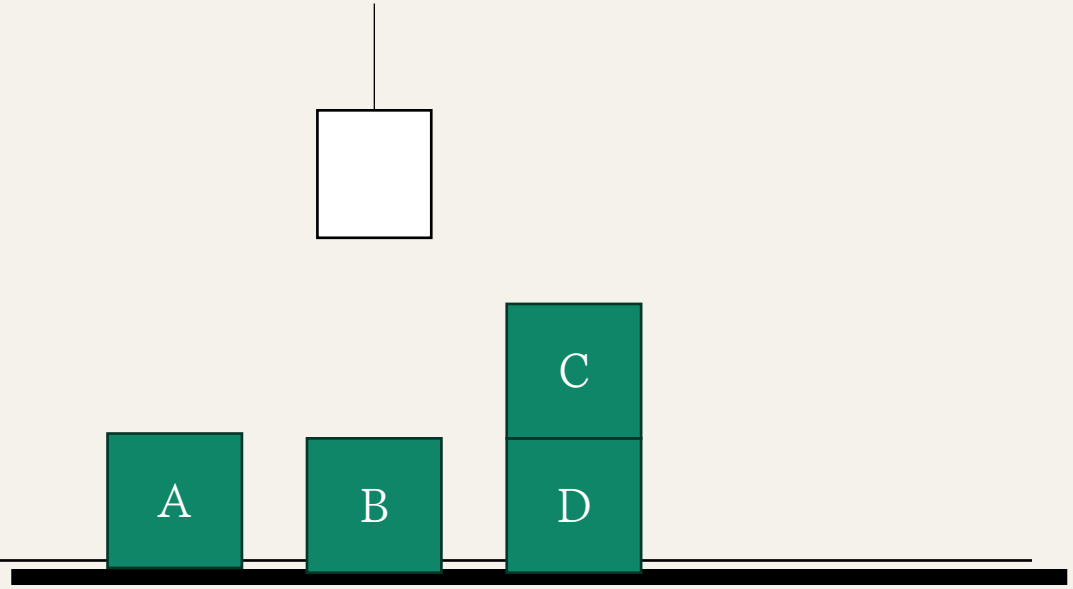
- $onTable(B) \wedge clear(B) \wedge armEmpty$
- ***pickUp(B)***
- $clear(C)$
- $clear(C) \wedge holding(B)$
- ***stack(B,C)***
- $on(A, B) \wedge on(B, C) \wedge on(C, D) \wedge onTable(D)$

$\boldsymbol{on(B, C)}$

LANGKAH 4

Current State

- $onTable(A) \wedge armEmpty \wedge clear(B) \wedge onTable\ (B) \wedge on(C, D) \wedge onTable(D)$



STACK

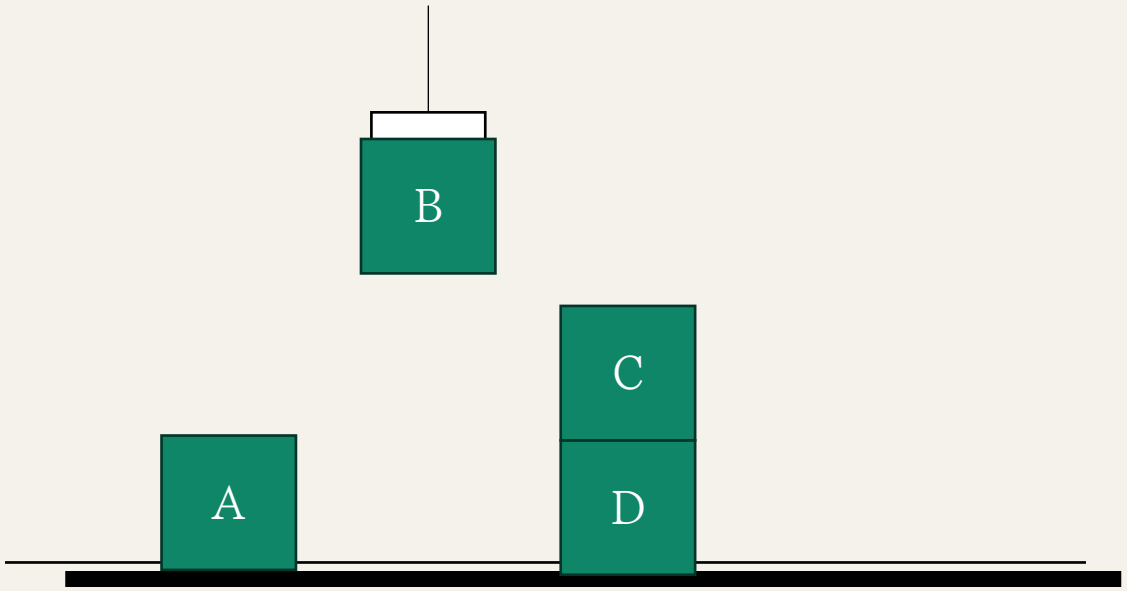
- ***pickUp(B)***
- $clear(C)$
- $clear(C) \wedge holding(B)$
- ***stack(B,C)***
- $on(A, B) \wedge on(B, C) \wedge on(C, D) \wedge onTable(D)$

$\boldsymbol{on(B, C)}$

LANGKAH 4

Current State

- $onTable(A) \wedge holding\ (B) \wedge on(C, D) \wedge onTable(D)$



STACK

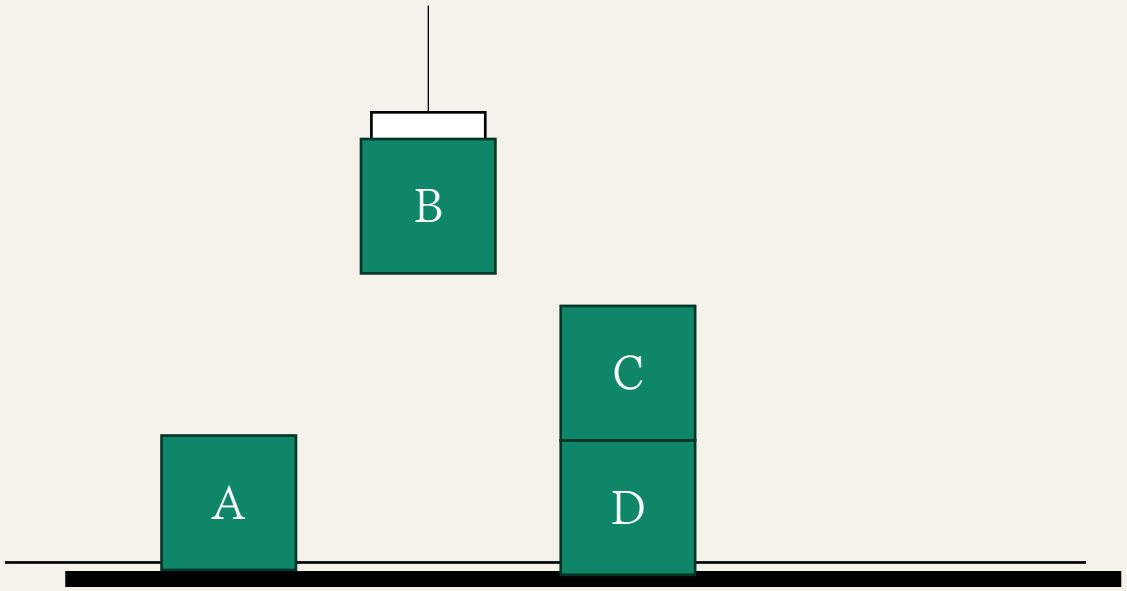
- $clear(C)$
- $clear(C) \wedge holding(B)$
- ***stack(B,C)***
- $on(A, B) \wedge on(B, C) \wedge on(C, D) \wedge onTable(D)$

$\boldsymbol{on(B, C)}$

LANGKAH 4

Current State

- $onTable(A) \wedge holding\ (B) \wedge on(C, D) \wedge onTable(D)$



STACK

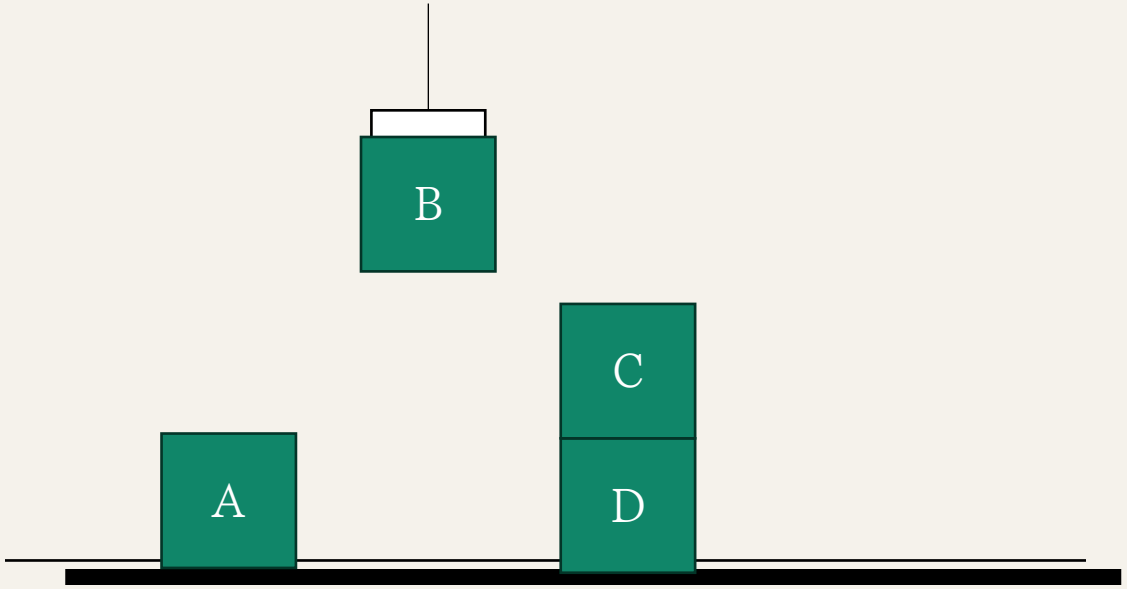
- $clear(C) \wedge holding(B)$
- ***stack(B,C)***
- $on(A, B) \wedge on(B, C) \wedge on(C, D) \wedge onTable(D)$

$\boldsymbol{on(B, C)}$

LANGKAH 4

Current State

- $onTable(A) \wedge holding\ (B) \wedge on(C, D) \wedge onTable(D)$



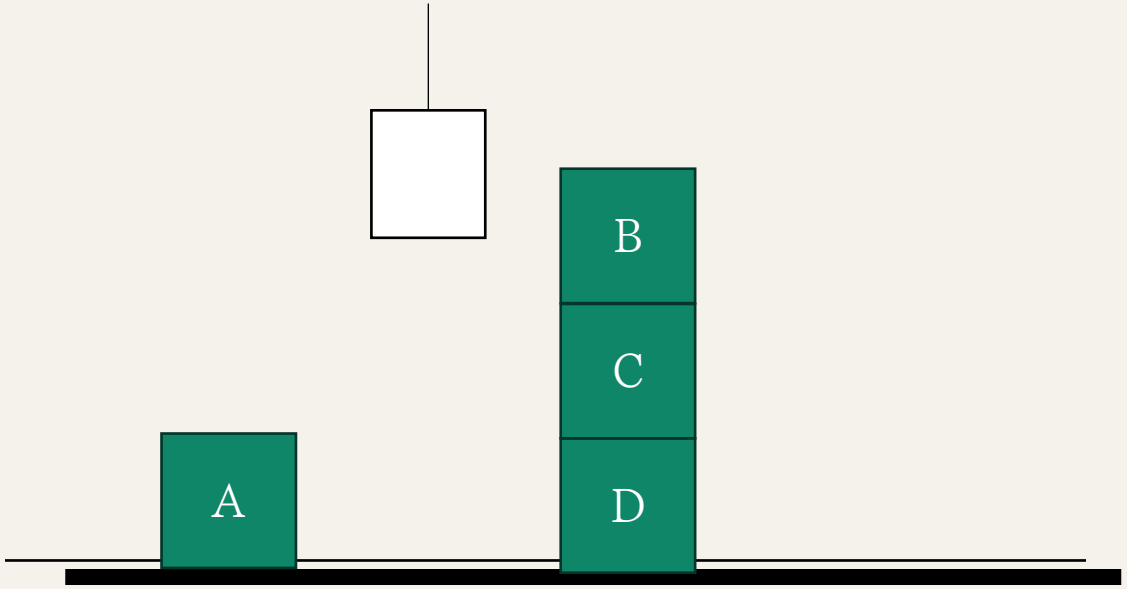
STACK

- ***stack(B,C)***
- $on(A, B) \wedge on(B, C) \wedge on(C, D) \wedge onTable(D)$

LANGKAH 4

Current State

- $onTable(A) \wedge on(B, C) \wedge on(C, D) \wedge onTable(D)$



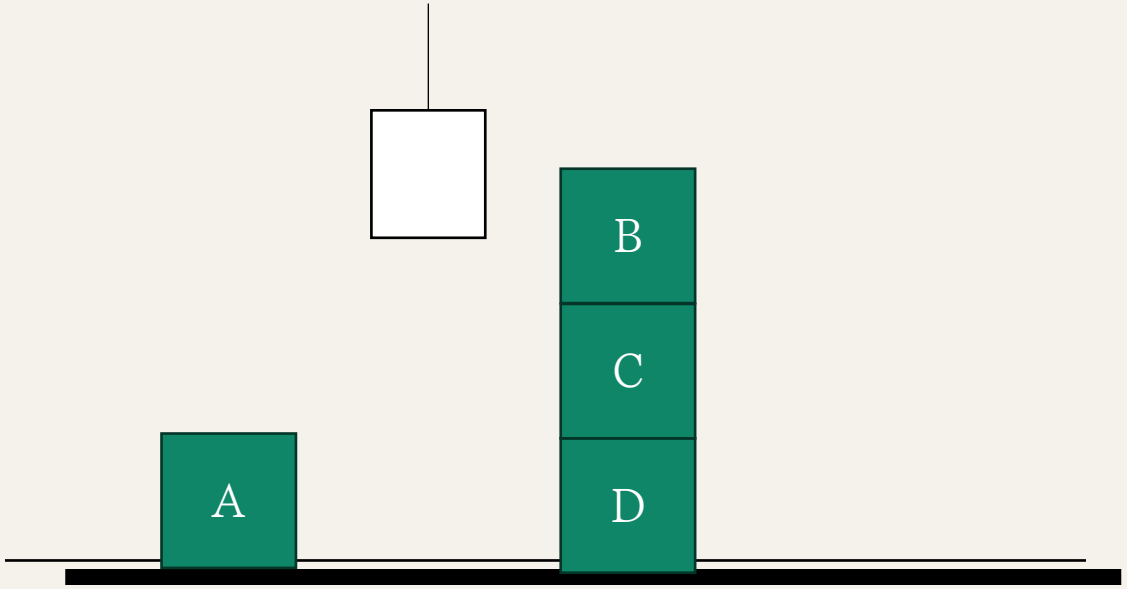
STACK

- $on(A, B) \wedge on(B, C) \wedge on(C, D) \wedge onTable(D)$

LANGKAH 4

Current State

- $onTable(A) \wedge on(B,C) \wedge on(C,D) \wedge onTable(D)$



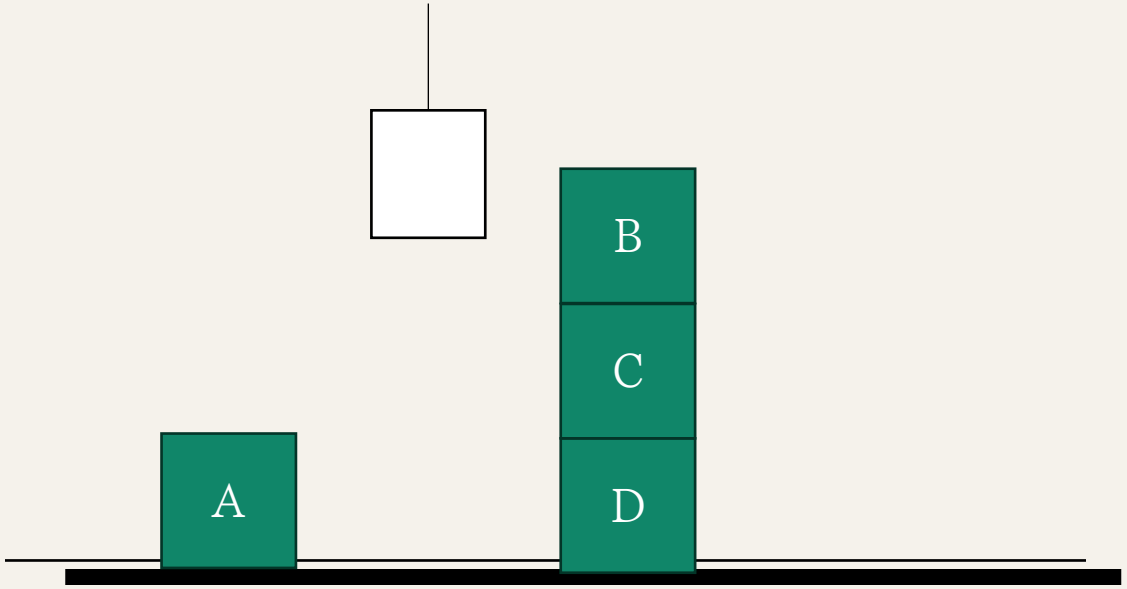
STACK

- $on(A,B) \wedge on(B,C) \wedge on(C,D) \wedge onTable(D)$

LANGKAH 4

Current State

- $onTable(A) \wedge on(B, C) \wedge on(C, D) \wedge onTable(D)$



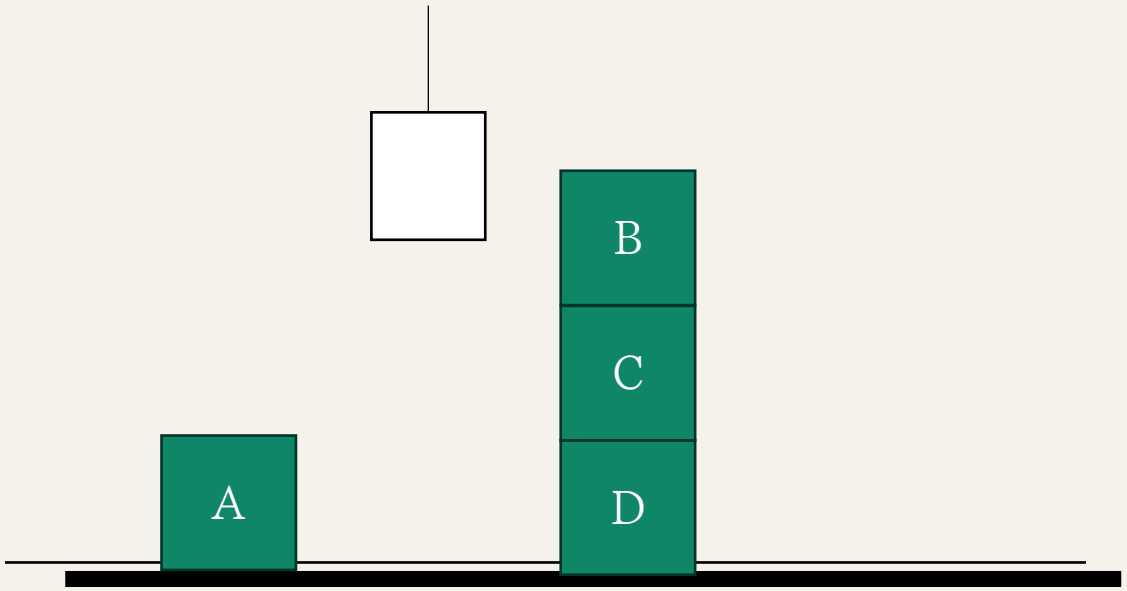
STACK

- $on(A, B)$
- $on(A, B) \wedge on(B, C) \wedge on(C, D) \wedge onTable(D)$

LANGKAH 4

Current State

- $onTable(A) \wedge on(B,C) \wedge on(C,D) \wedge onTable(D)$



STACK

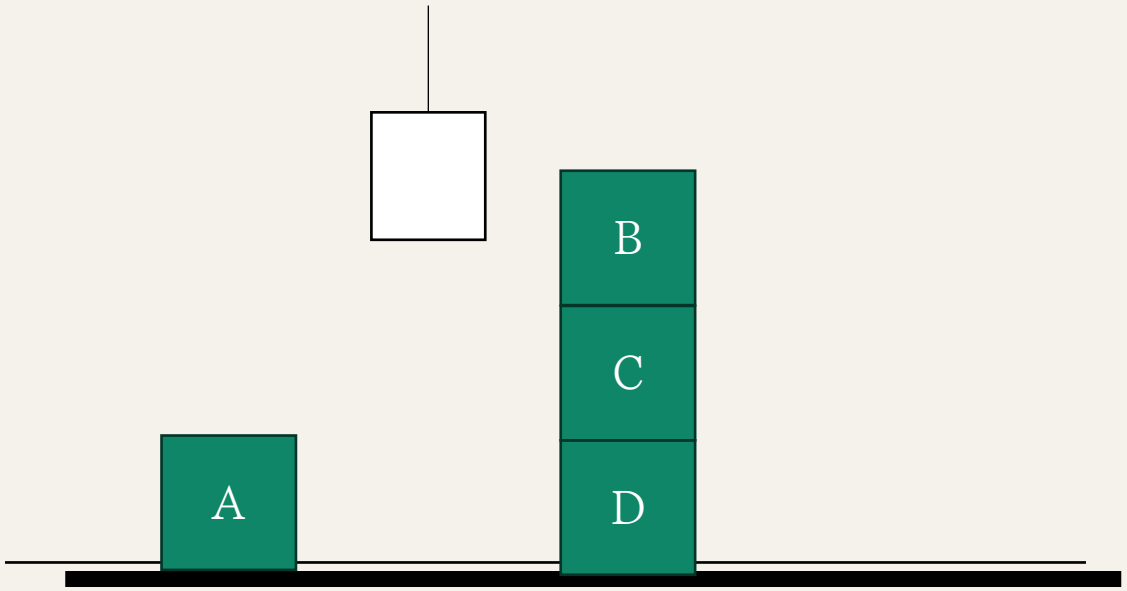
- $holding(A)$
- $clear(B)$
- $clear(B) \wedge holding(A)$
- ***stack(A,B)***
- $on(A,B) \wedge on(B,C) \wedge on(C,D) \wedge onTable(D)$

$\boldsymbol{on(A,B)}$

LANGKAH 4

Current State

- $onTable(A) \wedge on(B,C) \wedge on(C,D) \wedge onTable(D)$



STACK

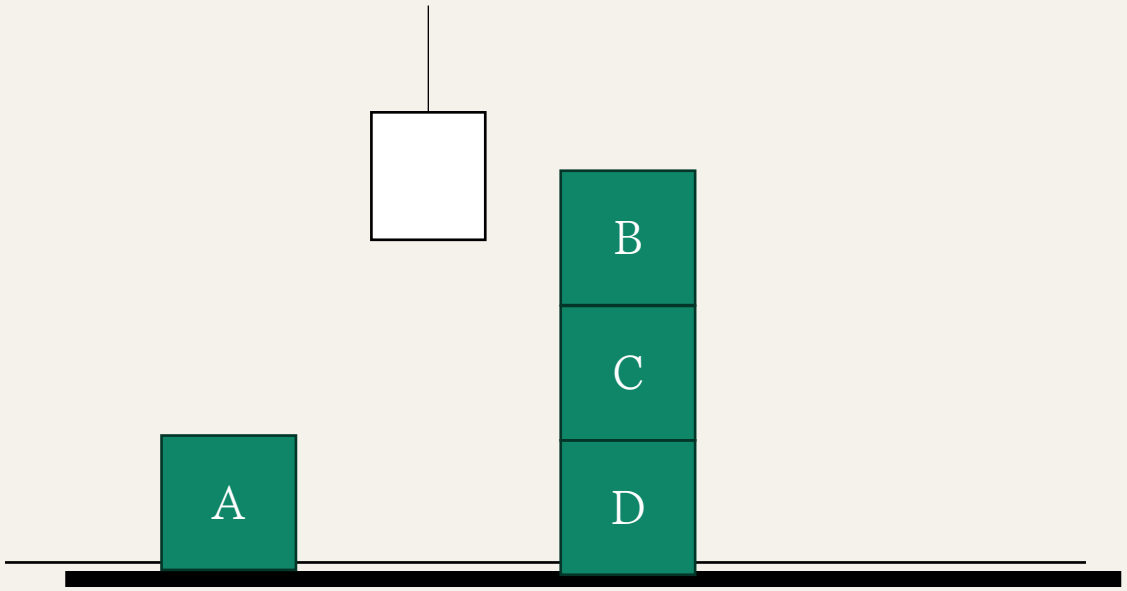
- $holding(A)$
- $clear(B)$
- $clear(B) \wedge holding(A)$
- ***stack(A,B)***
- $on(A,B) \wedge on(B,C) \wedge on(C,D) \wedge onTable(D)$

$\boldsymbol{on(A,B)}$

LANGKAH 4

Current State

- $onTable(A) \wedge on(B,C) \wedge on(C,D) \wedge onTable(D)$



STACK

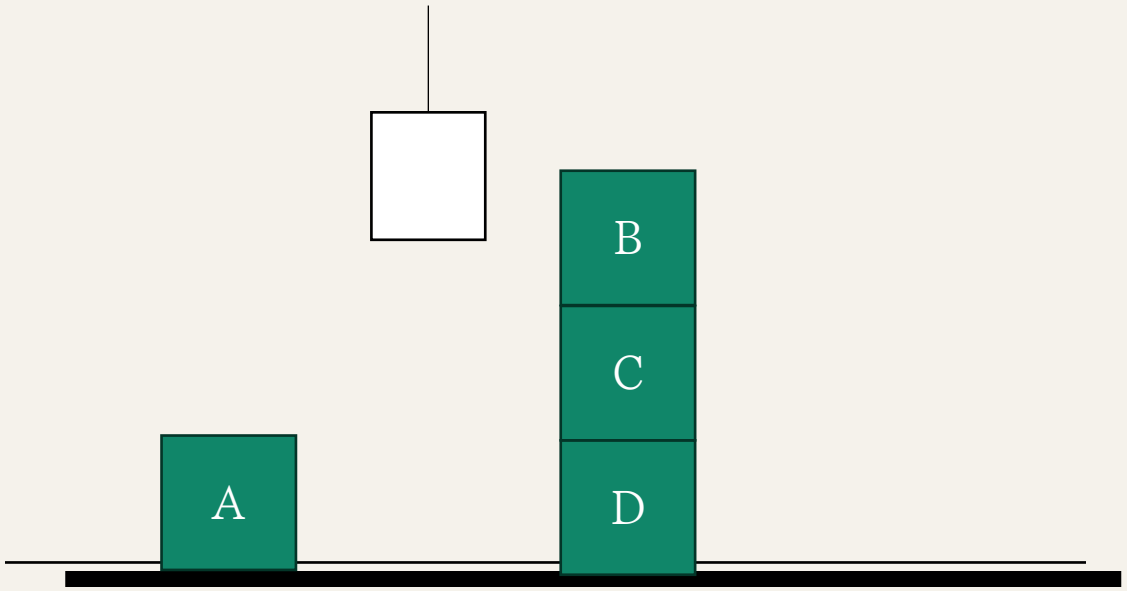
- $onTable(A)$
- $clear(A)$
- $armEmpty$
- $onTable(A) \wedge clear(A) \wedge armEmpty$
- ***pickUp(A)***
- $clear(B)$
- $clear(B) \wedge holding(A)$
- ***stack(A,B)***
- $on(A,B) \wedge on(B,C) \wedge on(C,D) \wedge onTable(D)$

$\boldsymbol{on(A,B)}$

LANGKAH 4

Current State

- $onTable(A) \wedge on(B,C) \wedge on(C,D) \wedge onTable(D)$



STACK

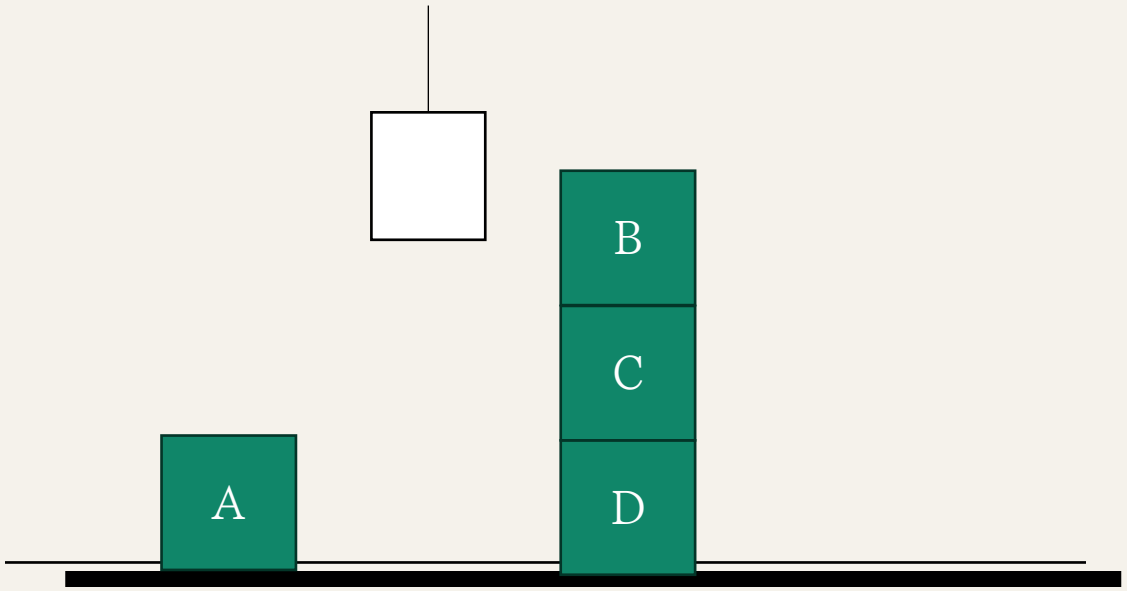
- $onTable(A) \wedge clear(A) \wedge armEmpty$
- ***pickUp(A)***
- $clear(B)$
- $clear(B) \wedge holding(A)$
- ***stack(A,B)***
- $on(A,B) \wedge on(B,C) \wedge on(C,D) \wedge onTable(D)$

$\boldsymbol{on(A,B)}$

LANGKAH 4

Current State

- $onTable(A) \wedge on(B,C) \wedge on(C,D) \wedge onTable(D)$



STACK

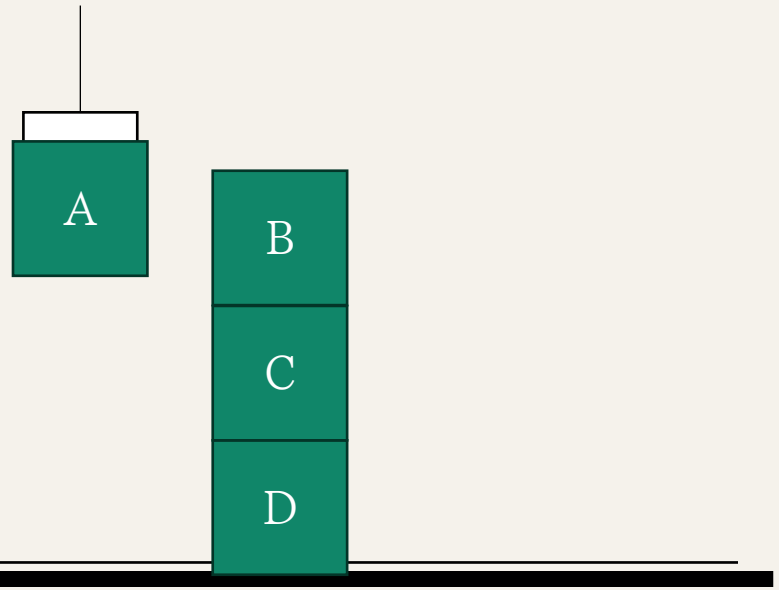
- ***pickUp(A)***
- $clear(B)$
- $clear(B) \wedge holding(A)$
- ***stack(A,B)***
- $on(A,B) \wedge on(B,C) \wedge on(C,D) \wedge onTable(D)$

$\boldsymbol{on(A,B)}$

LANGKAH 4

Current State

- $holding(A) \wedge on(B,C) \wedge on(C,D) \wedge onTable(D)$



STACK

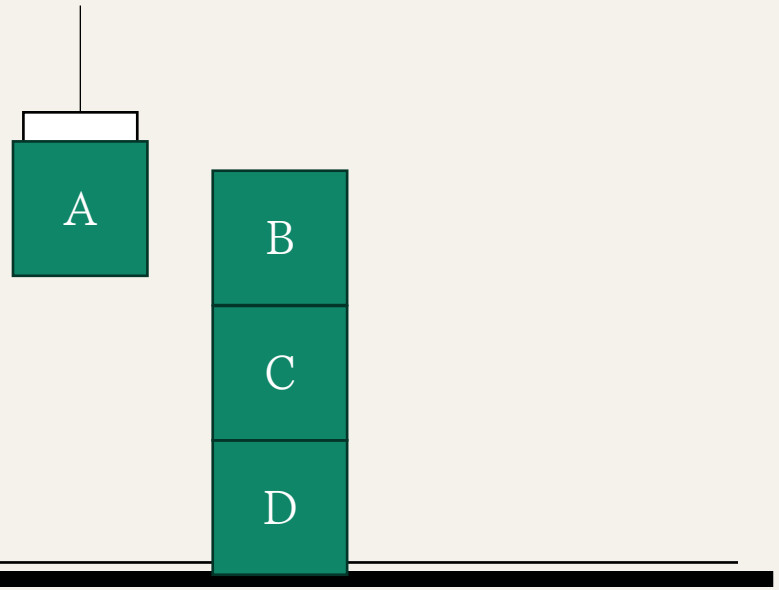
- $clear(B)$
- $clear(B) \wedge holding(A)$
- ***stack(A,B)***
- $on(A,B) \wedge on(B,C) \wedge on(C,D) \wedge onTable(D)$

on(A, B)

LANGKAH 4

Current State

- $holding(A) \wedge on(B,C) \wedge on(C,D) \wedge onTable(D)$



STACK

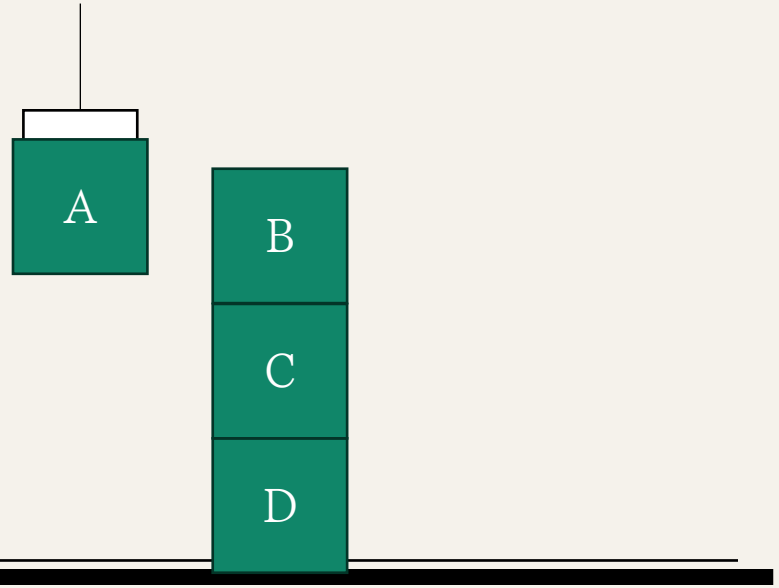
- *clear(B)*
- $clear(B) \wedge holding(A)$
- ***stack(A,B)***
- $on(A,B) \wedge on(B,C) \wedge on(C,D) \wedge onTable(D)$

on(A, B)

LANGKAH 4

Current State

- $holding(A) \wedge on(B, C) \wedge on(C, D) \wedge onTable(D)$



STACK

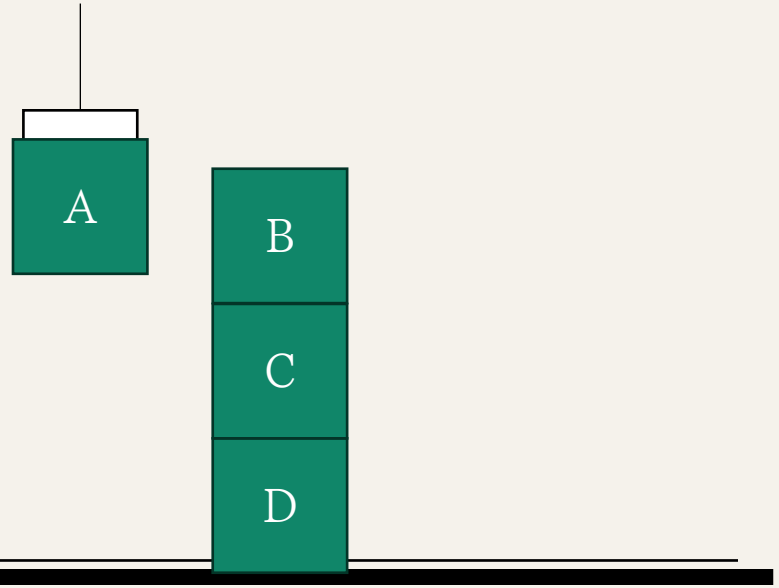
- $clear(B) \wedge holding(A)$
- ***stack(A,B)***
- $on(A, B) \wedge on(B, C) \wedge on(C, D) \wedge onTable(D)$

$\boldsymbol{on(A, B)}$

LANGKAH 4

Current State

- $holding(A) \wedge on(B, C) \wedge on(C, D) \wedge onTable(D)$



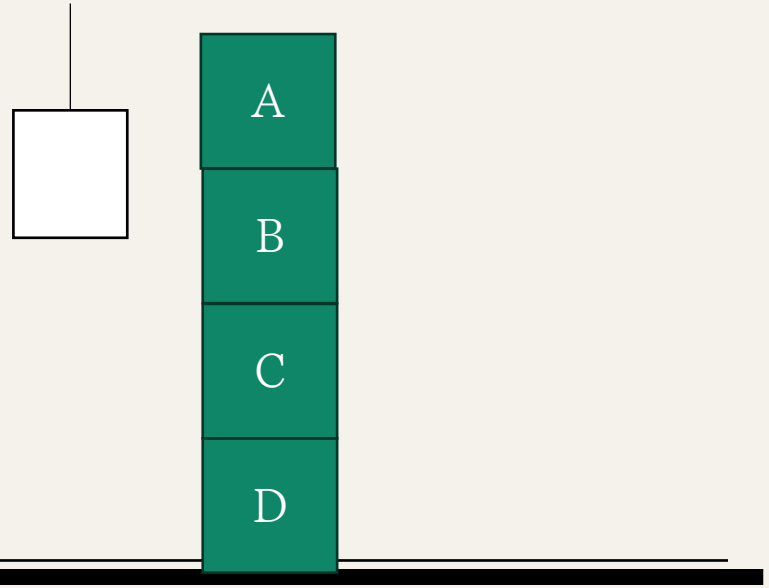
STACK

- ***stack(A,B)***
- $on(A, B) \wedge on(B, C) \wedge on(C, D) \wedge onTable(D)$

LANGKAH 4

Current State

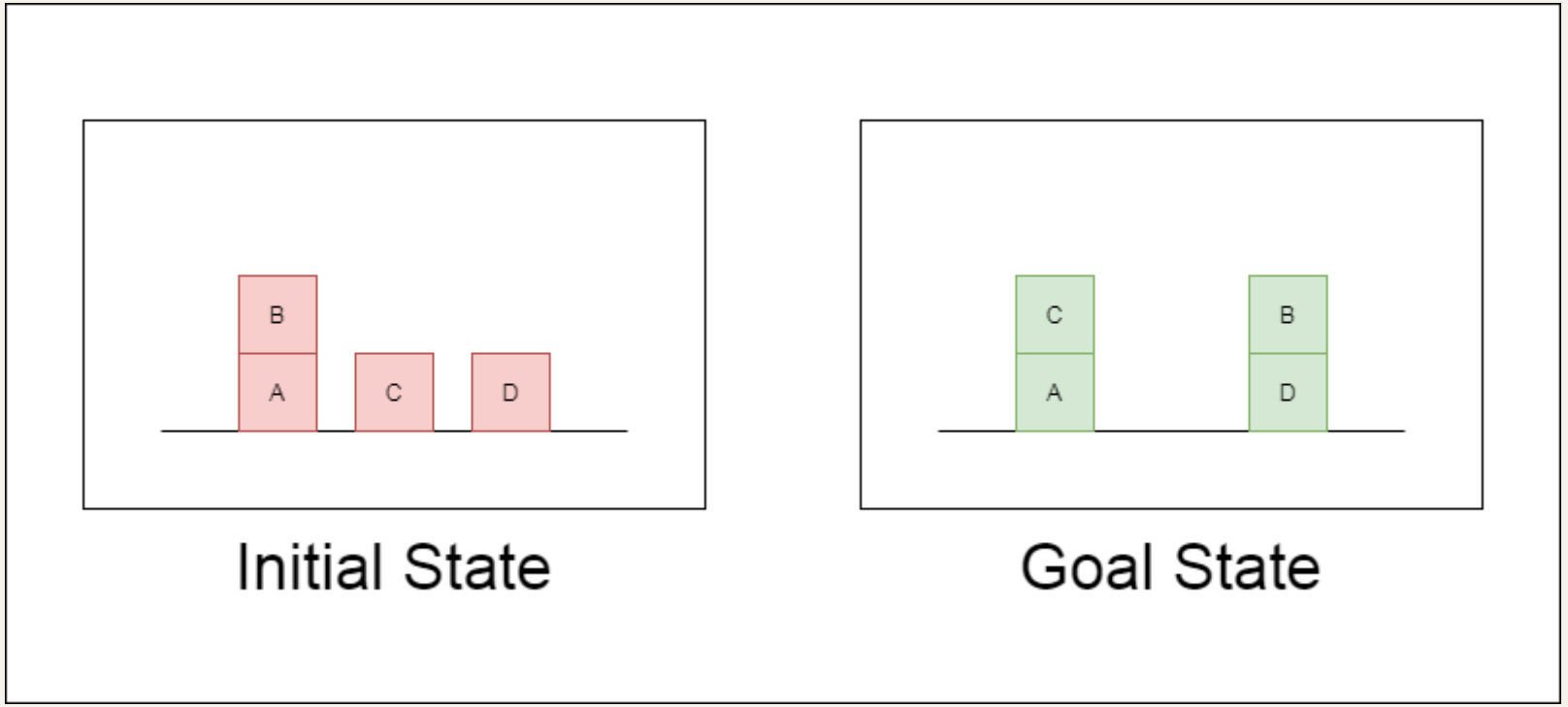
- $on(A) \wedge on(B,C) \wedge on(C,D) \wedge onTable(D)$



STACK

- ***stack(A,B)***
- $on(A,B) \wedge on(B,C) \wedge on(C,D) \wedge onTable(D)$

CONTOH MASALAH

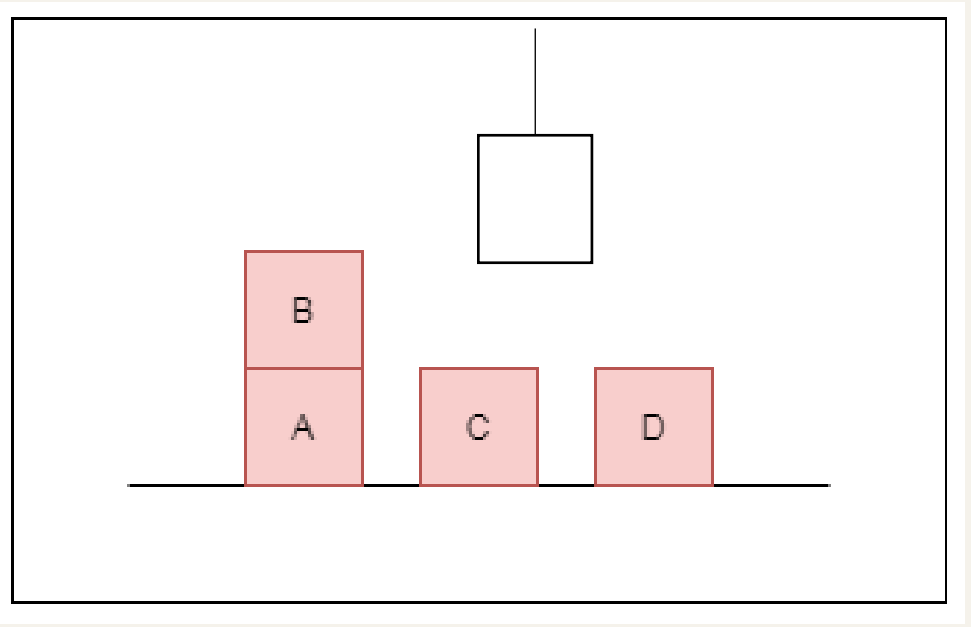


$ON(B, A) \wedge$
$ONTABLE(A) \wedge$
$ONTABLE(C) \wedge$
$ONTABLE(D) \wedge$
$ARMEMPTY$

$ON(C, A) \wedge$
$ONTABLE(A) \wedge$
$ON(B, D) \wedge$
$ONTABLE(D)$

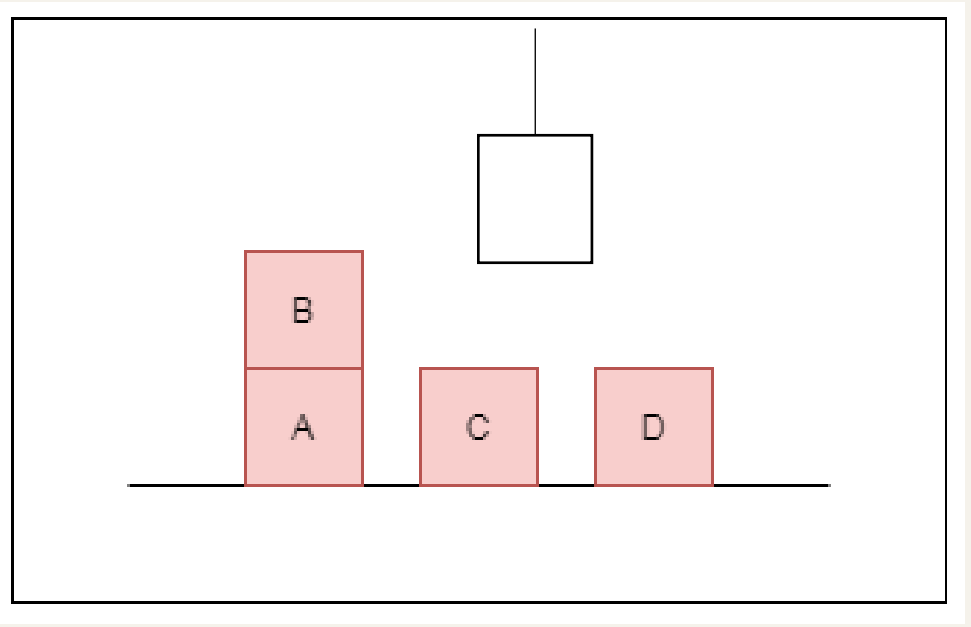
LANGKAH KE-1

- Stack
  - $ON(C, A) \wedge ONTABLE(A) \wedge ON(B, D) \wedge ONTABLE(D)$
- Current-State
  - $ON(B, A) \wedge ONTABLE(A) \wedge ONTABLE(C) \wedge ONTABLE(D) \wedge ARMEMPTY$



LANGKAH KE-2

- Stack
  - $ON(C, A)$
  - $ON(B, D)$
  - $ON(C, A) \wedge ONTABLE(A) \wedge ON(B, D) \wedge ONTABLE(D)$
- Current-State
  - $ON(B, A) \wedge ONTABLE(A) \wedge ONTABLE(C) \wedge ONTABLE(D) \wedge ARMEMPTY$

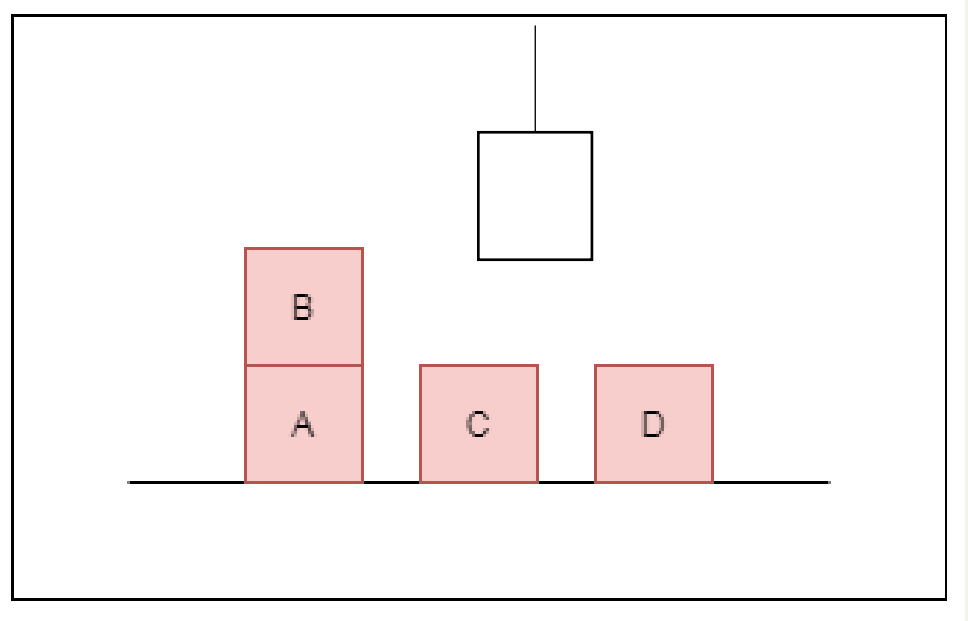


LANGKAH KE-3

- Stack
  - $ON(C, A)$
  - $ON(B, D)$
  - $ON(C, A) \wedge ONTABLE(A) \wedge ON(B, D) \wedge ONTABLE(D)$

memenuhi?

- Current-State
  - $ON(B, A) \wedge ONTABLE(A) \wedge ONTABLE(C) \wedge ONTABLE(D) \wedge ARMEMPTY$

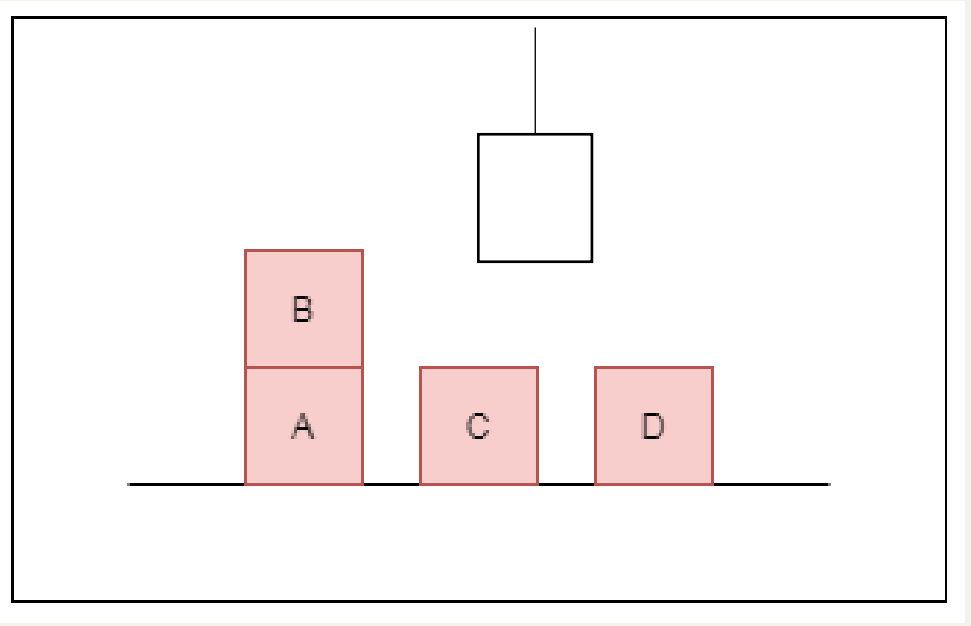


LANGKAH KE-3

- Stack
  - $ON(C, A)$
  - $ON(B, D)$
  - $ON(C, A) \wedge ONTABLE(A) \wedge ON(B, D) \wedge ONTABLE(D)$

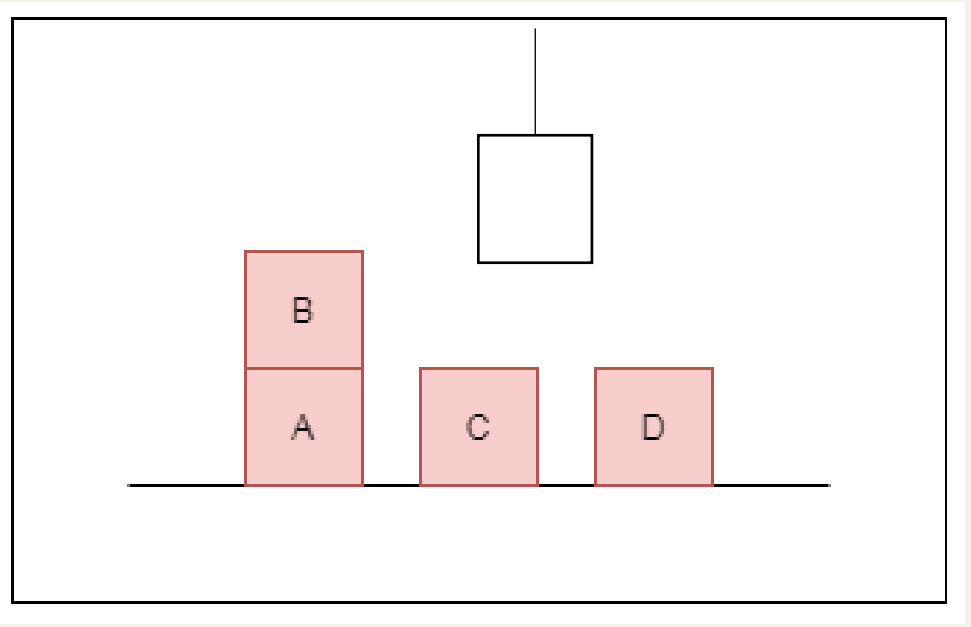
memenuhi? X

- Current-State
  - $ON(B, A) \wedge ONTABLE(A) \wedge ONTABLE(C) \wedge ONTABLE(D) \wedge ARMEMPTY$



LANGKAH KE-3

- Stack
  - $ON(C, A)$ → POP
  - $ON(B, D)$
  - $ON(C, A) \wedge ONTABLE(A) \wedge ON(B, D) \wedge ONTABLE(D)$
- Current-State
  - $ON(B, A) \wedge ONTABLE(A) \wedge ONTABLE(C) \wedge ONTABLE(D) \wedge ARMEMPTY$

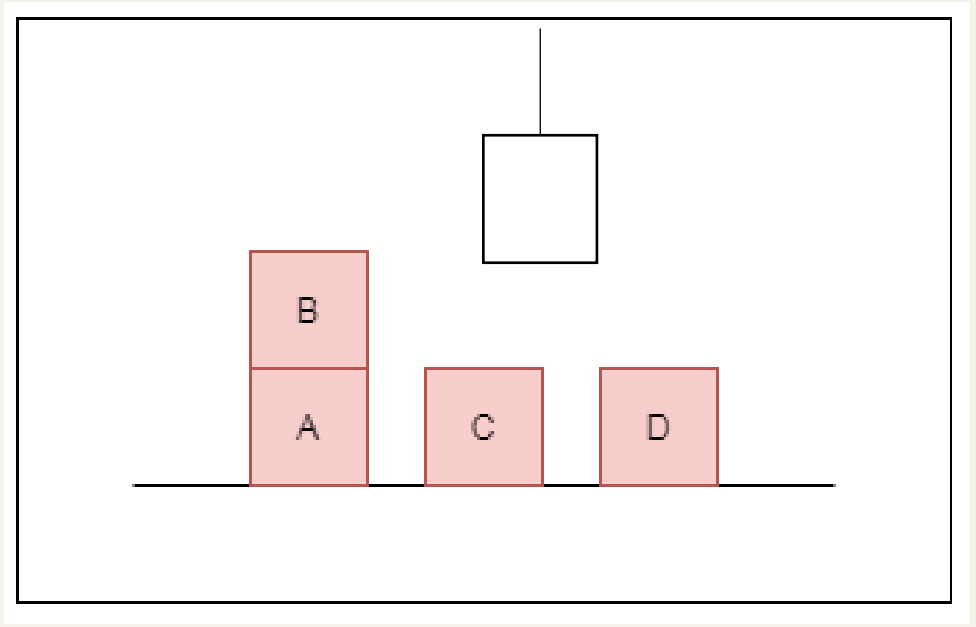


LANGKAH KE-3

- Stack
  - $CLEAR(A)$
  - $HOLDING(C)$
  - $CLEAR(A) \wedge HOLDING(C)$
  - $\boldsymbol{STACK(C, A)}$
  - $ON(B, D)$
  - $ON(C, A) \wedge ONTABLE(A) \wedge ON(B, D) \wedge ONTABLE(D)$

$ON(C, A)$

- Current-State
  - $ON(B, A) \wedge ONTABLE(A) \wedge ONTABLE(C) \wedge ONTABLE(D) \wedge ARMEMPTY$

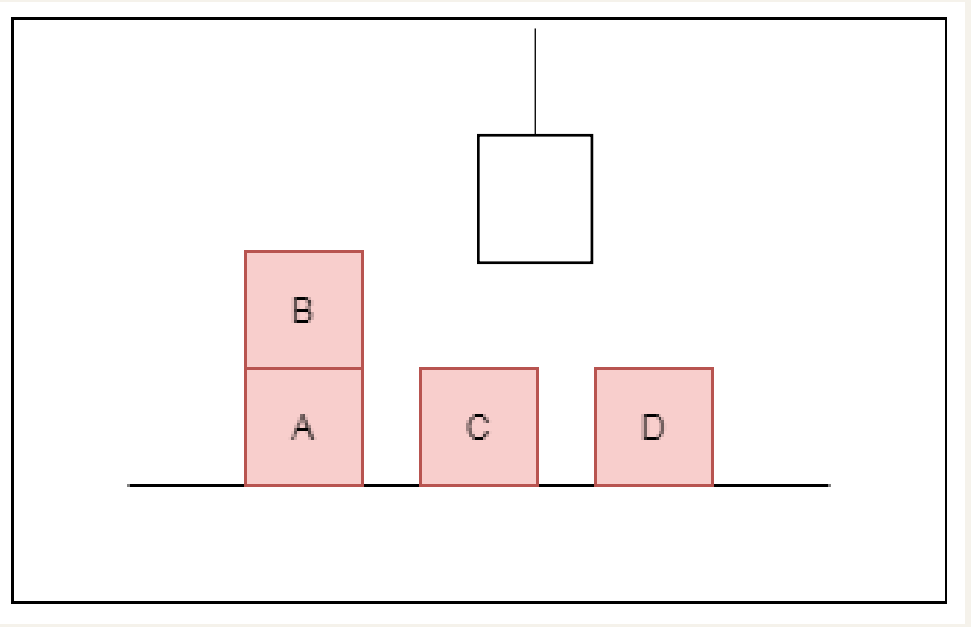


LANGKAH KE-4

- Stack
  - $CLEAR(A)$
  - $HOLDING(C)$
  - $CLEAR(A) \wedge HOLDING(C)$
  - $\boldsymbol{STACK(C, A)}$
  - $ON(B, D)$
  - $ON(C, A) \wedge ONTABLE(A) \wedge ON(B, D) \wedge ONTABLE(D)$

memenuhi?

- Current-State
  - $ON(B, A) \wedge ONTABLE(A) \wedge ONTABLE(C) \wedge ONTABLE(D) \wedge ARMEMPTY$

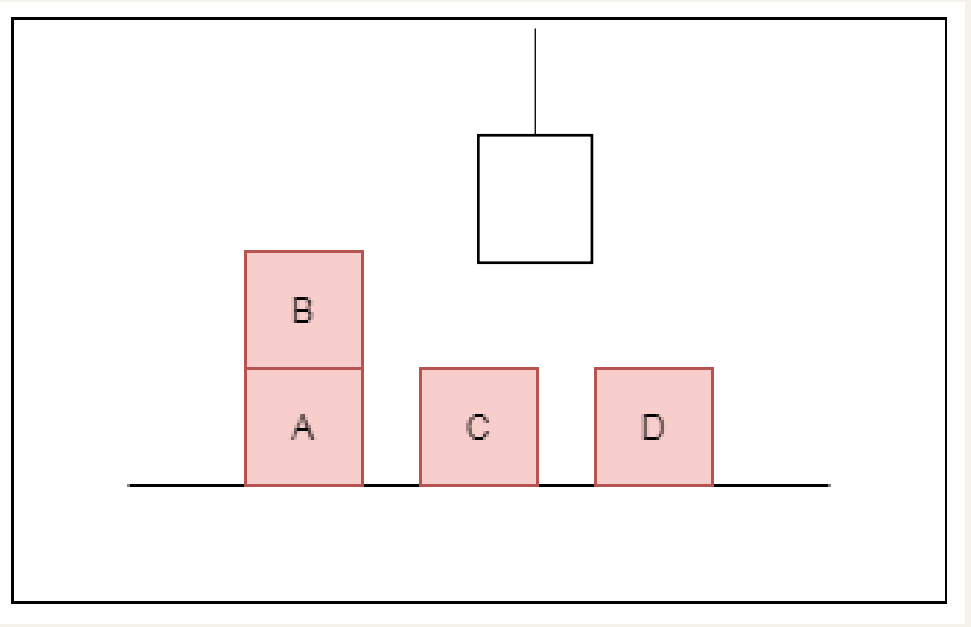


LANGKAH KE-4

- Stack
  - $CLEAR(A)$
  - $HOLDING(C)$
  - $CLEAR(A) \wedge HOLDING(C)$
  - $\boldsymbol{STACK(C, A)}$
  - $ON(B, D)$
  - $ON(C, A) \wedge ONTABLE(A) \wedge ON(B, D) \wedge ONTABLE(D)$

memenuhi? X

- Current-State
  - $ON(B, A) \wedge ONTABLE(A) \wedge ONTABLE(C) \wedge ONTABLE(D) \wedge ARMEMPTY$

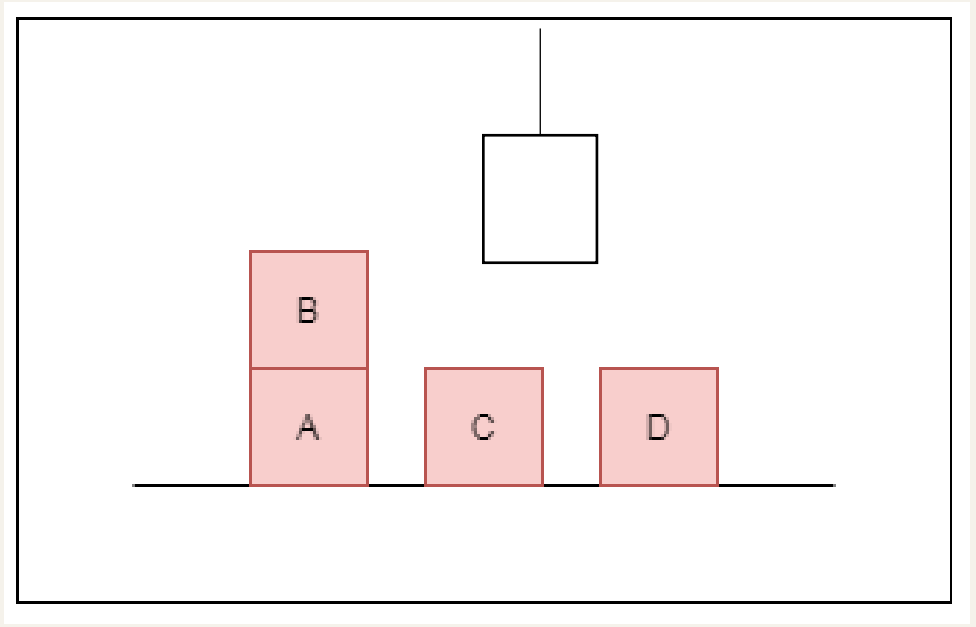


LANGKAH KE-4

- Stack
  - $ON(B, A)$
  - $CLEAR(B)$
  - $ARMEMPTY$
  - $ON(B, A) \wedge CLEAR(B) \wedge ARMEMPITY$
  - $\boldsymbol{UNSTACK(B, A)}$
  - $HOLDING(C)$
  - $CLEAR(A) \wedge HOLDING(C)$
  - $\boldsymbol{STACK(C, A)}$
  - $ON(B, D)$
  - $ON(C, A) \wedge ONTABLE(A) \wedge ON(B, D) \wedge ONTABLE(D)$

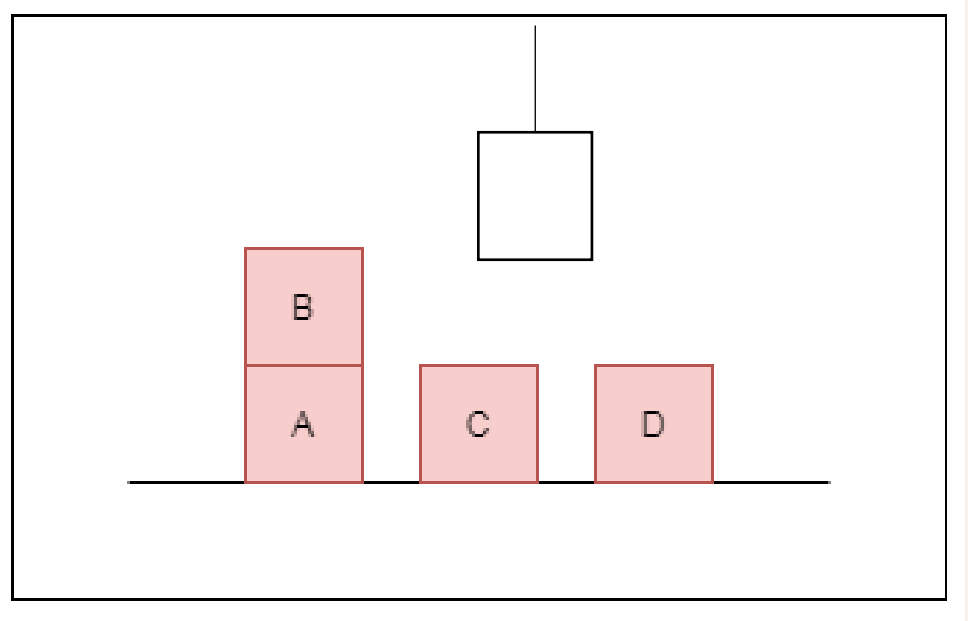
$CLEAR(A)$

- Current-State
  - $ON(B, A) \wedge ONTABLE(A) \wedge ONTABLE(C) \wedge ONTABLE(D) \wedge ARMEMPTY$



LANGKAH KE-4

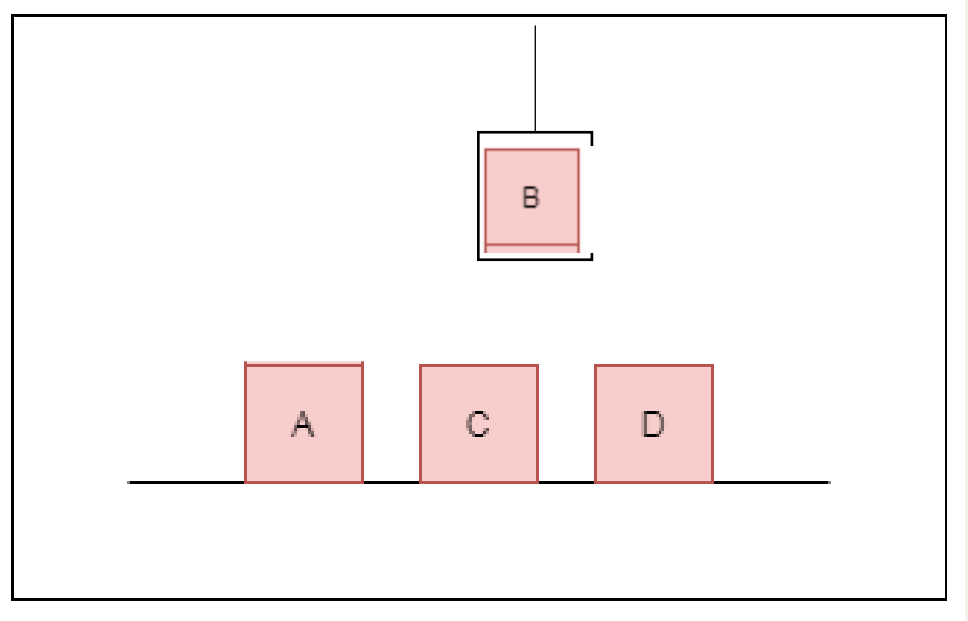
- Stack
  - $ON(B, A)$
  - $CLEAR(B)$
  - $ARMEMPTY$
  - $ON(B, A) \wedge CLEAR(B) \wedge ARMEMPITY$
  - $\boldsymbol{UNSTACK(B, A)}$
  - $HOLDING(C)$
  - $CLEAR(A) \wedge HOLDING(C)$
  - $\boldsymbol{STACK(C, A)}$
  - $ON(B, D)$
  - $ON(C, A) \wedge ONTABLE(A) \wedge ON(B, D) \wedge ONTABLE(D)$
- Current-State
  - $ON(B, A) \wedge ONTABLE(A) \wedge ONTABLE(C) \wedge ONTABLE(D) \wedge ARMEMPTY$



LANGKAH KE-4

- Stack
  - $ON(B, A)$
  - $CLEAR(B)$
  - $ARMEMPTY$
  - $ON(B, A) \wedge CLEAR(B) \wedge ARMEMPITY$
  - $\boldsymbol{UNSTACK(B, A)}$
  - $HOLDING(C)$
  - $CLEAR(A) \wedge HOLDING(C)$
  - $\boldsymbol{STACK(C, A)}$
  - $ON(B, D)$
  - $ON(C, A) \wedge ONTABLE(A) \wedge ON(B, D) \wedge ONTABLE(D)$

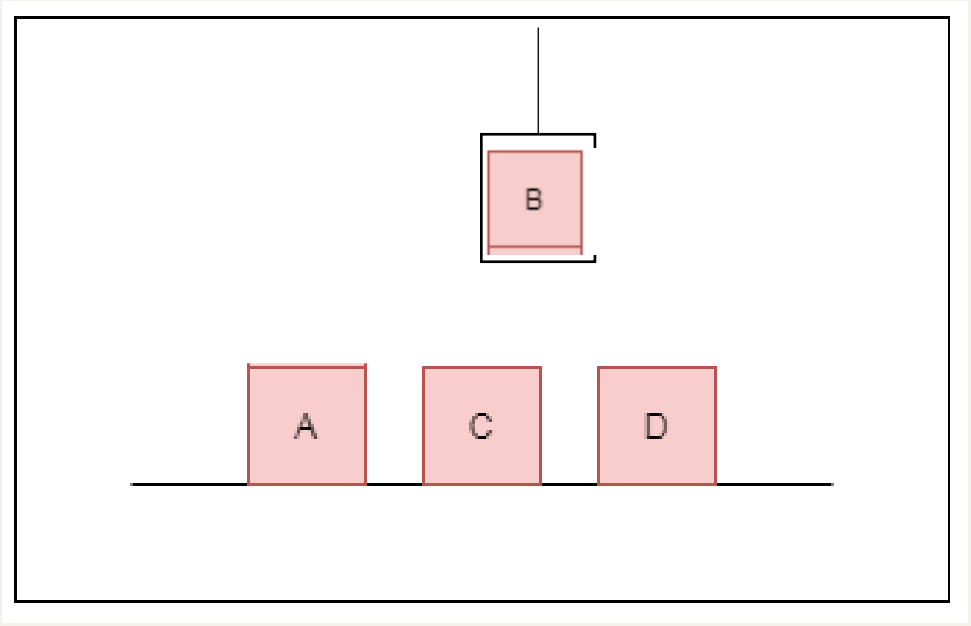
- Current-State
  - $ONTABLE(A) \wedge ONTABLE(C) \wedge ONTABLE(D) \wedge HOLDING(B)$



LANGKAH KE-5

- Stack
  - $HOLDING(C)$
  - $CLEAR(A) \wedge HOLDING(C)$
  - $\boldsymbol{STACK(C, A)}$
  - $ON(B, D)$
  - $ON(C, A) \wedge ONTABLE(A) \wedge ON(B, D) \wedge ONTABLE(D)$

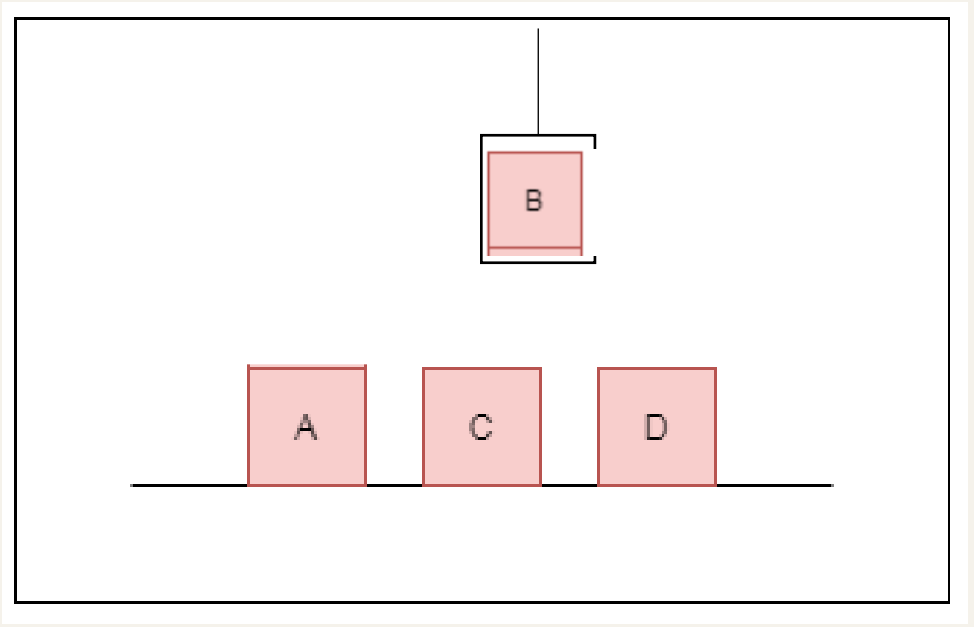
- Current-State
  - $ONTABLE(A) \wedge ONTABLE(C) \wedge ONTABLE(D) \wedge HOLDING(B)$



LANGKAH KE-5

- Stack
  - $HOLDING(C)$
  - $CLEAR(A) \wedge HOLDING(C)$
  - $\boldsymbol{STACK(C, A)}$
  - $ON(B, D)$
  - $ON(C, A) \wedge ONTABLE(A) \wedge ON(B, D) \wedge ONTABLE(D)$

- Current-State
  - $ONTABLE(A) \wedge ONTABLE(C) \wedge ONTABLE(D) \wedge HOLDING(B)$

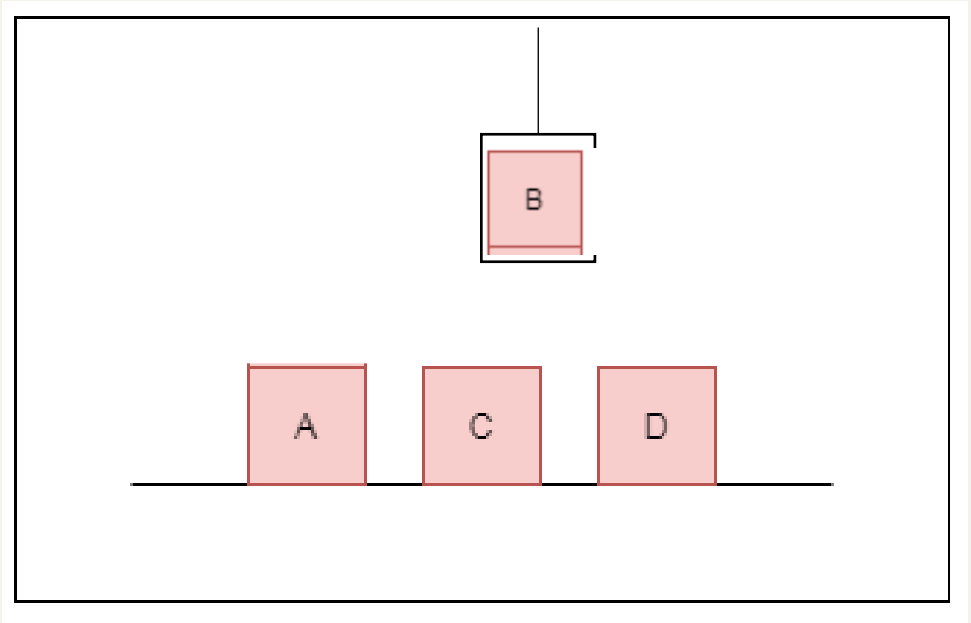


LANGKAH KE-5

- Stack
  - $ONTABLE(C)$
  - $CLEAR(C)$
  - $ARMEMPTY$
  - $ONTABLE(C) \wedge CLEAR(C) \wedge ARMEMPTY$
  - $\boldsymbol{PICKUP(C)}$
  - $CLEAR(A) \wedge HOLDING(C)$
  - $\boldsymbol{STACK(C, A)}$
  - $ON(B, D)$
  - $ON(C, A) \wedge ONTABLE(A) \wedge ON(B, D) \wedge ONTABLE(D)$

$HOLDING(C)$

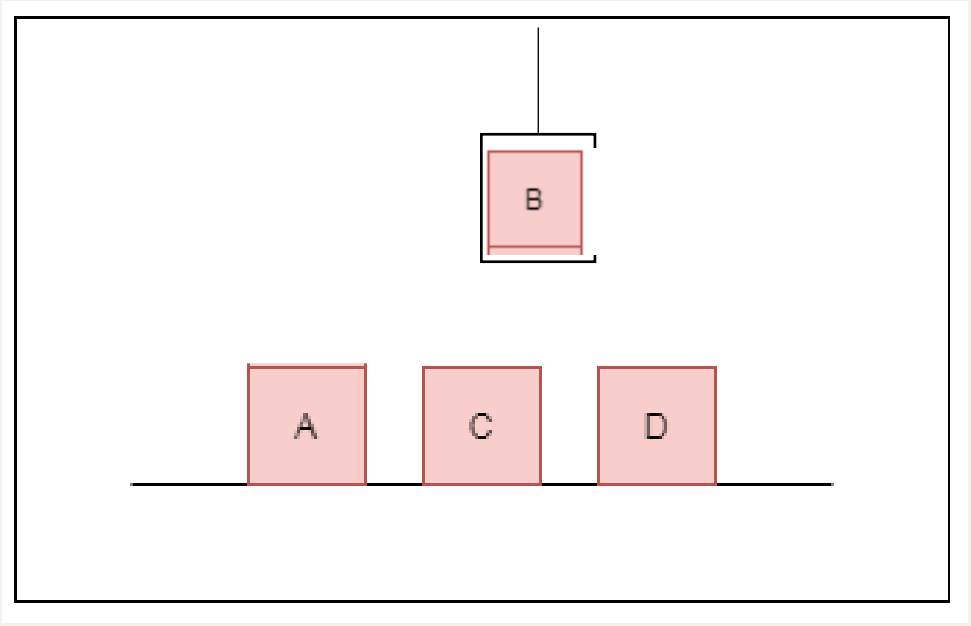
- Current-State
  - $ONTABLE(A) \wedge ONTABLE(C) \wedge ONTABLE(D) \wedge HOLDING(B)$



LANGKAH KE-6

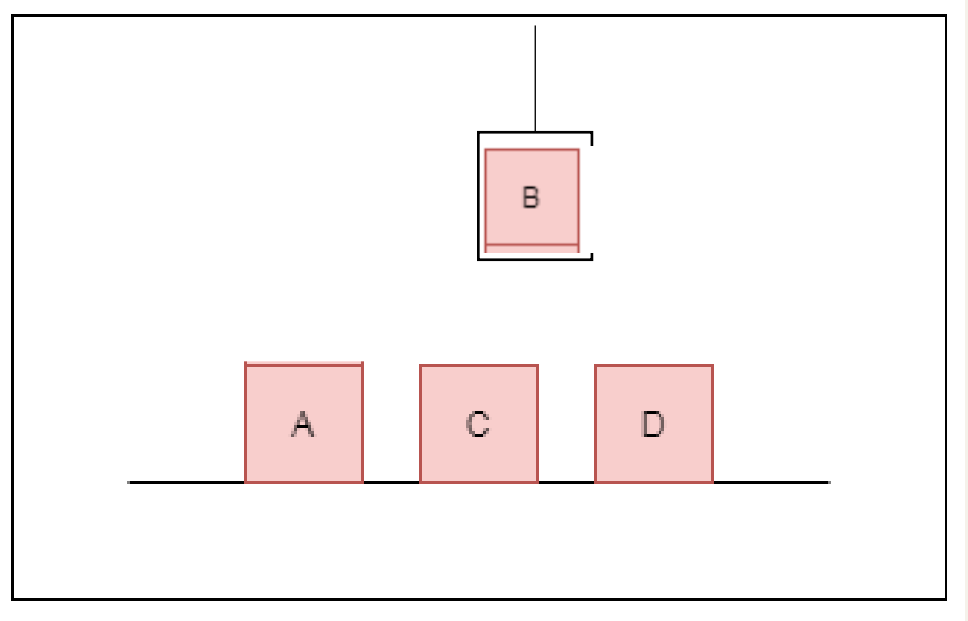
- Stack
  - $ONTABLE(C)$
  - $CLEAR(C)$
  - $ARMEMPTY$
  - $ONTABLE(C) \wedge CLEAR(C) \wedge ARMEMPTY$
  - $\boldsymbol{PICKUP(C)}$
  - $CLEAR(A) \wedge HOLDING(C)$
  - $\boldsymbol{STACK(C, A)}$
  - $ON(B, D)$
  - $ON(C, A) \wedge ONTABLE(A) \wedge ON(B, D) \wedge ONTABLE(D)$

- Current-State
  - $ONTABLE(A) \wedge ONTABLE(C) \wedge ONTABLE(D) \wedge HOLDING(B)$



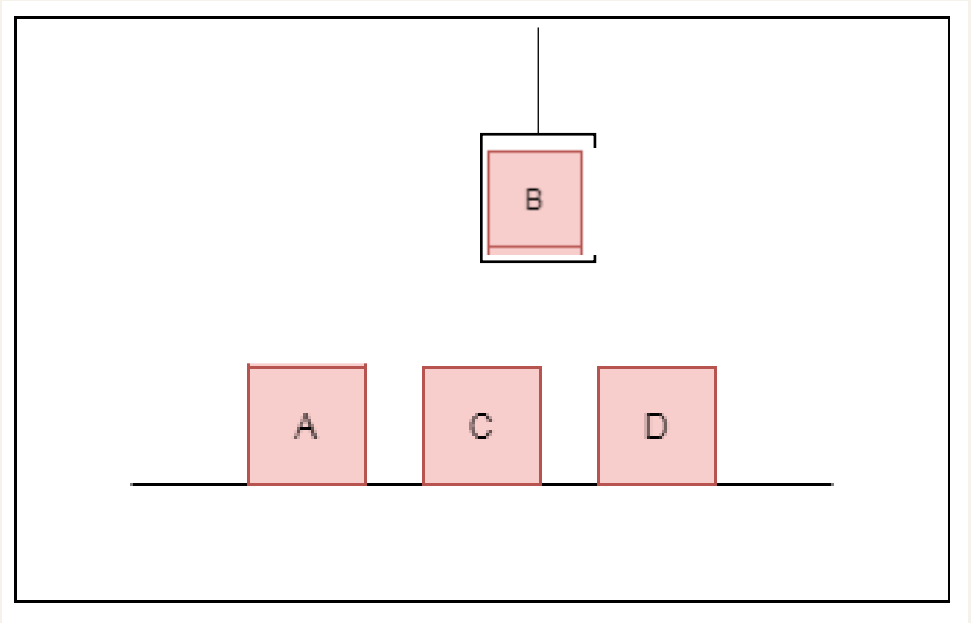
LANGKAH KE-6

- Stack
  - $CLEAR(D)$
  - $HOLDING(B)$
  - $CLEAR(B) \wedge HOLDING(B)$
  - $\boldsymbol{STACK(B, D)}$
  - $ONTABLE(C) \wedge CLEAR(C) \wedge ARMEMPTY$
  - $\boldsymbol{PICKUP(C)}$
  - $CLEAR(A) \wedge HOLDING(C)$
  - $\boldsymbol{STACK(C, A)}$
  - $ON(B, D)$
  - $ON(C, A) \wedge ONTABLE(A) \wedge ON(B, D) \wedge ONTABLE(D)$
- Current-State
  - $ONTABLE(A) \wedge ONTABLE(C) \wedge ONTABLE(D) \wedge HOLDING(B)$



LANGKAH KE-6

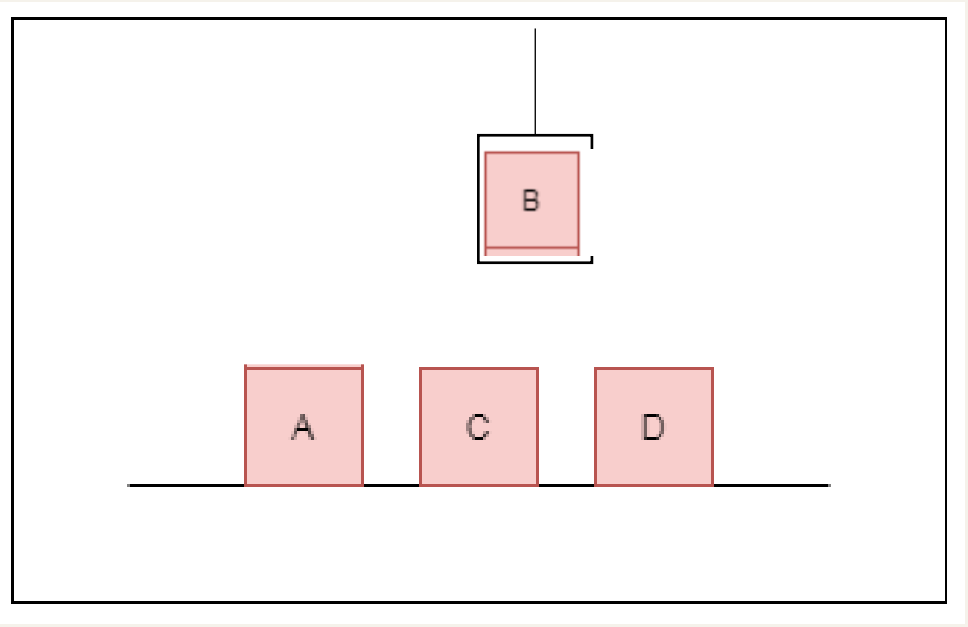
- Stack
  - $CLEAR(D)$
  - $HOLDING(B)$
  - $CLEAR(B) \wedge HOLDING(B)$
  - $\boldsymbol{STACK(B, D)}$
  - $ONTABLE(C) \wedge CLEAR(C) \wedge ARMEMPTY$
  - $\boldsymbol{PICKUP(C)}$
  - $CLEAR(A) \wedge HOLDING(C)$
  - $\boldsymbol{STACK(C, A)}$
  - $ON(B, D)$
  - $ON(C, A) \wedge ONTABLE(A) \wedge ON(B, D) \wedge ONTABLE(D)$
- Current-State
  - $ONTABLE(A) \wedge ONTABLE(C) \wedge ONTABLE(D) \wedge HOLDING(B)$



LANGKAH KE-6

- Stack
  - $HOLDING(B)$
  - $CLEAR(B) \wedge HOLDING(B)$
  - $\boldsymbol{STACK(B, D)}$
  - $ONTABLE(C) \wedge CLEAR(C) \wedge ARMEMPTY$
  - $\boldsymbol{PICKUP(C)}$
  - $CLEAR(A) \wedge HOLDING(C)$
  - $\boldsymbol{STACK(C, A)}$
  - $ON(B, D)$
  - $ON(C, A) \wedge ONTABLE(A) \wedge ON(B, D) \wedge ONTABLE(D)$

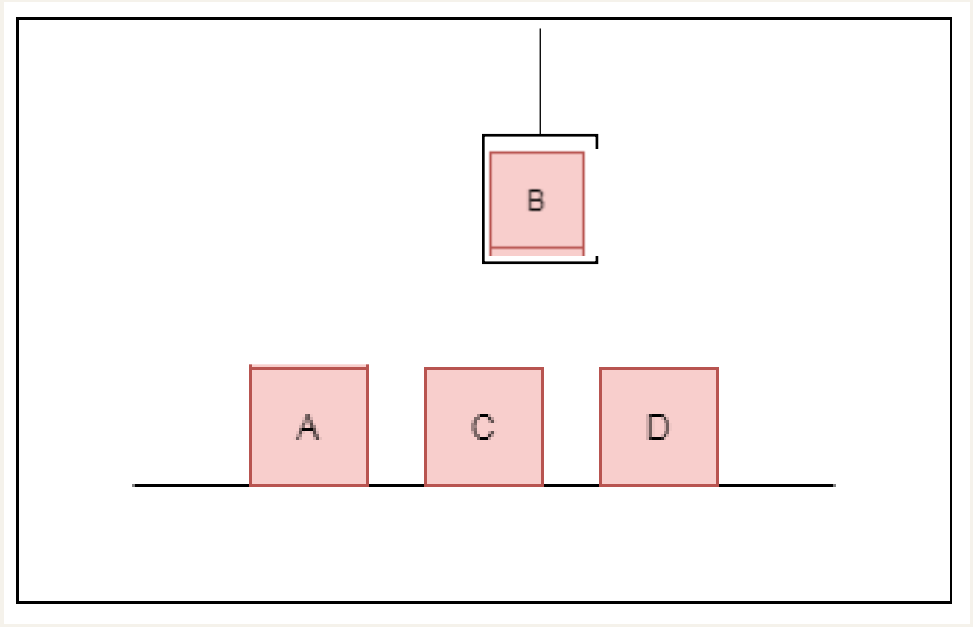
- Current-State
  - $ONTABLE(A) \wedge ONTABLE(C) \wedge ONTABLE(D) \wedge HOLDING(B)$



LANGKAH KE-6

- Stack
  - $CLEAR(B) \wedge HOLDING(B)$
  - $\boldsymbol{STACK(B, D)}$
  - $ONTABLE(C) \wedge CLEAR(C) \wedge ARMEMPTY$
  - $\boldsymbol{PICKUP(C)}$
  - $CLEAR(A) \wedge HOLDING(C)$
  - $\boldsymbol{STACK(C, A)}$
  - $ON(B, D)$
  - $ON(C, A) \wedge ONTABLE(A) \wedge ON(B, D) \wedge ONTABLE(D)$

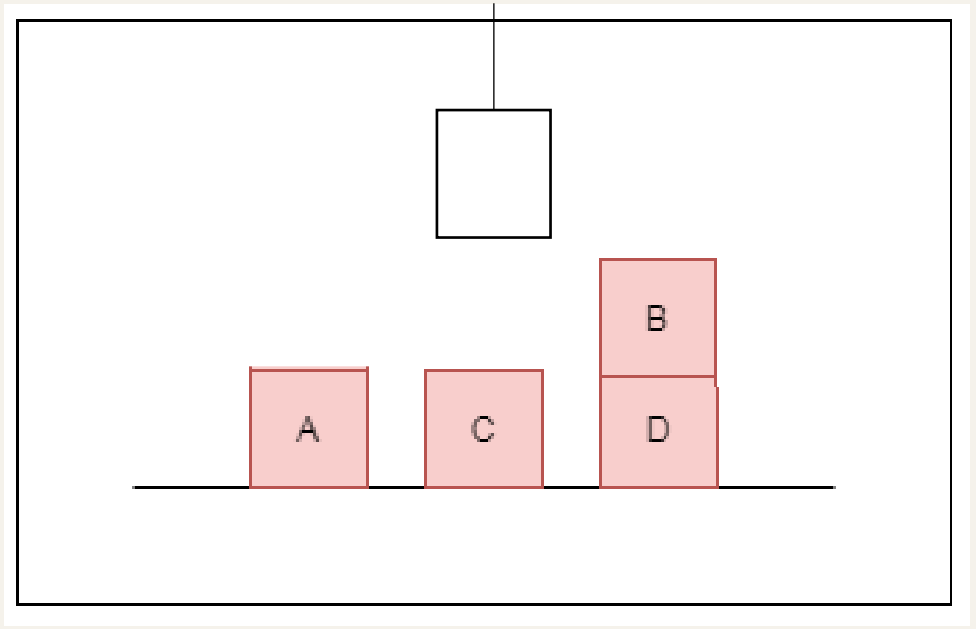
- Current-State
  - $ONTABLE(A) \wedge ONTABLE(C) \wedge ONTABLE(D) \wedge HOLDING(B)$



LANGKAH KE-6

- Stack
  - $\boldsymbol{STACK(B, D)}$
  - $ONTABLE(C) \wedge CLEAR(C) \wedge ARMEMPTY$
  - $\boldsymbol{PICKUP(C)}$
  - $CLEAR(A) \wedge HOLDING(C)$
  - $\boldsymbol{STACK(C, A)}$
  - $ON(B, D)$
  - $ON(C, A) \wedge ONTABLE(A) \wedge ON(B, D) \wedge ONTABLE(D)$

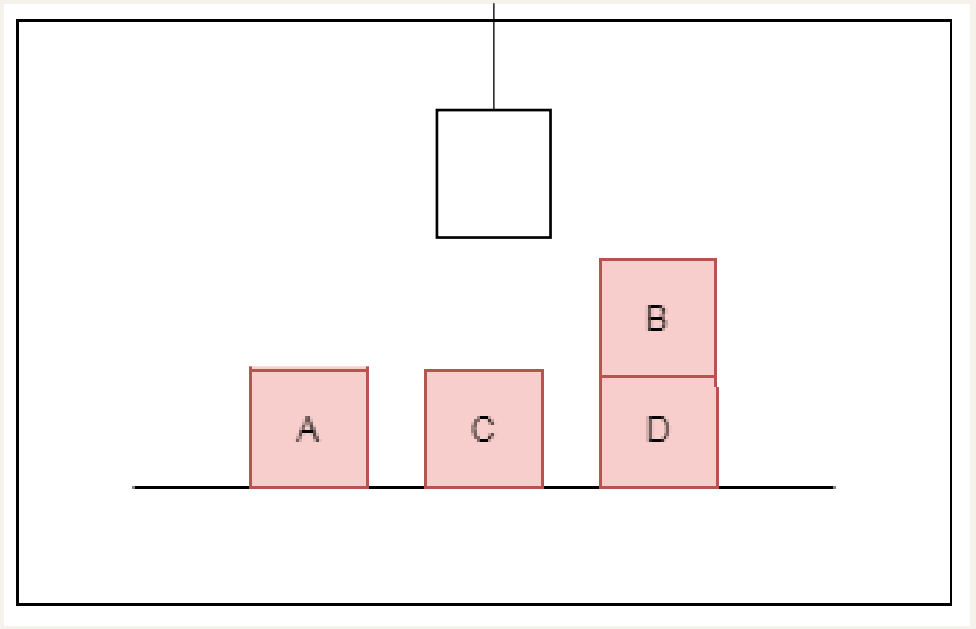
- Current-State
  - $ONTABLE(A) \wedge ONTABLE(C) \wedge ONTABLE(D) \wedge ON(B, D)$



LANGKAH KE-6

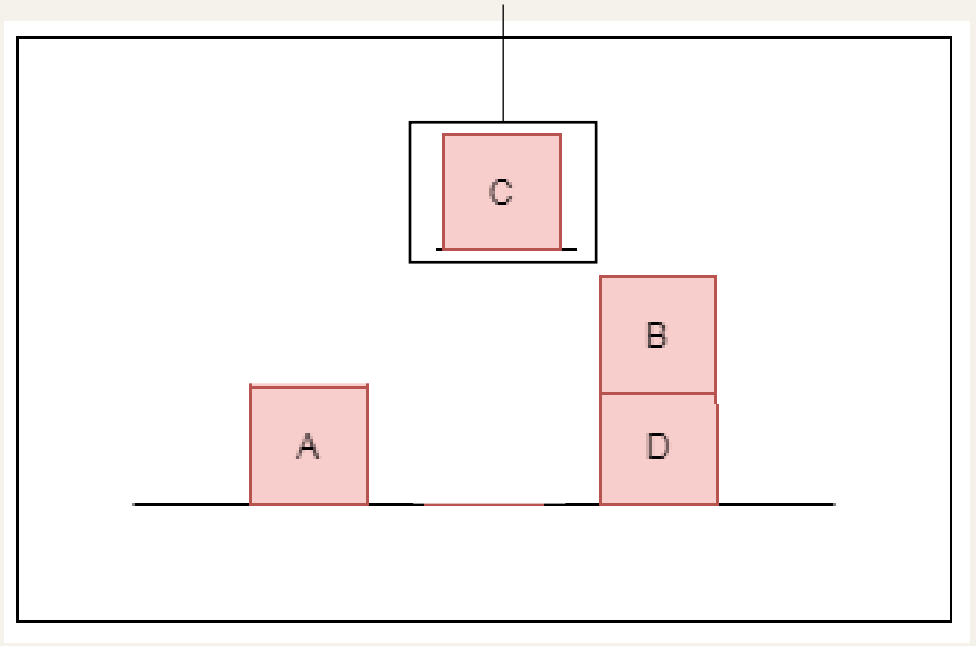
- Stack
  - $ONTABLE(C) \wedge CLEAR(C) \wedge ARMEMPTY$
  - $\boldsymbol{PICKUP(C)}$
  - $CLEAR(A) \wedge HOLDING(C)$
  - $\boldsymbol{STACK(C, A)}$
  - $ON(B, D)$
  - $ON(C, A) \wedge ONTABLE(A) \wedge ON(B, D) \wedge ONTABLE(D)$

- Current-State
  - $ONTABLE(A) \wedge ONTABLE(C) \wedge ONTABLE(D) \wedge ON(B, D)$



LANGKAH KE-6

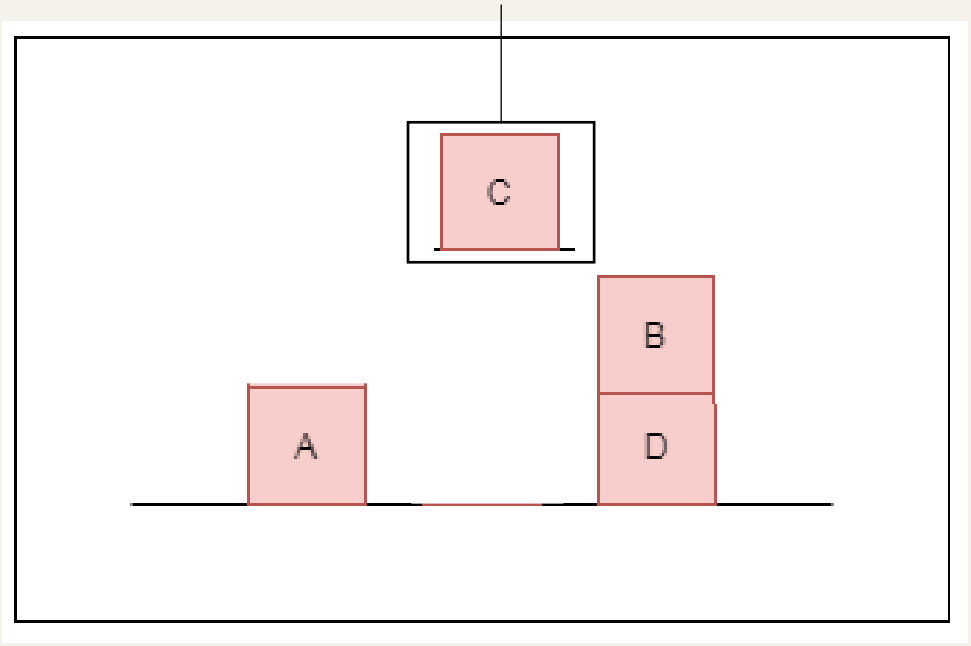
- Stack
  - $\boldsymbol{PICKUP(C)}$
  - $CLEAR(A) \wedge HOLDING(C)$
  - $\boldsymbol{STACK(C, A)}$
  - $ON(B, D)$
  - $ON(C, A) \wedge ONTABLE(A) \wedge ON(B, D) \wedge ONTABLE(D)$
- Current-State
  - $ONTABLE(A) \wedge ONTABLE(C) \wedge ONTABLE(D) \wedge ON(B, D)$



LANGKAH KE-6

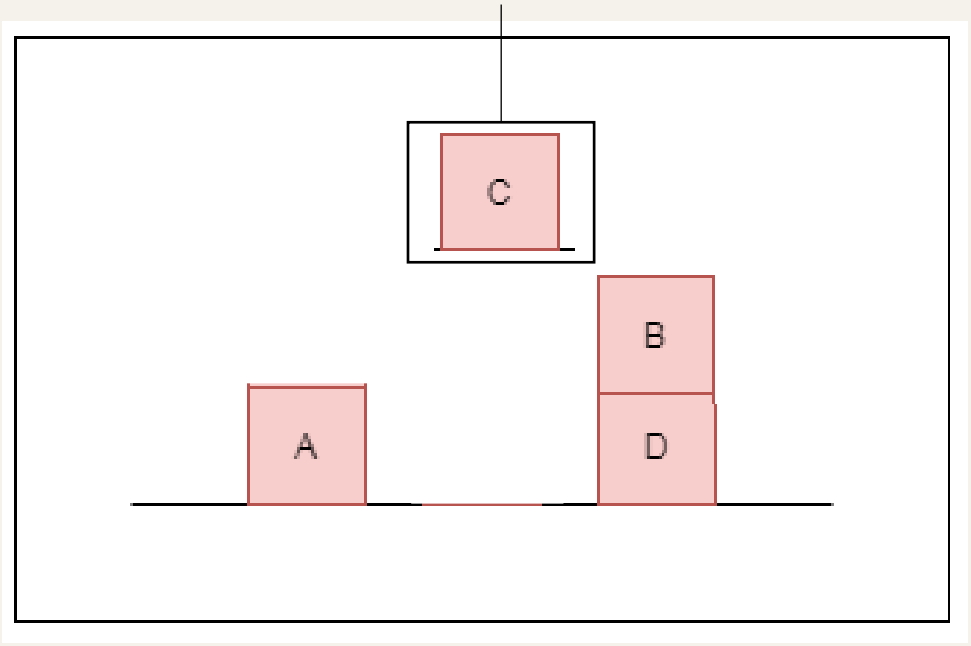
- Stack
  - $CLEAR(A) \wedge HOLDING(C)$
  - $\boldsymbol{STACK(C, A)}$
  - $ON(B, D)$
  - $ON(C, A) \wedge ONTABLE(A) \wedge ON(B, D) \wedge ONTABLE(D)$

- Current-State
  - $ONTABLE(A) \wedge HOLDING(C) \wedge ONTABLE(D) \wedge ON(B, D)$



LANGKAH KE-6

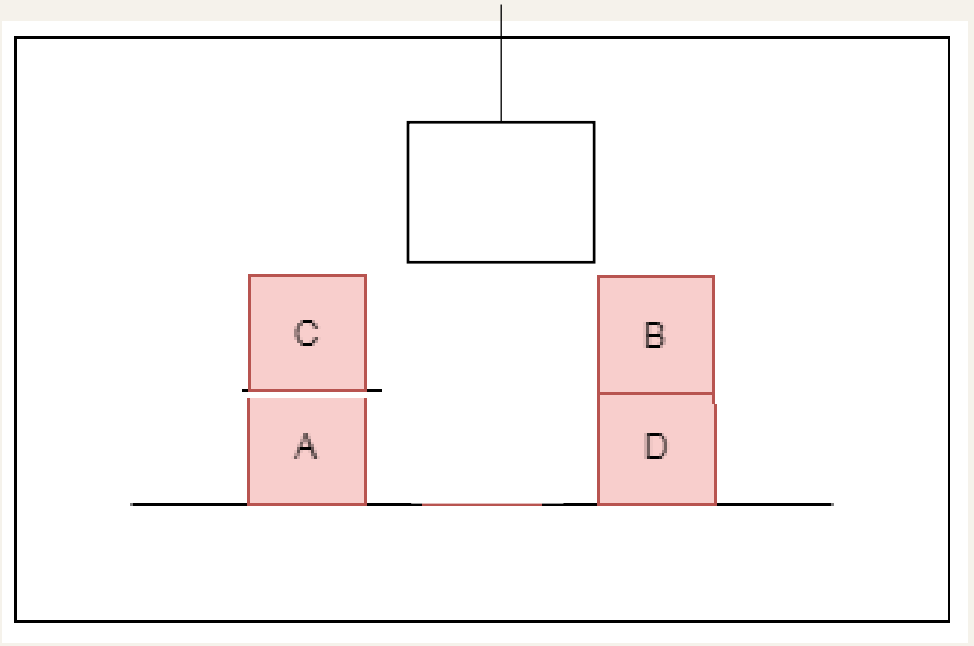
- Stack
  - $CLEAR(A) \wedge HOLDING(C)$
  - $\boldsymbol{STACK(C, A)}$
  - $ON(B, D)$
  - $ON(C, A) \wedge ONTABLE(A) \wedge ON(B, D) \wedge ONTABLE(D)$
- Current-State
  - $ONTABLE(A) \wedge HOLDING(C) \wedge ONTABLE(D) \wedge ON(B, D)$



LANGKAH KE-6

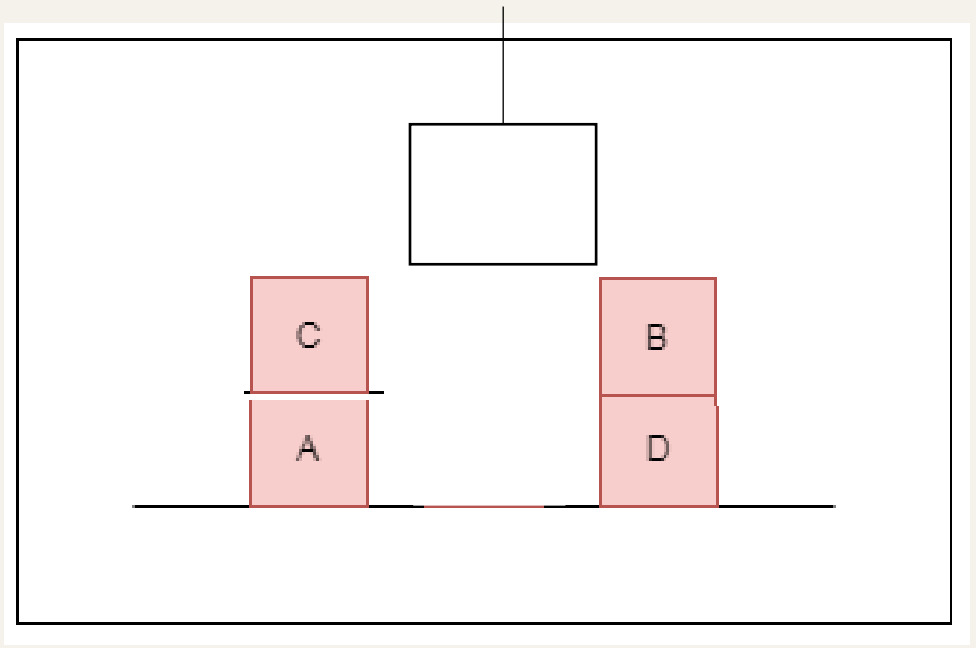
- Stack
  - $\boldsymbol{STACK(C, A)}$
  - $ON(B, D)$
  - $ON(C, A) \wedge ONTABLE(A) \wedge ON(B, D) \wedge ONTABLE(D)$

- Current-State
  - $ONTABLE(A) \wedge HOLDING(C) \wedge ONTABLE(D) \wedge ON(B, D)$



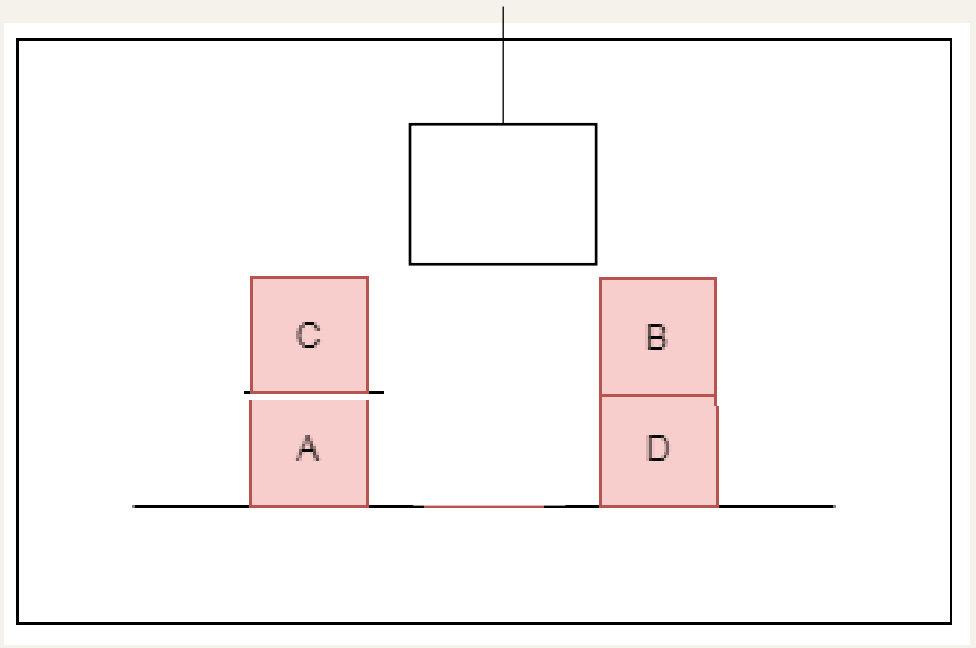
LANGKAH KE-6

- Stack
  - $ON(B, D)$
  - $ON(C, A) \wedge ONTABLE(A) \wedge ON(B, D) \wedge ONTABLE(D)$
- Current-State
  - $ONTABLE(A) \wedge ON(C, A) \wedge ONTABLE(D) \wedge ON(B, D)$



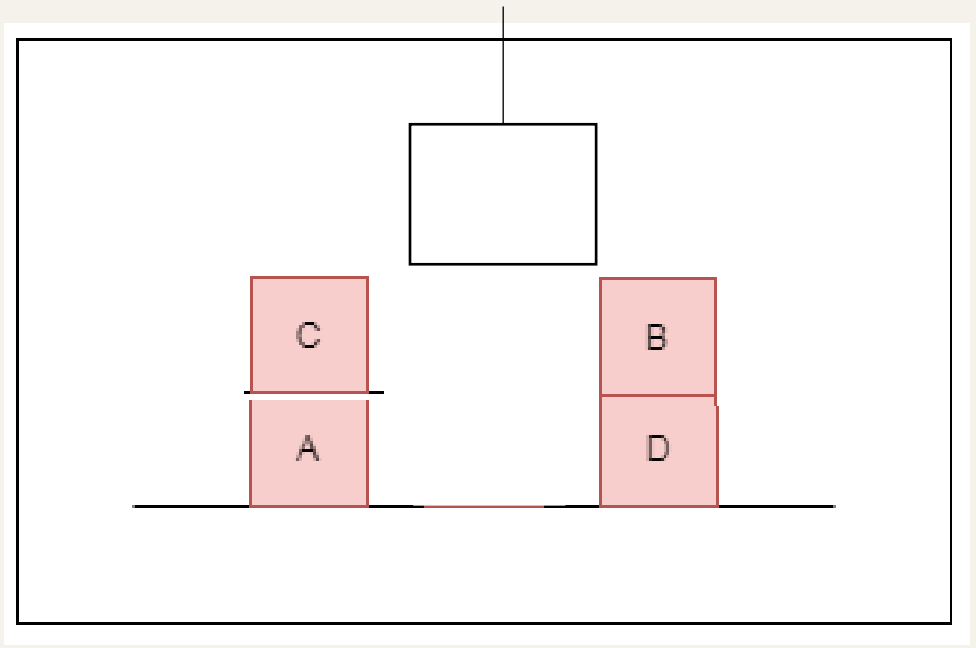
LANGKAH KE-6

- Stack
  - $ON(B, D)$
  - $ON(C, A) \wedge ONTABLE(A) \wedge ON(B, D) \wedge ONTABLE(D)$
- Current-State
  - $ONTABLE(A) \wedge ON(C, A) \wedge ONTABLE(D) \wedge ON(B, D)$



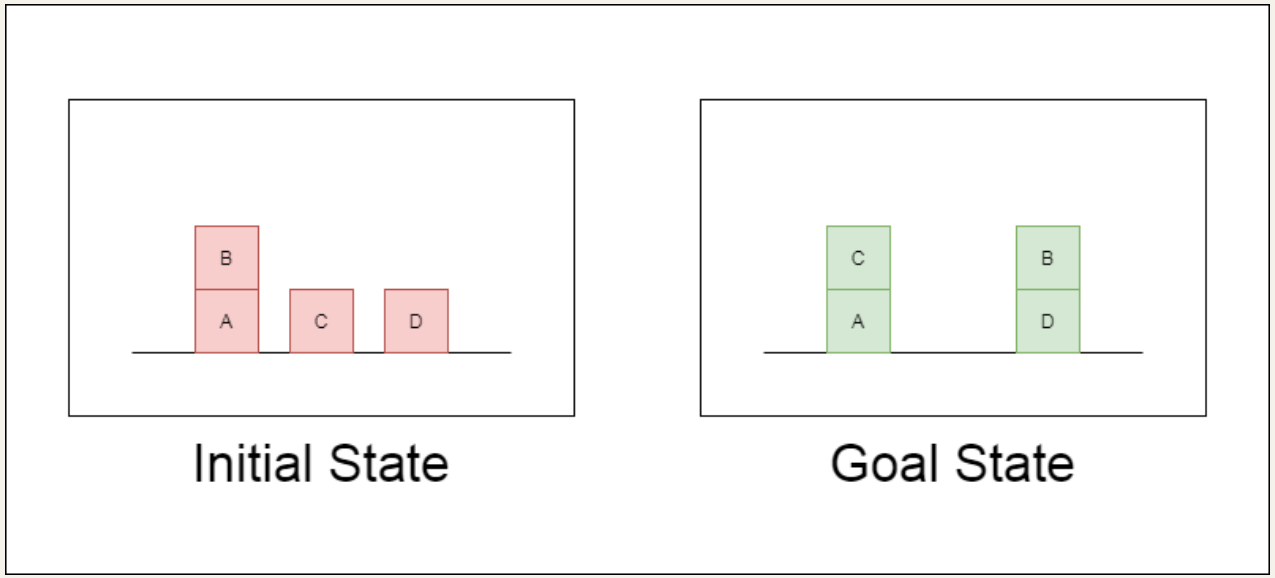
LANGKAH KE-6

- Stack
  - $ON(C, A) \wedge ONTABLE(A) \wedge ON(B, D) \wedge ONTABLE(D)$
- Current-State
  - $ONTABLE(A) \wedge ON(C, A) \wedge ONTABLE(D) \wedge ON(B, D)$

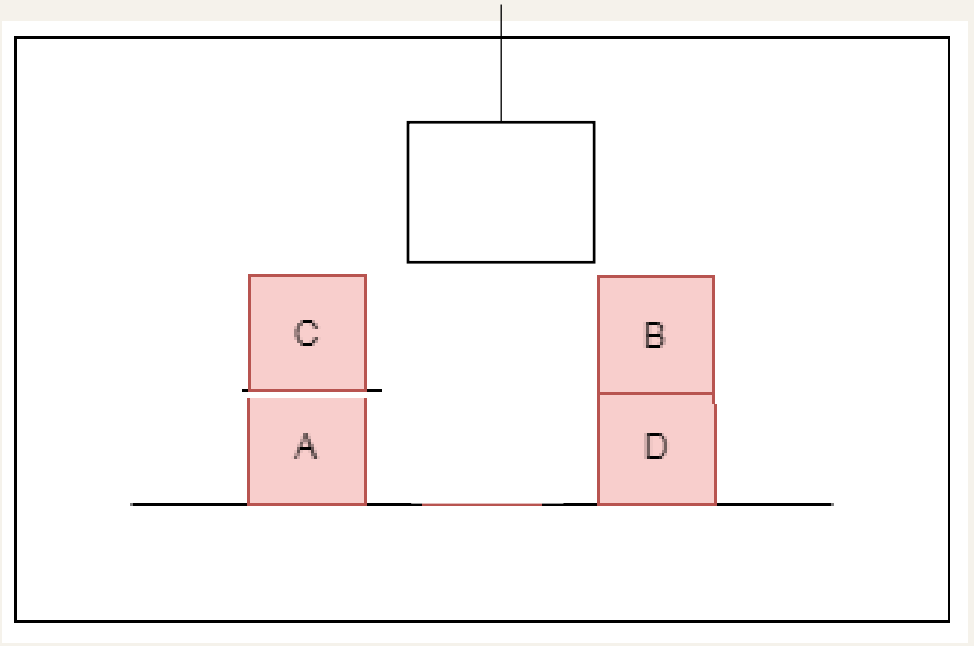


LANGKAH KE-6

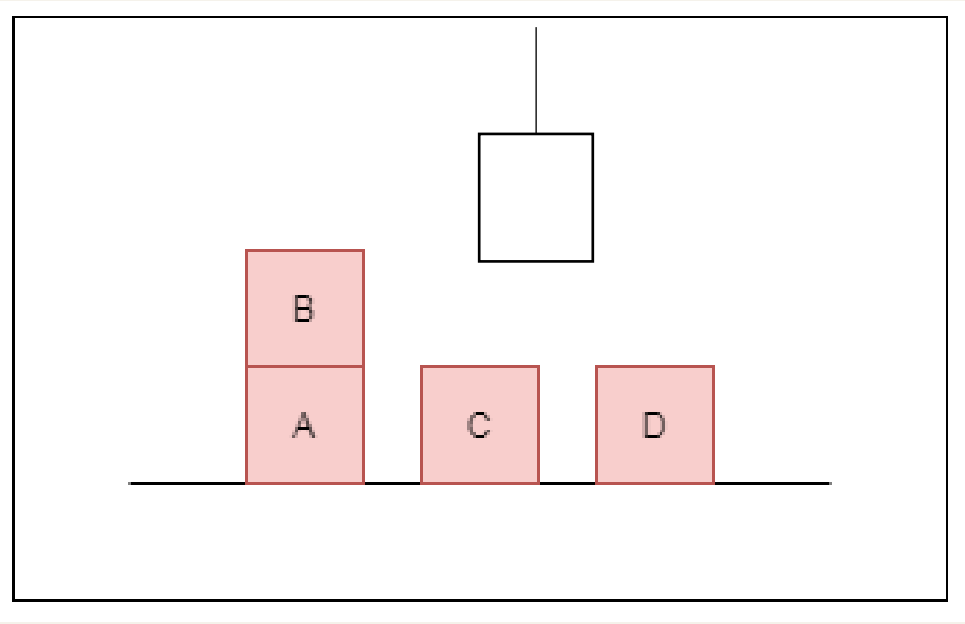
- Stack
  - $ON(C, A) \wedge ONTABLE(A) \wedge ON(B, D) \wedge ONTABLE(D)$



- Current-State
  - $ONTABLE(A) \wedge ON(C, A) \wedge ONTABLE(D) \wedge ON(B, D)$

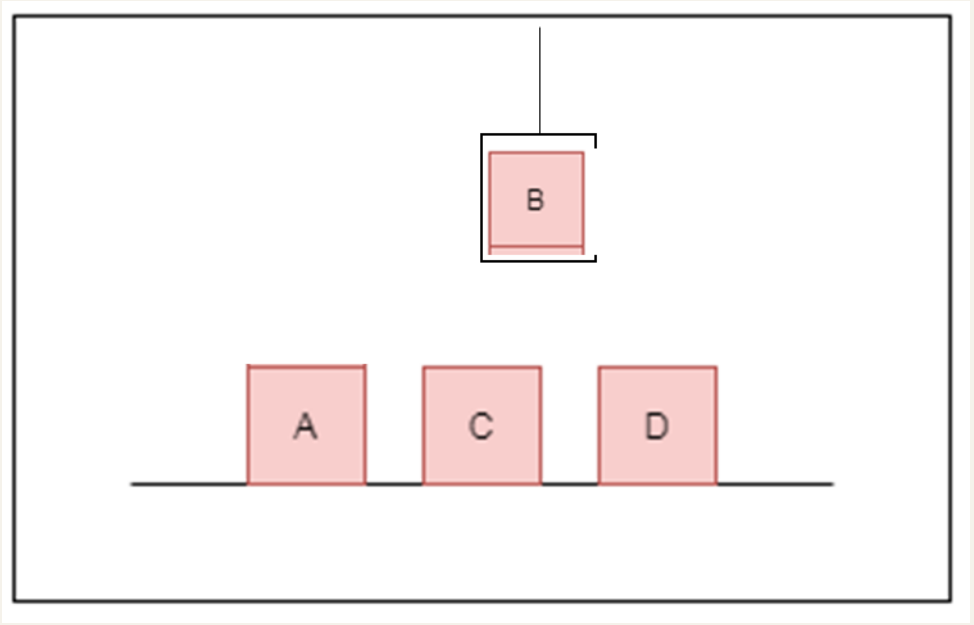


RENCANA PENYELESAIAN MASALAH-1



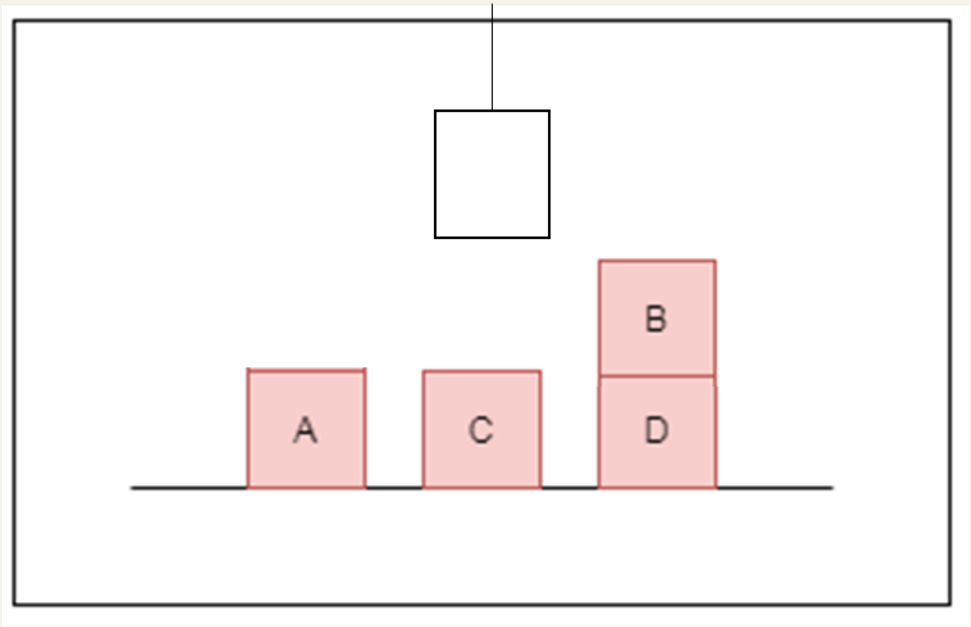
RENCANA PENYELESAIAN MASALAH-1

1. $UNSTACK(B, A)$
2.



RENCANA PENYELESAIAN MASALAH-1

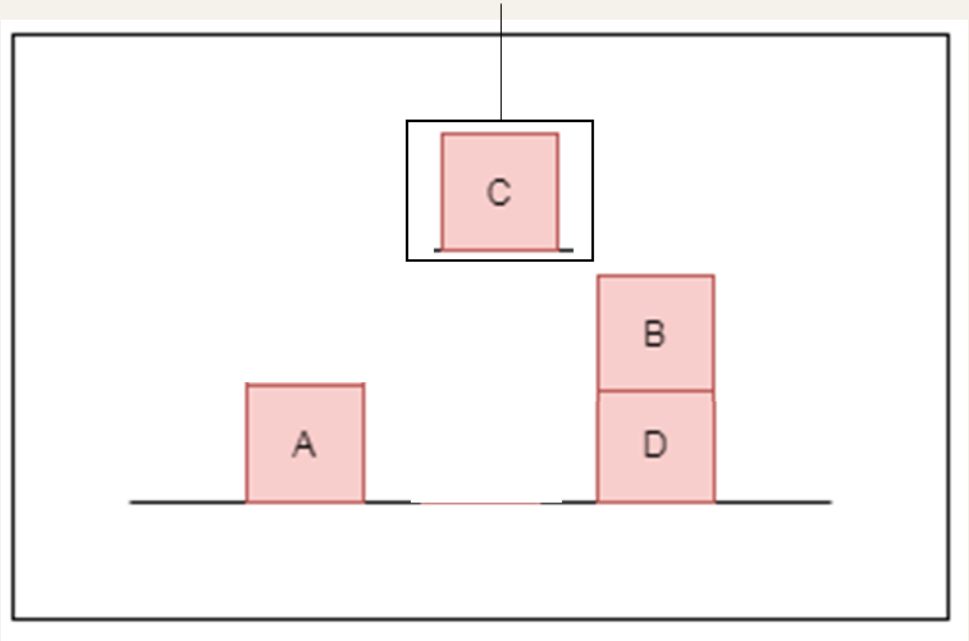
1. $UNSTACK(B, A)$
2. $STACK(B, D)$



4/26/2023

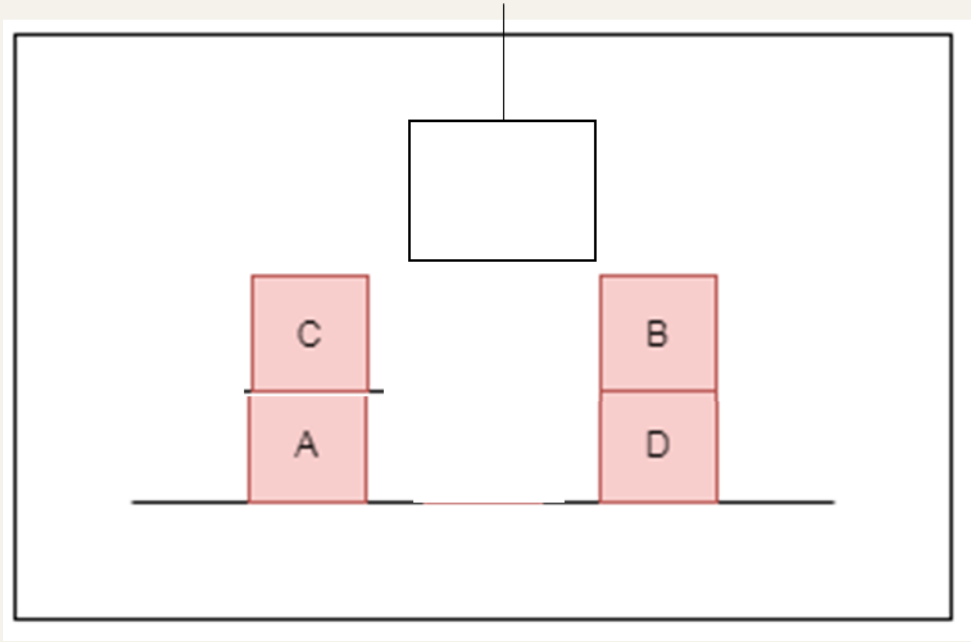
RENCANA PENYELESAIAN MASALAH-1

1. $UNSTACK(B, A)$
2. $STACK(B, D)$
3. $PICKUP(C)$



RENCANA PENYELESAIAN MASALAH-1

1. $UNSTACK(B, A)$
2. $STACK(B, D)$
3. $PICKUP(C)$
4. $STACK(C, A)$



DISKUSI KELOMPOK

L7

DISKUSI KELOMPOK

- Carilah materi, diskusikan dan susunlah jawaban untuk pertanyaan berikut:
  1. Dalam banyak kasus, mengapa ***Goal-Stack-Planning*** (GSP) menghasilkan solusi yang efisiensinya lebih rendah dibandingkan solusi yang dihasilkan ***Constraint-Posting*** (CP)?
  2. Mengapa metode CP disebut juga sebagai *non-linear planning*?
  3. Pada banyak masalah, metode CP bisa menghasilkan solusi yang lebih efisien daripada GSP. Tetapi dari segi pemrogramannya CP lebih sulit diimplementasikan. Mengapa demikian?
  4. Untuk kasus masalah-1 pada pembahasan sebelumnya, bagaimanakah langkah penyelesaian jika menggunakan metode CP?

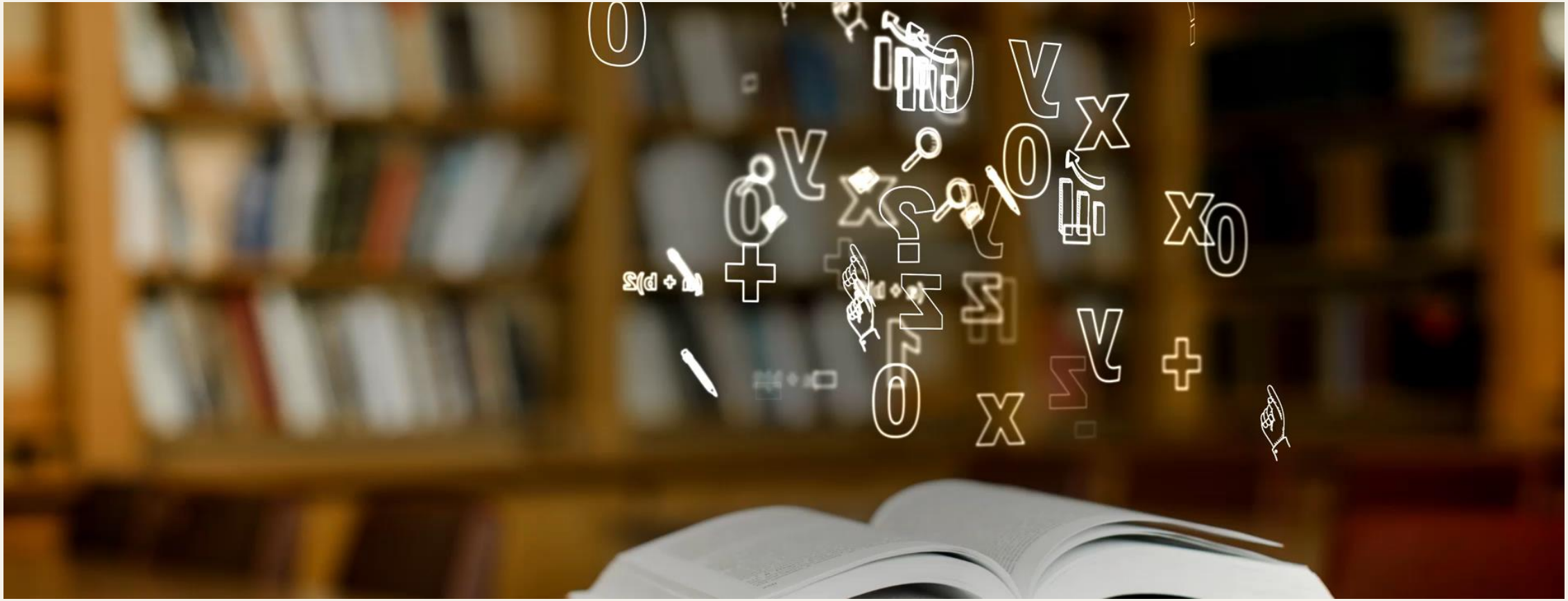
TUGAS 07

s.d. 17 Mei 2024 Pkl 23.30 WIB

IKUTI INTRUKSI DIBAWAH INI:

- Pastikan anda telah mempelajari pokok bahasan L7, kemudian selesaikan soal Diskusi Kelompok pada slide materi ini.
- Hasil pembelajaran susun dalam sebuah laporan yang memuat data:
  - Nama, kelas, sumber referensi, dan uraian hasil diskusi kelompok, simpan dalam bentuk word/ pdf;
  - Beri nama file : Tugas07_Kelas_NIM.
- Submit file laporan ke LMS.

L8: KONSEP *LEARNING*



KECERDASAN BUATAN

2024

TERIMA KASIH

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