#### Quiz

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## **PAH (Planning and Games)**

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#### Heuristic *h* dominates *h'* when

- 1. h < h' for all states
- 2.  $h \ge h'$  for all states
- 3.  $h \neq h'$  for all states



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# What is the most commonly used relaxation of a STRIPS action $a = \langle pre(a), add(a), del(a) \rangle$ ?

- 1.  $a^+ = \langle \emptyset, \operatorname{add}(a), \operatorname{del}(a) \rangle$
- 2.  $a^+ = \langle \operatorname{pre}(a), \emptyset, \operatorname{del}(a) \rangle$
- 3.  $a^+ = \langle \operatorname{pre}(a), \operatorname{add}(a), \emptyset \rangle$



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# How can a multi-valued variable $V \in \{v_1, ..., v_k\}$ be relaxed?



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# How can a multi-valued variable $V \in \{v_1, ..., v_k\}$ be relaxed?

#### Answer:

Accumulating semantics:  $V \subseteq \{v_1, ..., v_k\}$ .



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### What is not true?

- 1. Relaxations of plans are relaxed plans.
- 2. Relaxations are no harder to solve than the original task.
- Optimal relaxed plans may be longer than optimal plans for original tasks.



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## What is not true?

- 1. Relaxations of plans are relaxed plans.
- Relaxations are no harder to solve than the original task.
- Optimal relaxed plans may be longer than the optimal plans for original tasks.

#### Answer:

Optimal relaxed plans are always shorter (or equal) than the optimal plans for original tasks.



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$$cost(p) = \min_{p \in add(a)} cost(a)$$
$$cost(a) = \max_{p \in pre(a)} cost(p)$$

- 1.  $h_{\text{max}}$
- 2. *h*<sub>add</sub>
- 3. h<sub>STRIPS</sub>
- 4. *h*<sub>FF</sub>



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## For $h_{add}$ is not true:

- 1. Assumes independence of facts.
- 2. All facts are assumed to be achieved by the cheapest action.
- 3. Is admissible.



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#### Answer:

 $h_{\rm add}$  is not admissible.

Why?



## For $h_{add}$ is not true:

- 1. Assumes independence of facts.
- 2. All facts are assumed to be achieved by the cheapest action.
- 3. Is admissible.

#### Answer:

hadd is not admissible.

Why?



- 1. *h*<sub>max</sub>
- 2. *h*<sub>add</sub>
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Why? Why not h<sub>STRIPS</sub>? Why not h<sub>FF</sub>?



- 1. *h*<sub>max</sub>
- 2. hadd
- 3. h<sub>STRIPS</sub>
- 4. *h*<sub>FF</sub>

## Why?

Why not h<sub>STRIPS</sub>? Why not h<sub>FF</sub>?



- 1. *h*<sub>max</sub>
- 2. hadd
- 3.  $h_{\text{STRIPS}}$
- 4. h<sub>FF</sub>

Why?

Why not  $h_{STRIPS}$ ?



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Why?
Why not *h*<sub>STRIPS</sub>?
Why not *h*<sub>FF</sub>?

