Abstractions

PAH (Planning and Games)

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Abstractions

- General approach to computing heuristic estimates
- *Abstract* multiple states into one to make the problem smaller
    - But preserve the transition behaviour
- Easy to be admissible

Quiz

- To give admissible estimates, an abstraction T‘ of transition system T‘ does not have to satisfy:
  1. if s is the init state in T , then a(s) is the init state in T‘
  2. a(s) is a goal state in T‘ if and only if s is a goal state in T
  3. if T has a transition from s to t, then T, has a transition from a(s) to a(t)

Answer:

2. If s is a goal state in T, then a(s) is a goal state in T‘.

Quiz

- Which combination of several abstractions is always admissible?:
  1. sum
  2. multiplication
  3. maximum

Answer:

3. maximum

Quiz

- Let Π be an FDR planning task, and let A be an abstraction of $T(\Pi)$ with abstraction mapping α. Then $h^{A,\alpha}$ is:
    1. safe, goal-aware, admissible and consistent
    2. safe, goal-aware, not admissible and not consistent
    3. only admissible

Answer:

1. safe, goal-aware, admissible and consistent

Quiz

- Let $\alpha_1 \ldots \alpha_k$ be abstraction mappings on T.
- We say that $\alpha_1 \ldots \alpha_k$ are orthogonal if for all transitions <s,l,t> of T :
  1. $\alpha_i(s) \neq \alpha_j(t)$ for all $i \neq j$
  2. $\alpha_i(s) \neq \alpha_i(t)$ for at least one $i \in [k]$
  3. $\alpha_i(s) \neq \alpha_i(t)$ for at most one $i \in [k]$

Answer:

3. $\alpha_i(s) \neq \alpha_i(t)$ for at most one $i \in [k]$

Quiz

- Let $\alpha_1 \ldots \alpha_k$ be orthogonal abstraction mappings on T.
- Then $\sum_{i \in [k]} h^{A,\alpha_i}$ is:
  1. safe, goal-aware, admissible and consistent
  2. safe, goal-aware, not admissible and not consistent
  3. only admissible

Answer:

1. safe, goal-aware, admissible and consistent

Quiz

- Let $h^{A,\alpha}$ and $h^{A,\beta}$ be abstraction heuristics for the same planning task Π such that $\langle A,\alpha\rangle$ is a refinement of $\langle B,\beta\rangle$.
- Then:
  1. $h^{A,\alpha} == h^{A,\beta}$ for all states s of Π.
  2. $h^{A,\alpha} <= h^{A,\beta}$ for all states s of Π.
  3. $h^{A,\alpha} >= h^{A,\beta}$ for all states s of Π.

Answer:

3. $h^{A,\alpha} >= h^{A,\beta}$ for all states s of Π.