Practice Exercise Solutions to CSP planning

1 Directed Questions

- What is meant by the *horizon* in a planning problem?

  Answer: The number of time steps for which the problem is "rolled out."

- What are *initial state constraints* in a CSP problem?

  Answer: They constrain the state variables at time 0, i.e. before any action has occurred.

- What are *goal constraints*?

  Answer: They constrain the state variables at some time k, where k is the horizon.

- What are *precondition constraints*?

  Answer: They are constraints between state variables at time t and actions at time t. In other words, they specify what must hold for an action to take place.

- What are *effect constraints*?

  Answer: They are constraints between state variables at time t, actions at time t and state variables at time $t + 1$. In other words, the state variable at time $t + 1$ is affected by the actions at time t and its own previous value at time t.

2 CSP planning

There's a big football game tonight, and you can't miss it. You're trying to decide whether to watch it in person or on TV. Watching it in person requires having some money for a ticket. Watching it on TV is only possible if you have a TV and there isn't a local television blackout on the game. If you need money for a ticket, you can always sell your TV.

Figure 1 shows a CSP representation for this planning problem where the goal is to watch the game.

- What are the actions? **Answer:** watchAtPark, watchAtHome, sellTV

- What are the state variables? **Answer:** haveMoney, haveTV, blackout, sawGame

- What is the horizon shown in Figure 1? **Answer:** The horizon is 1.

- Give the truth tables for the precondition constraint for action *watchAtPark* (labelled p1_s0 in the figure) and the effect constraint between *blackout* at step 0 and *blackout* at step 1 (labelled e3_s1).
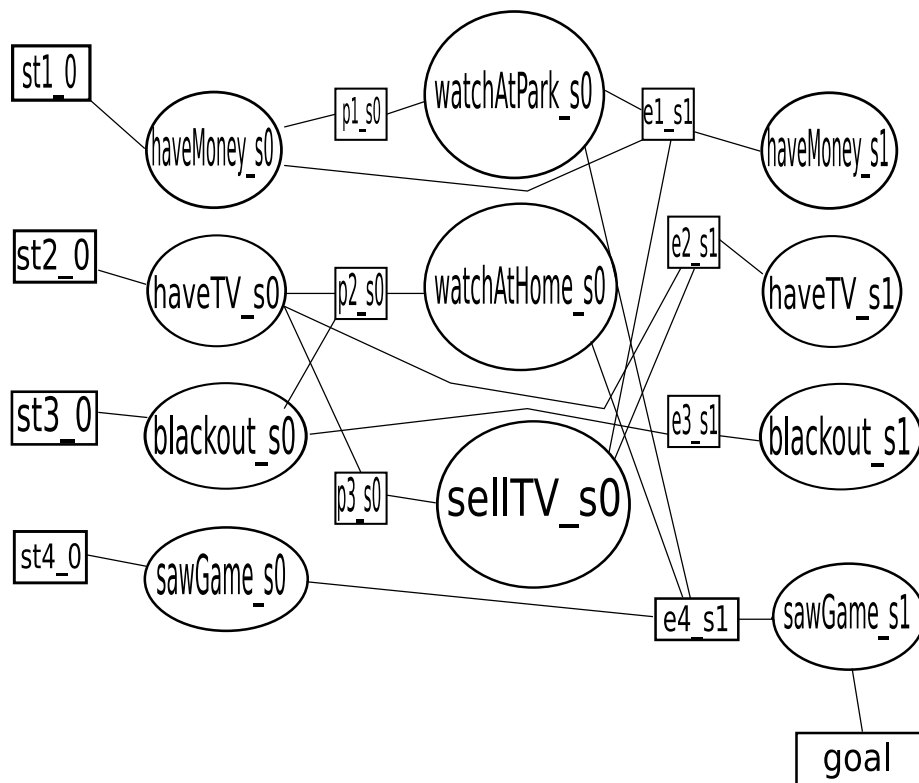
  Answer:

  For p1_s0:

Figure 1: CSP representation for viewing the game

haveMoney_s0	watchAtPark_s0	p1_s0
true	true	true
true	false	true
false	true	false
false	false	true

For e3_s1:

blackout_s0	blackout_s0	e3_s1
true	true	true
true	false	false
false	true	false
false	false	true

- What is the minimum horizon needed to achieve the goal, if the start constraints specify that you have no money and that there is a TV blackout?

  Answer: A horizon of 2. At step 1 you sell the TV and at step 2 you watch the game in person.

3 Learning Goals

You can:

- Translate a planning problem in STRIPS representation into a CSP planning problem (and vice-versa).