

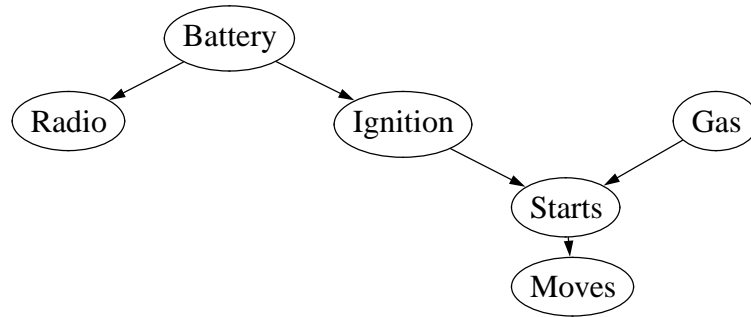
CSIS0270 Artificial Intelligence
Assignment 4
Deadline May 31, 2002, 11:59pm.
Tutor: lchen2@csis.hku.hk

This is a written assignment. Hand-in your answers to the assignment box (L5).

1. **Planning (25%).** Consider the following planning problem, which tries to ready a camera for taking pictures:
 - Initially, there is no battery in the camera, and a roll of used films is within the camera. Both the battery and film compartments are closed, and a set of used film is installed and is at its end. There is a set of new battery and a roll of unused film.
 - *OpenCase, CloseCase:* You can open the battery compartment if it is originally closed. You can open the film compartment if it is originally closed, and the film installed is at the start. Conversely, you can close either compartment if it is originally open.
 - *InstallBattery, InstallFilm, RemoveBattery, RemoveFilm:* You can install battery if the battery compartment is opened and empty. You can install film if the film compartment is opened and empty. In doing so, the film will be at the starting position. Conversely, you can remove them when the film compartment is opened, and the battery and film is in the camera.
 - *Rewind:* You can rewind the film if the film is originally at the end.
 - The goal is to for the camera to be ready for taking photos, i.e., have good battery installed, with unused film at the beginning, with both slots closed.
 - a. Write the STRIP description of the problem. Use the objects *Battery1, Film1, Film2, FilmCompartment* and *BatteryCompartment*. Use the predicates *Opened(compartment), Closed(compartment), Empty(compartment), InCamera(x), BatteryGood(battery), FilmNew(film), FilmUsed(film), FilmAtBegin(film)* and *FilmAtEnd(film)*.
 - b. Give one smallest (i.e., fewest state and ordering constraints) partial-order plan that solves the problem. Show all the causal links (you may use double arrows to represent causal links). Give all serializations of your partial plan.
2. **Recursive planner (25%).** In the notes, we see that the recursive means-end planner failed to find the optimal plan for a problem in the block world: instead of a plan of 3 steps, the plan is a 4-step plan.
 - a. Explain how the recursive planner succeed in producing the four-step plan.
 - b. Show a similar problem in which there is a possible plan, but the recursive fail to find any plan at all.
3. **Conditional probability and Bayes rule (25%).** (Adapted from textbook question 14.12) Three prisoners, A, B and C, are locked in their cells. It is common knowledge that one of them will be executed the next day and the others pardoned. Only the governor knows which one will be executed. Prisoner A asks the guard a favor: "Please ask the governor who will be executed, and then take a message to one of my friends B and C to let him know that he will be pardoned in the morning." The guard agrees, and comes back later and tells A that he gave the pardon message to B.

What are A's chances of being executed, given this information?

- a. By using the definition of conditional probability, find the needed posterior probability.
 - b. Explain how the same posterior probability can be found using the Bayes' rule.
4. **Belief network (25%).** (Adapted from Textbook 15.1) If figure 15.5 of the book, the following network is shown for dealing with car problems:



- a. Give reasonable probabilities for each of the CPTs you need. Remember to be absolute only when it is actually the case—e.g., even if the engine does start, it might not move if there is some other problems. (N.B.: don't look at others when you design your CPT: the same CPT or one which has the same value for most of the entries will provide strong evidence for plagiarism.)
- b. Suppose Radio is found not to be playing, and the car doesn't move. What is the probability that there is no Gas in the car? Find the answer by **dry-running the belief network query algorithm**.
- c. Repeat to find the above probability, using the definition of conditional probability and the full joint interpretation of the belief network..