

# CIS\*3700 (Winter 2007) Assignment One Solutions

Instructor: F. Song

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## Part I: Paper-and-Pencil Questions (30 marks)

1. These two sub-questions can have multiple correction answers, depending on the assumptions you made. Nonetheless, you are encouraged to think deeper in terms of coverage, reduced redundancy, and accuracy in your descriptions.

(a) Robot soccer player: assuming that the robot is a typical player on the field (not a goalie, for example), the PEAS description can be given as follows:

Performance measures: safety, obeying the rules, good attack in terms of goals in a given time period, and good defense in terms of blocking the attacks.

Environment: other players (on the same team or the other team), the ball, referee(s), goal nets, field size and layout, and a time clock.

Actuators: motors to move around in the field, control the ball, and shoot the ball, and speaker to communicate with other players.

Sensors: camera to observe the environment (particularly the ball), infrared range finder to estimate the distance to other objects, voice recognizer to understand other players and voice signals.

Properties of the environment:

- Partially observable: views may be blocked by other players.
- Stochastic: wind or other players may change the course of the ball.
- Sequential: watching the moves of the other players and the ball to decide what to do next.
- Dynamic: real time game, and the position of the ball and other players are changing all the time.
- Continuous: the ball moves continuously to another location when hit.
- Multi-agent: there are other players and the referee(s) on the field.

(b) Automated language translator that translates what you say in one language to another foreign language.

Performance measures: Accuracy, good style (coherent, cohesive, low redundancy, and understandable to the reader), and possibly speed.

Environment: contents in terms of voice, printing, or online files in different languages.

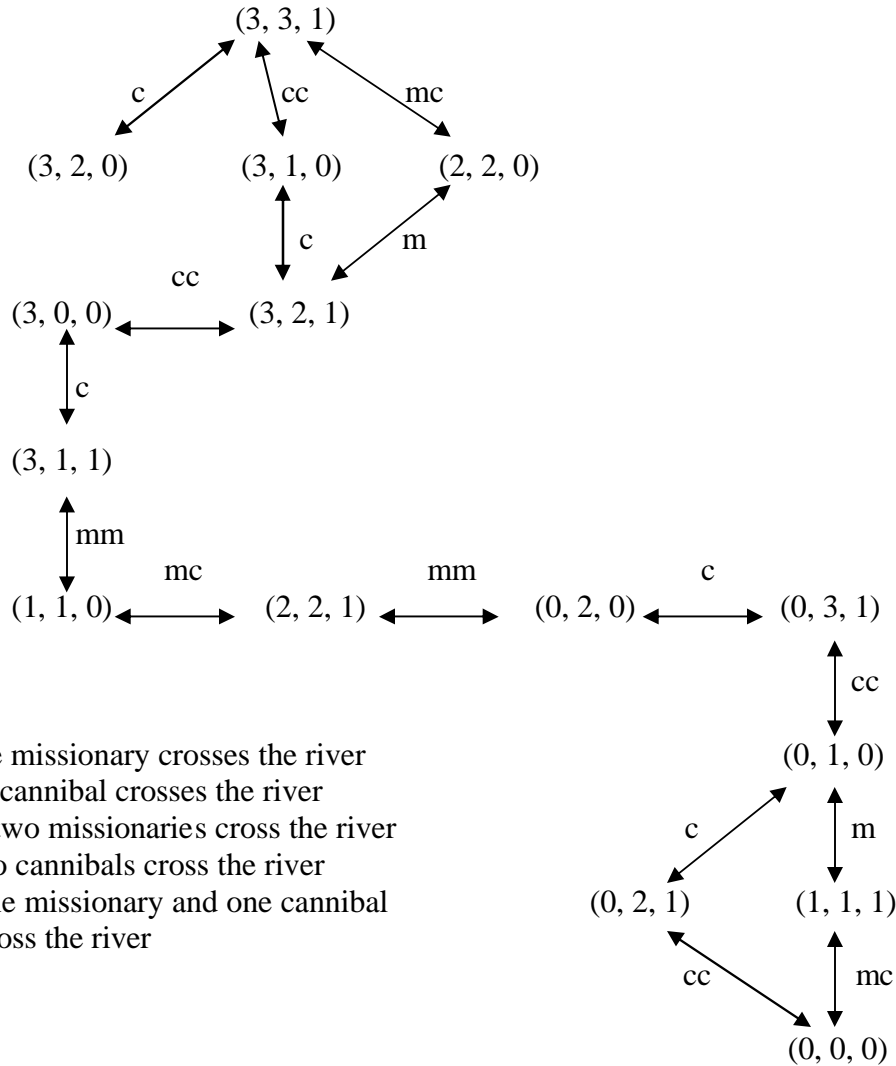
Actuators: speaker to say contents in another language, or display device or printer to show the contents in another language.

Sensors: speech recognizer, or OCR device, or input device (such as keyboard), or online files that provide contents in a given language.

Properties of the environment:

- Fully observable: all the contents are available to the agent.
- Sequential: previous context affects the meaning of the translation.
- Deterministic: the agent decides the translated sentences.
- Static or semi-dynamic: depending on the task requirement. If no deadline, it's static; otherwise, it's semi-dynamic.
- Discrete: the agent acts and perceives in concrete steps.
- Single-agent: we can assume that the other objects are passive, making the robot a single agent in the environment.

2. We use a 3-tuple:  $(m, c, b)$  to represent the state of one side of the river, since the other side can be easily inferred. Here,  $m$  stands for the number of missionaries,  $c$ , the number of cannibals, and  $b$ , whether the boat is at this side of the river. Initially, we have the state  $(3, 3, 1)$  and the goal state should be  $(0, 0, 0)$ . The state space is drawn as follows:



Is it a good idea to check the cycles? Yes, all the links in the state space are bidirectional, indicating that the graph is full of cycles. However, all the cycles correspond to the case where we undo an action immediately after it is performed. If we can expand the search in a way to avoid undoing the actions, then cycle-checking is not really necessary.