Sample final exam questions

CS470/570 Spring 2017

Consider an Archer enemy in a computer game that tries to shot arrow at the human player. The Archer's behavior depends on how clearly the player is seen and on the difficulty level of the game. In this case we might chose to use fuzzy reasoning to decide the Archer's actions.

The two graphs shown below are for the fuzzy measure of visibility as a function of distance (as the player gets further away it gets blurrier) and the fuzzy measure of difficulty (the game has at least 13 levels of difficulty that are mapped to fuzzy values).

Currently the player is 6 units away from the Archer and playing on difficulty level 7, as shown by the vertical bars on the graphs.

**a)** What are the values for each of the fuzzy variables:

clear:

blurry:

unseen:

easy:

difficult:

very hard:

**b)** The fuzzy rules controlling the Archer's actions are:

1. If clear AND easy then shoot
2. If clear AND difficult then shoot
3. If clear AND very hard then shoot
4. If blurry AND easy then move
5. If blurry AND difficult then shoot
6. If blurry AND very hard then shoot
7. If unseen AND easy then stand still
8. If unseen AND difficult then move
9. If unseen AND very hard then move carefully

Based on the player's position (6 units away) and the current difficulty level (7) how active are each of the rules? (For example, rule 1 might be active or triggered at the fuzzy level .3, although in this case it isn't.)

**c)**  Propose two ways for the Archer agent to choose its actual action based on the active rules. I.e. two ways for that agent to defuzzify its output.

**d)** If all of the ANDs in the fuzzy rule set were replaced with ORs then how active would each of the rules be? (I.e. redo part b assuming the ANDs are ORs.)

What is an admissible heuristic?

Why is it more difficult to write an evaluation function for stochastic games (games with an element of chance) than for deterministic games?

What is a hill-climbing search?

Write Prolog statements to represent the following English sentences (note that the sentences are not necessarily true, for purposes of this question you may assume that they are true).

1. All animals that have scales and lay eggs are reptiles.
2. Any animal X that builds a nest also lays eggs.
3. For all Y, if Y is an animal, and Y has bilateral symmetry, and Y has tentacles modified from a foot, then Y is a cephalopod.
4. Consider the following Bayesian network describing C programming errors. The following abbreviations are used 0: divide by zero in code; e: logical error; s: missing semicolon; d: program core dumps; c: compilation fails; o: correct output.

Divide by 0

P(0)

0.1

Missing semicolon

P(s)

0.1

Logical error

P(e)

0.1

Core dump

|  |  |  |
| --- | --- | --- |
| 0 | e | P(d) |
| T | T | 0.9 |
| T | F | 0.85 |
| F | T | 0.15 |
| F | F | 0.1 |

Compiler error

|  |  |
| --- | --- |
| s | P(c) |
| T | 0.95 |
| F | 0.1 |

Correct output

|  |  |  |  |
| --- | --- | --- | --- |
| d | e | c | P(o) |
| T | T | T | 0 |
| T | T | F | 0 |
| T | F | T | 0 |
| T | F | F | 0 |
| F | T | T | 0 |
| F | T | F | 0.4 |
| F | F | T | 0 |
| F | F | F | 0.9 |

Calculate the following three probabilities. Show your work.

1. What is the probability of creating a program that has the correct output, doesn’t core dump, doesn’t produce a compiler error, doesn’t have a divide by zero error, does have a logical error and is missing a semicolon.
2. What is the probability of creating a program that has the correct output, doesn’t core dump, doesn’t produce a compiler error, doesn’t have a divide by zero error, does have a logical error and is not missing a semicolon.
3. What is the probability of creating a program with the correct output?