

1a) The formal requirements are: Two player, turn-based, zero sum, full-information, deterministic (but expectimax for non-deterministic games exists). Some mention also the practical requirements that one must have a heuristic function to evaluate states, and that the branching factor must not be too big.

1b) Minimax makes optimal decisions (given the knowledge provided by the heuristic evaluation), but assumes that the opponent is also optimal. One can deviate from minimax to allow the opponent to make a mistake. For example, a small but certain loss might be worse than a potential loss that occurs only if the opponent makes no mistakes. A learning program might learn what mistakes the opponent makes. One may want to introduce some randomness in the AI-player, to avoid that the human player learns a consistent mistake by the program.

(Some answers mention that a different search depth or search order can give different results. That is certainly true, but that does not mean that they deviate from minimax.)

2a) Decision trees are used to put examples into categories. Each internal node is associated with a question with a few possible answers, which each lead to a child in the tree. The leaves are associated with categories. For a given example, you start at the root, ask the question and follow the answer, until you arrive at the leaf.

b) It learns the simplest one. The philosophical motivation for this choice is the principle of Occam's razor (see the book). The practical motivation is that this minimizes the number of questions asked. (Not asked, but correct, is that ID3 achieves this by asking the question with maximal information content first.)

3.

- Academic AI aims for the best solution (or at least a good solution given the available time and memory). An AI in a game should behave natural, which is often not the same as optimal.

As a consequence:

- Game balance is important: the opponent must not be much better or much worse than the player.

- The AI should not know things that it cannot know

(no perfect hearing, X-ray vision, etc., unless this is part of the "natural laws" of the game).

- The AI should be "aware": it must reason with the things that it reasonably does now.

- In academic AI, deterministic behaviour is usually an advantage. In game AI, deterministic behaviour quickly becomes boring and unnatural.

A comment: game AI sometimes includes phenomena like gravity (goal: objects fall naturally), which are not part of academic AI.

4.

a Because CFG:s can't remember, they can't for example check that the number of the noun and the verb agree.

b many examples

5.

a $\text{est}(D,E) = 14 > \text{dist}(D,E) = 7 \Rightarrow$ not optimistic \Rightarrow not monotone

b $\text{est}(D,E) = 8 > \text{dist}(D,E) = 7 \Rightarrow$ not optimistic \Rightarrow not monotone

c Optimistic \Rightarrow best path will be found

Monotone \Rightarrow When a node is found it is via the shortest path \Rightarrow the shortest path will be found in the shortest time

6.

$\text{CF}(D_1) = 0.75 * \max(0.6, \min(8.8, 0.9)) = 0.6$

$\text{CF}(D_2) = 1 * 0.5 = 0.5$

$\text{CF}(D) = 0.6 + 0.5 - 0.6 * 0.5 = 0.8$