Stochastic Games

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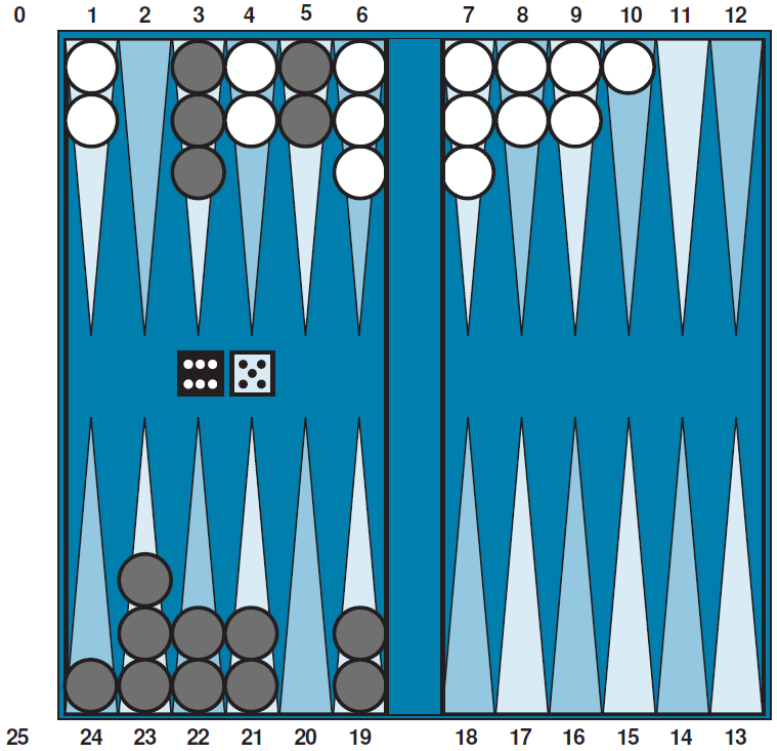

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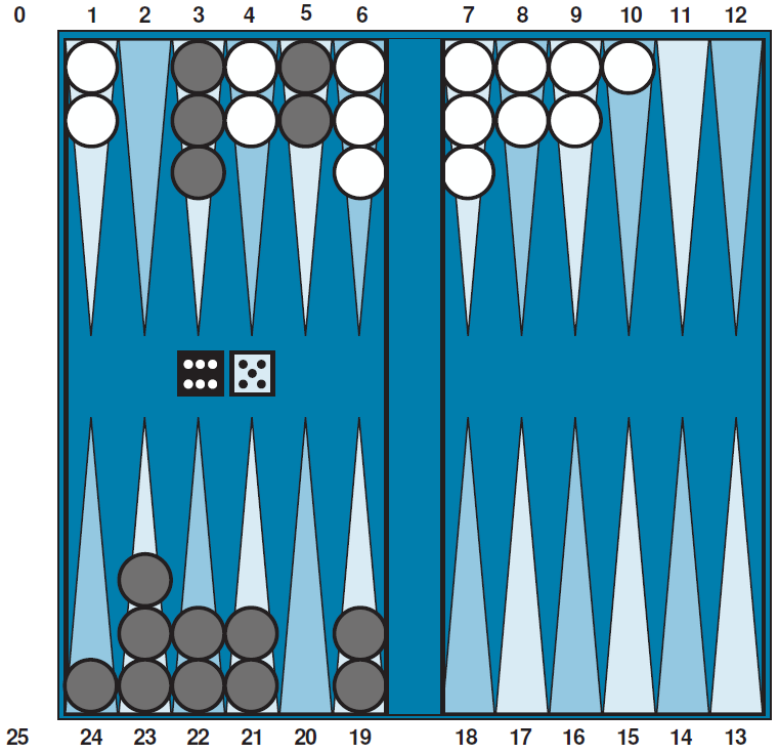

- Include *chance nodes* in addition to MAX and MIN nodes.

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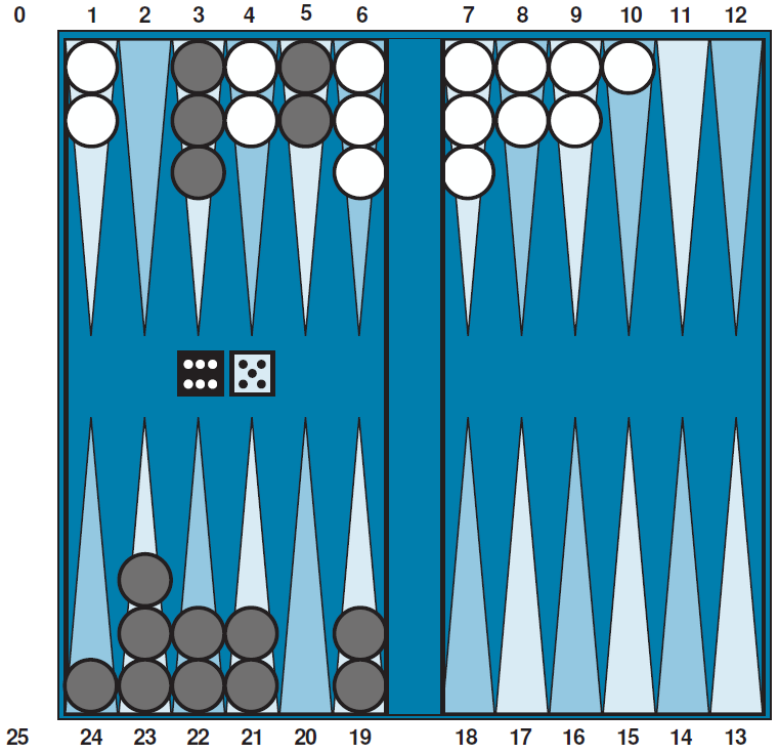

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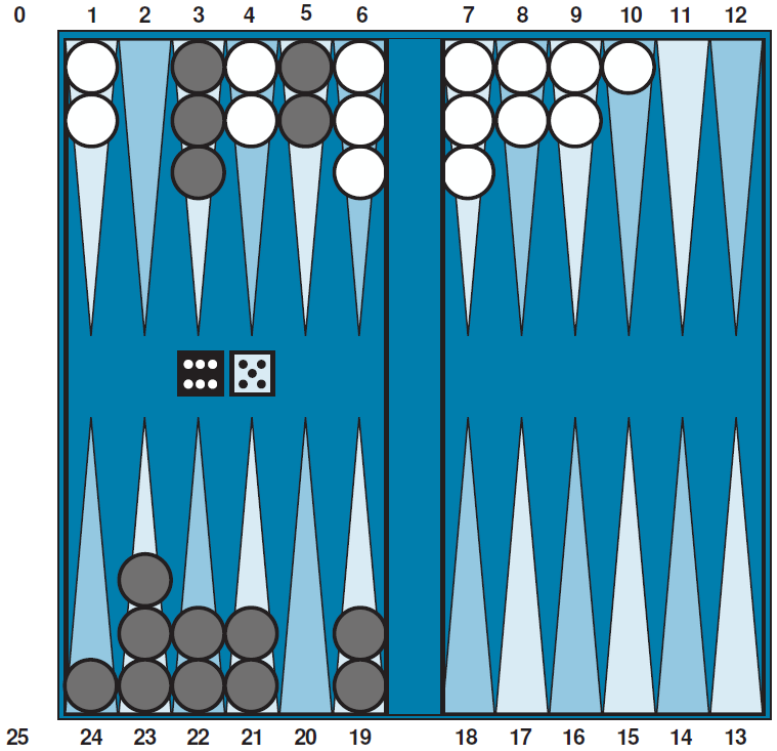

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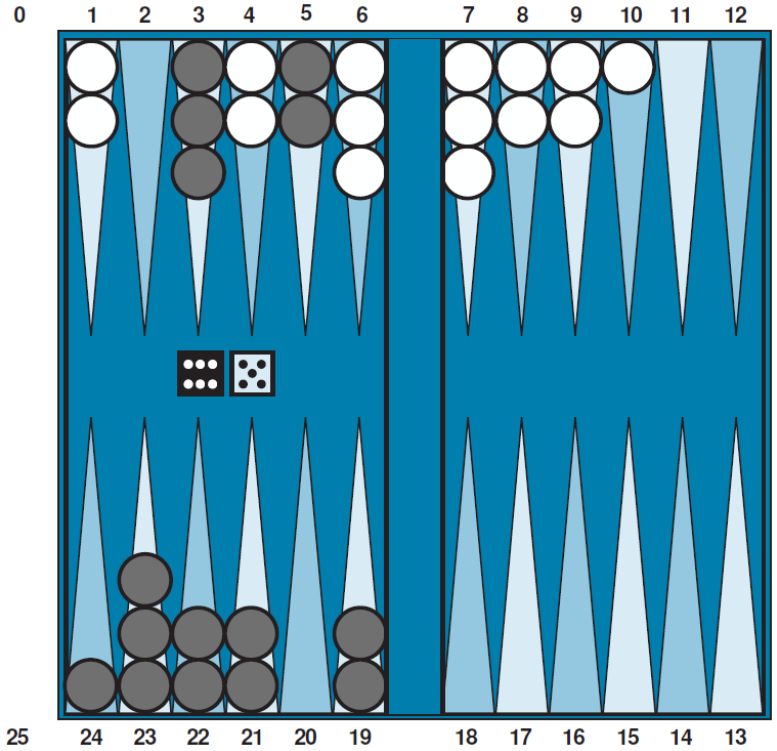

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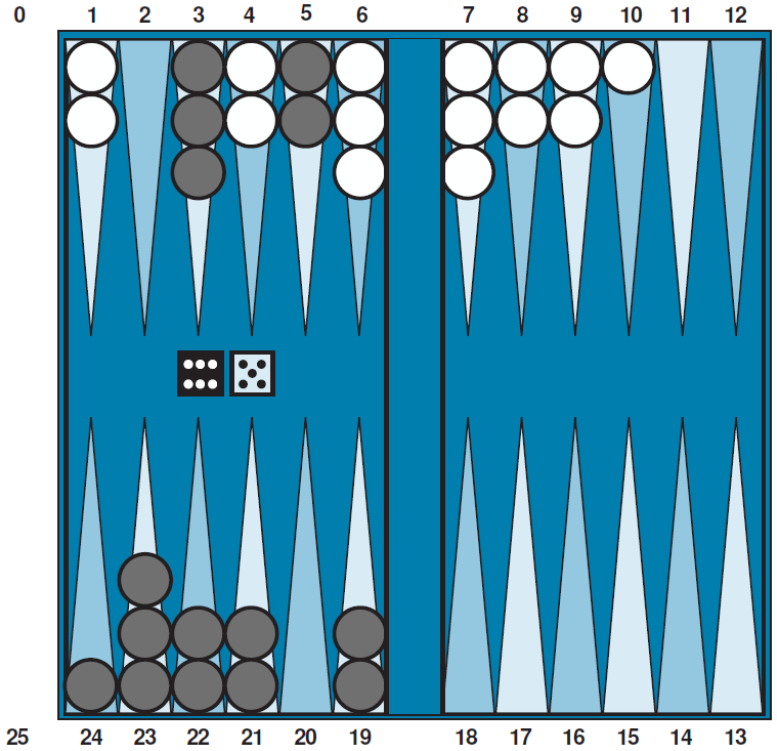

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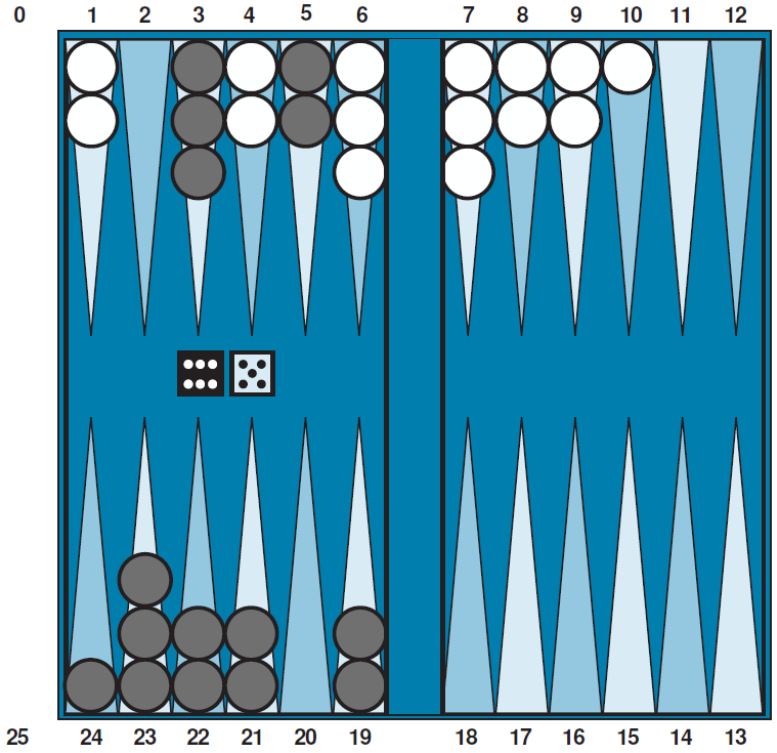

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- Calculate expected value (called *expectiminimax* value) of a position.

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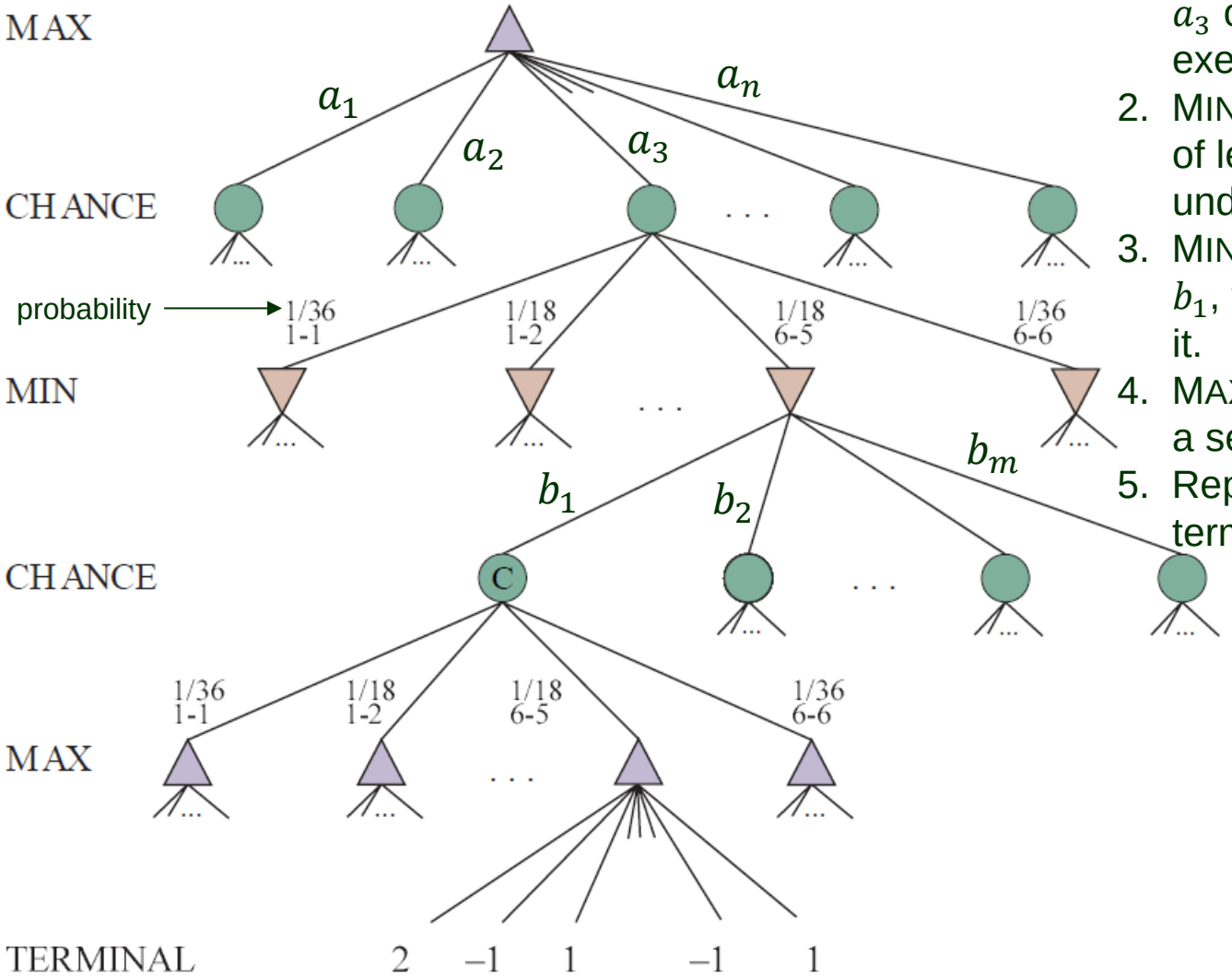
Game Tree for a Backgammon Position



1. MAX chooses an action, say, a_3 out of $\{a_1, .., a_n\}$ and executes it.
2. MIN rolls a die and gets a set of legal actions $\{b_1, .., b_m\}$ under some CHANCE node.
3. MIN chooses an action, say, b_1, from the set and executes it.
4. MAX rolls a die and gets a set of legal actions.
5. Repeat steps 1-4 until a terminal state is reached.

Expectiminimax Value

$\text{EXPECTIMINIMAX}(s) =$

$\text{UTILITY}(s, \text{MAX})$ if $\text{IS-TERMINAL}(s)$

$\max_a \text{EXPECTIMINIMAX}(\text{RESULT}(s, a))$ if $\text{TO-MOVE}(s) = \text{MAX}$

$\min_a \text{EXPECTIMINIMAX}(\text{RESULT}(s, a))$ if $\text{TO-MOVE}(s) = \text{MIN}$

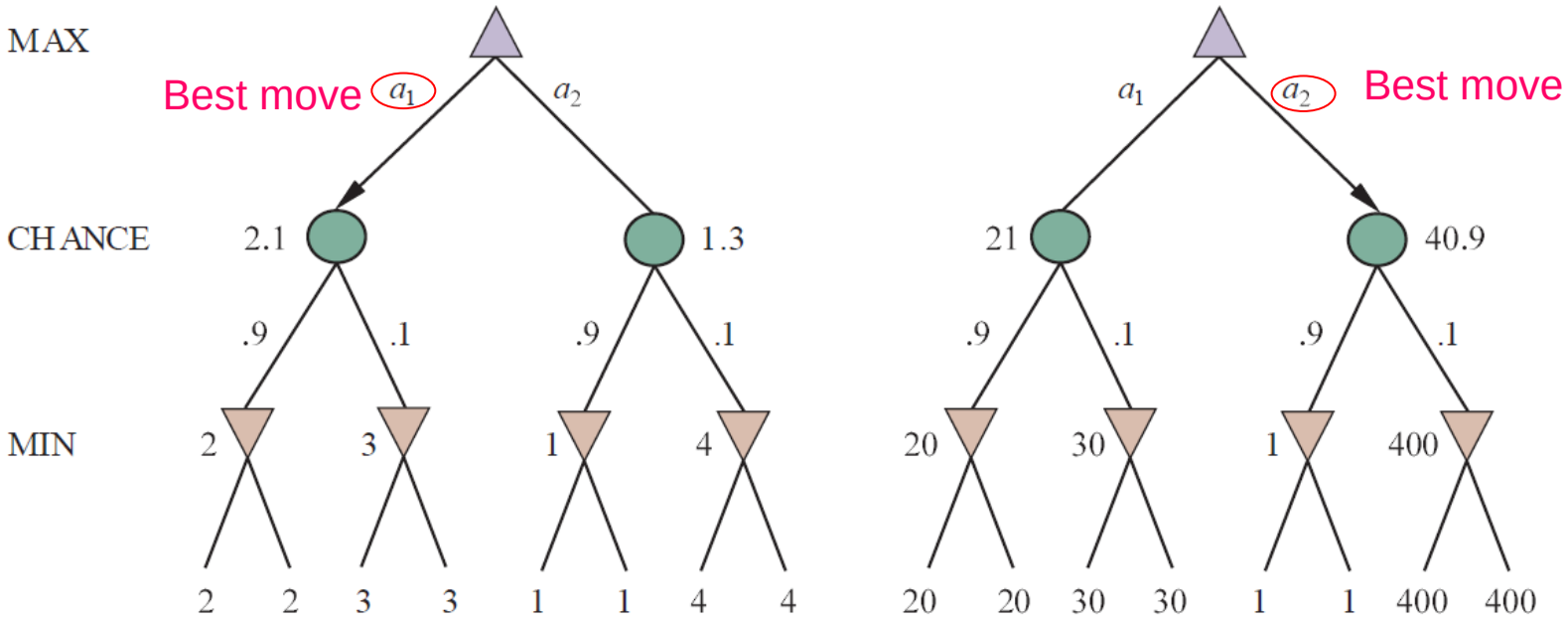
$\sum_r P(r)\ \text{EXPECTIMINIMAX}(\text{RESULT}(s, r))$ if $\text{TO-MOVE}(s) = \text{CHANCE}$

expected value

one possible dice roll

Evaluation Functions

Evaluation functions with the same order of leaf values can yield different move choices at a state.



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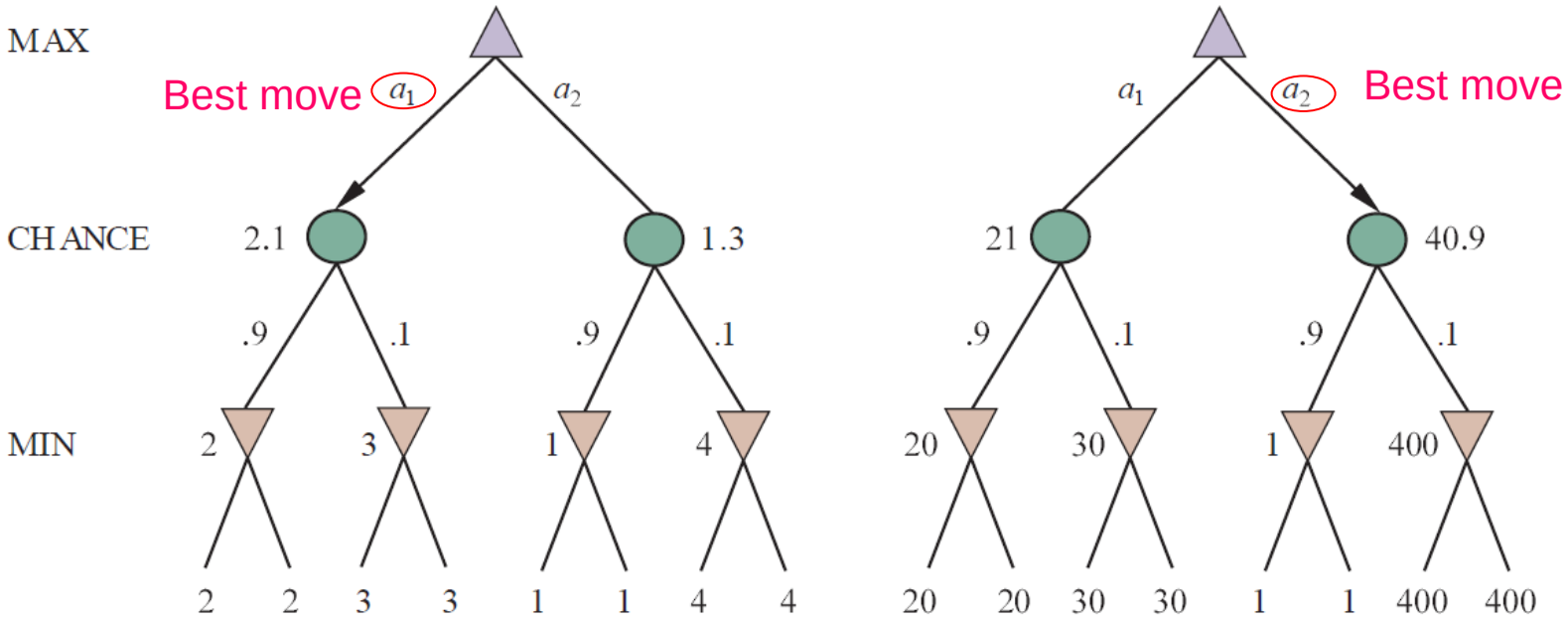

Alpha-beta pruning is still applicable if we can bound values on chance nodes.