



Examiner : Dr. Mustafa M. Shiple
 Subject: Autonomous Multiagent Systems (AI 314)
 Score: 10 Marks

Term: Spring 2023
 Exam Time:60 min

Instructions:

- Use the space provided to write your answers.
- Ask in case of doubt.

ANSWER THE FOLLOWING QUESTIONS:

1. Fill in the spaces [5 marks] [A_q,C_a]
- Genetic Algorithms (GA) use principles of natural evolution. There are five important features of GA
 - Elitism is a technique that
 - AND gate in a nondeterministic environment, branching is also introduced by the of outcome for each action AI.
 - In genatic algorithm, the final numeric value to player p when the game ends in terminal state s is called
 - In the game theory, Chess game is classified as environment and information.

Solution:

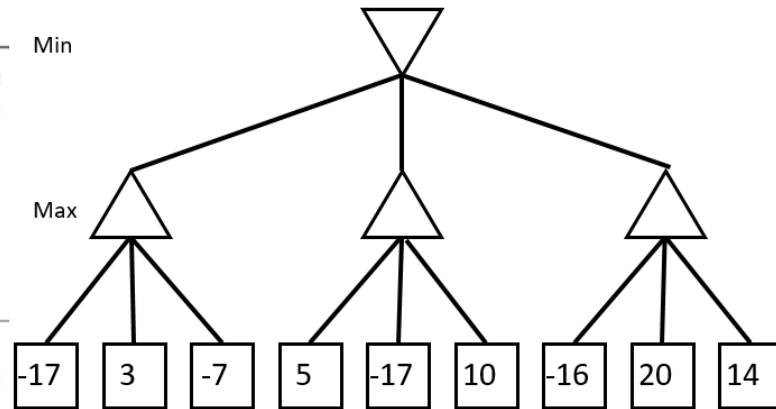
- Initial Population, Fitness Function, Selection, Crossover, Mutation.
- Guarantees that overall fitness will never decrease over time.
- Environment's choice
- UTILITY(s, p).
- deterministic , perfect .

2. On the show diagram, calculate the Minimax values for each branch and indicate which states will not be explored if alpha-beta pruning is used. Circle all unvisited subtrees, and indicate α, β values at each node. [5 marks] [D_c]

function ALPHA-BETA-SEARCH(*state*) **returns** an action
 $v \leftarrow \text{MAX-VALUE}(\text{state}, -\infty, +\infty)$
return the *action* in $\text{ACTIONS}(\text{state})$ with value v

function MAX-VALUE(*state*, α , β) **returns** a utility value
if $\text{TERMINAL-TEST}(\text{state})$ **then return** $\text{UTILITY}(\text{state})$
 $v \leftarrow -\infty$
for each a **in** $\text{ACTIONS}(\text{state})$ **do**
 $v \leftarrow \text{MAX}(v, \text{MIN-VALUE}(\text{RESULT}(s,a), \alpha, \beta))$
if $v \geq \beta$ **then return** v
 $\alpha \leftarrow \text{MAX}(\alpha, v)$
return v

function MIN-VALUE(*state*, α , β) **returns** a utility value
if $\text{TERMINAL-TEST}(\text{state})$ **then return** $\text{UTILITY}(\text{state})$
 $v \leftarrow +\infty$
for each a **in** $\text{ACTIONS}(\text{state})$ **do**
 $v \leftarrow \text{MIN}(v, \text{MAX-VALUE}(\text{RESULT}(s,a), \alpha, \beta))$
if $v \leq \alpha$ **then return** v
 $\beta \leftarrow \text{MIN}(\beta, v)$
return v



Solution:

