PYTHON INTERNSHIP

Task no 1:

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Red   Blue Game

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Introduction:

What is the Red Blue Game?

The Red Blue Nim game is a two player game with two types of marbles: red and blue. There are two versions of the game:

1. Standard Version:
   Setup: Start with a certain number of red and blue marbles.
   Turns: Players take turns removing marbles. They can remove any number from one pile or one marble from each pile.
   Ending: The game ends when a player has no marbles to remove on their turn.
   Losing Condition: A player loses if either pile is empty on their turn.

2. Misrere Version:
   Setup: Start with a certain number of red and blue marbles.
   Turns: Players take turns removing marbles. They can remove any number from one pile or one marble from each pile.
   Ending: The game ends when a player has no marbles to remove on their turn.
   Winning Condition: A player wins if either pile is empty on their turn.

Scoring:
  Each red marble left is worth 2 points.
  Each blue marble left is worth 3 points.
  The final score is the sum of the points for each remaining marble. The player with the higher score wins.

Rules

Command Line Usage:
To play the game, use the command line tool with the following format:

python red_blue_nim.py   num red <num>   num blue <num>   version <version>   first player <player>   depth <depth>

Parameters:
- num red <num>`: Number of red marbles. Example: `   num red 10`
- num blue <num>`: Number of blue marbles. Example: `   num blue 10`
- version <version>`: Game version (`standard` or `misere`). Default is `standard`.
- first player <player>`: Who plays first (`human` or `computer`). Default is `computer`.
- depth <depth>`: Search depth for AI. Example: `   depth 5`

Game Flow

- 1. Initialization: Start with a set number of marbles and determine the first player.
- 2. Human Move: Enter your move (e.g., "1 red" or "2 blue 1 red").
- 3. Input Validation: Ensure the move is valid (e.g., not more marbles than available).
- 4. Update Game State: Reflect the human move in the game state.

- 5. Computer Move: AI makes a move using MinMax algorithm with Alpha Beta Pruning.
- 6. Update Game State: Reflect the computer's move in the game state.
- 7. Game Over Check: Check if the game has ended.
- 8. Repeat: Continue alternating moves until the game ends.

Human Move Input and Validation:

When it's your turn:
   Enter the move as "X red" or "X blue Y red".
   The program checks if the move is valid (e.g., not removing more marbles than available).

Computer Move Determination:

MinMax Algorithm:
- Purpose: Determines the best move by exploring all possible outcomes.
- Alpha Beta Pruning: Optimizes MinMax by reducing the number of nodes to explore.

How It Works:
- Alpha and Beta: Track the best possible scores for both players.
- Pruning: Avoid exploring moves that don't improve the outcome.

Move Ordering:

Standard Version:
- ➢ Pick 2 red marbles
- ➢ Pick 2 blue marbles
- ➢ Pick 1 red marble
- ➢ Pick 1 blue marble

- ➢ Misère Version:
- ➢ Pick 1 blue marble
- ➢ Pick 1 red marble
- ➢ Pick 2 blue marbles
- ➢ Pick 2 red marbles

Depth   Limited Search (Extra Credit)

 Purpose: Improve efficiency by limiting search depth.
   Heuristic Evaluation: Score game states based on factors like marble counts and potential moves.

End of Game:

Game Over Conditions:

Standard Version:
  Ends when a pile is empty.

Misere Version:
  Ends when one player has one marble left in one pile, and the other player has no moves left.

Can also end if a player resigns or the maximum number of moves is reached.

Scoring Calculation:
- Red Marbles: 2 points each.
- Blue Marbles: 3 points each.

Demonstration:

Initial Game State:
- Red Marbles: 10
- Blue Marbles: 10
- Human Player Goes First

Example Moves:
- o Human Move: 2 red marbles, 1 blue marble
- o Updated Game State: Red Marbles: 8, Blue Marbles: 9
- o Computer Move: 1 red marble, 2 blue marbles
- o Updated Game State: Red Marbles: 7, Blue Marbles: 7

Game Over Example:
- ❖ Final State: Red Marbles: 0, Blue Marbles: 3
- ❖ Human Score: 6 (3 blue marbles x 2 points each)
- ❖ Computer Score: 14 (7 red marbles x 2 points each + 3 blue marbles x 3 points each)

Result: Computer wins!