CSE 4110 – Artificial Intelligence Laboratory

CANADIAN CHECKERS

1707040 – Rahat Mahmud Khan
1707057 – Talha Ibne Mahmud
1707060 – Rakibul Haque

AN OVERVIEW

Canadian checkers (or **Canadian draughts**) is a variant of the strategy board game *"draughts"* or *"checkers"*.
It is one of the largest draughts games, played on a 12×12 checkered board with 30 game pieces per player.

The game was invented by the French settlers of *Quebec*, Canada; it was named *Grand jeu de dames*.

GAME DESCRIPTION

Canadian checkers are played on a 12x12 board of alternating dark and light colours

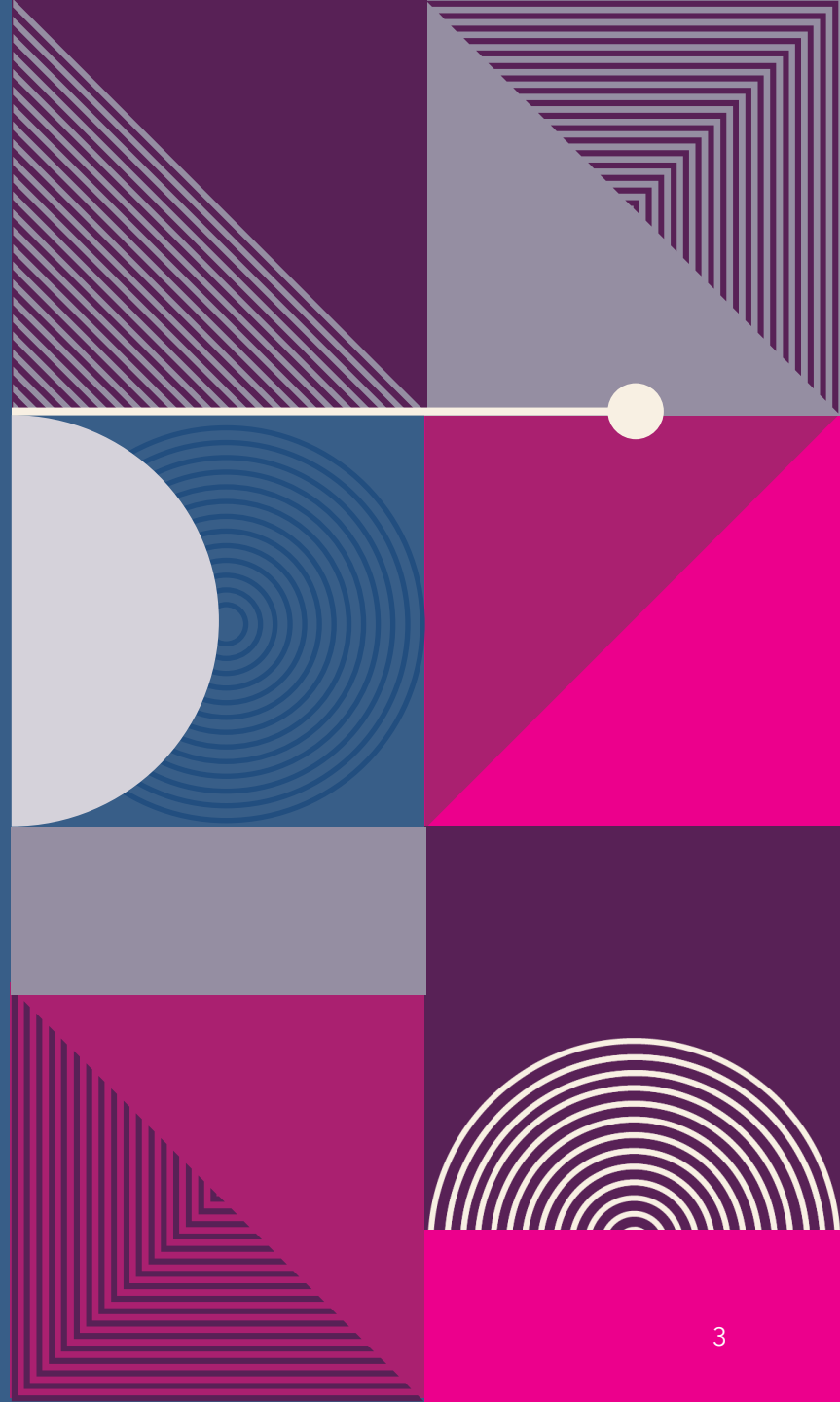
The board is placed so that both players have the dark square on their left edge of the first row

Each player has 30 pieces to start with

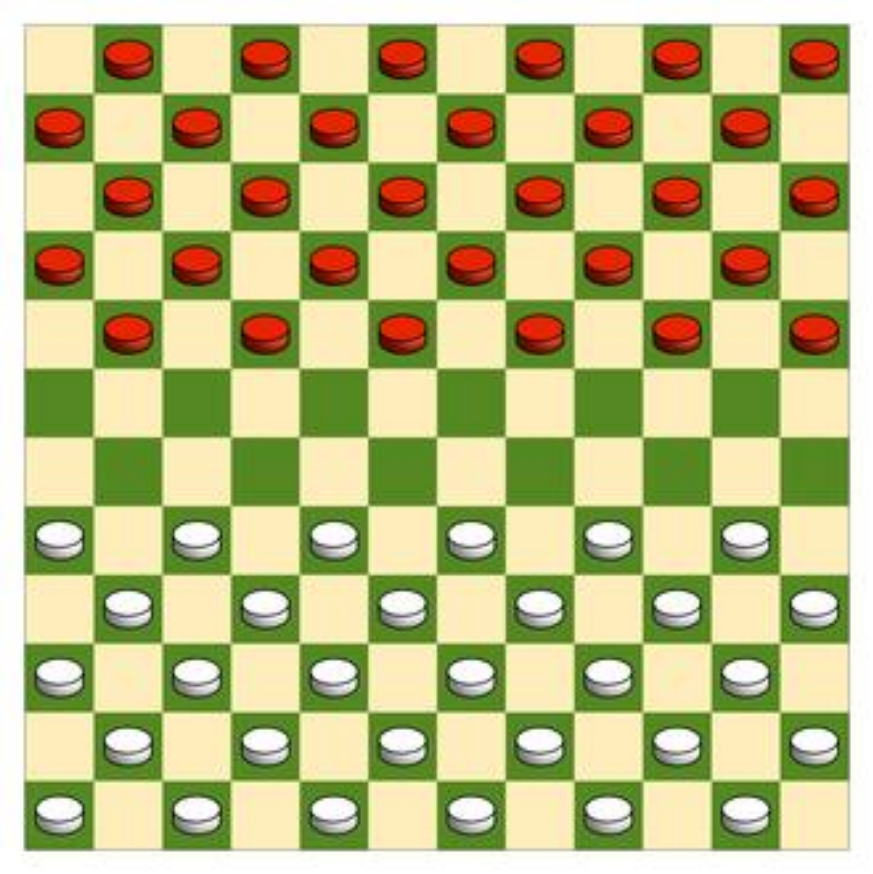
The pieces are usually coloured in RED and WHITE

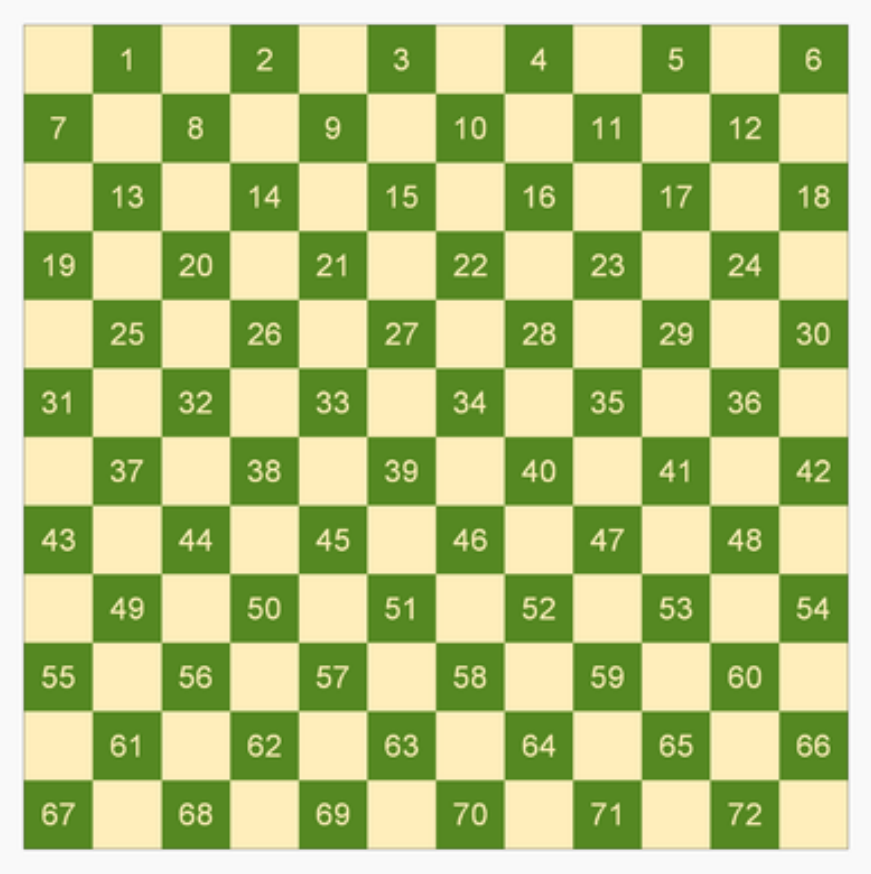
The pieces are placed on the dark squares of the first 5 rows of each side

The player with the lighter-coloured piece moves first. Then turn alternates



STARTING POSITION & NOTATION

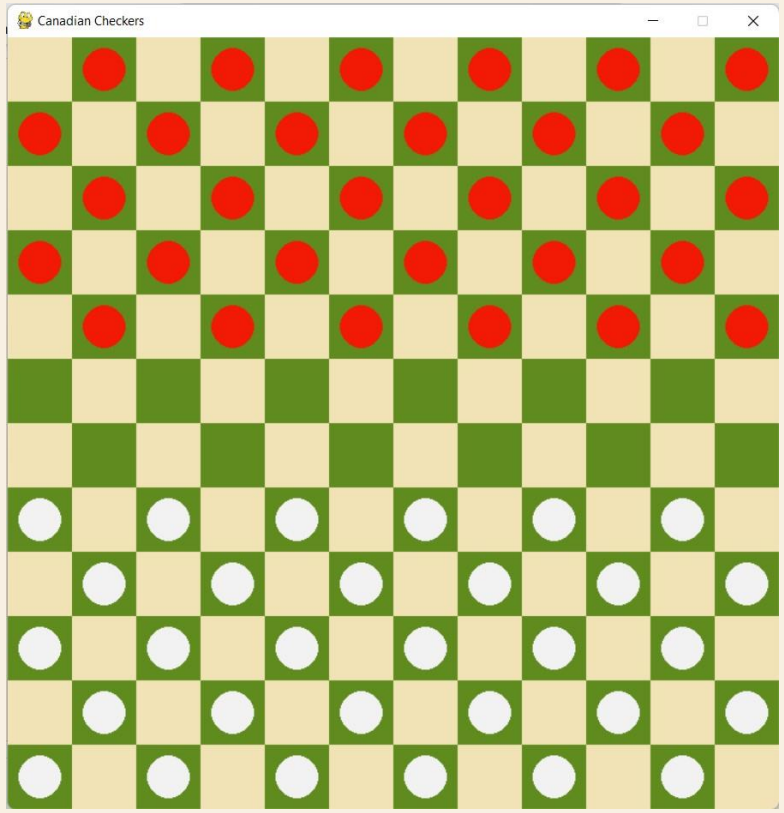




GAME RULES

MOVES

- The general rule is that all the moves and captures are made diagonally
- The player with the light pieces moves first. Then turns alternate.
- Ordinary pieces move one square diagonally forward to an unoccupied square.



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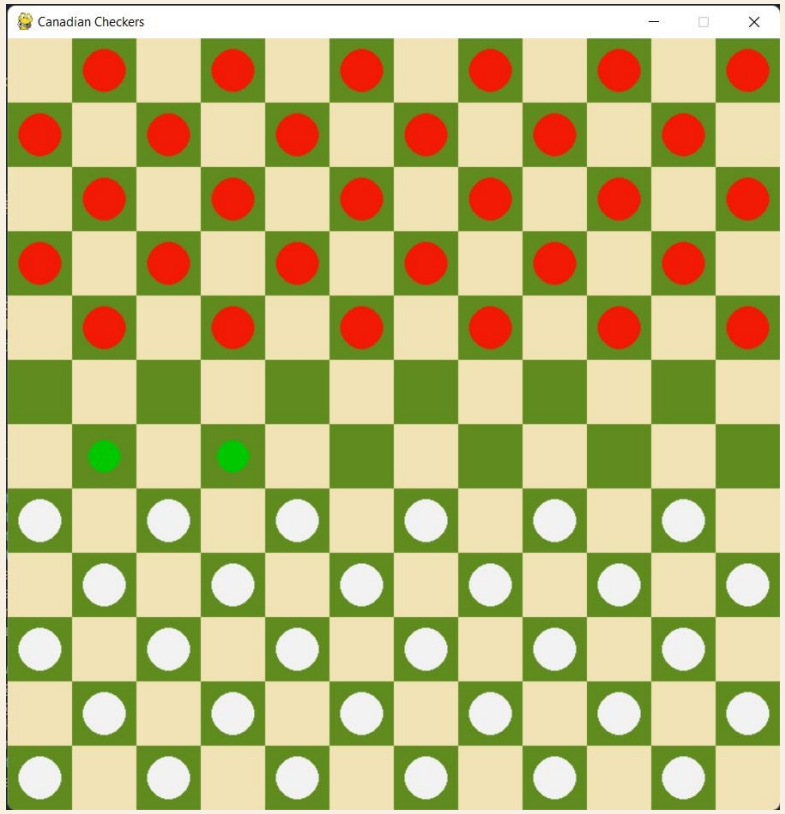

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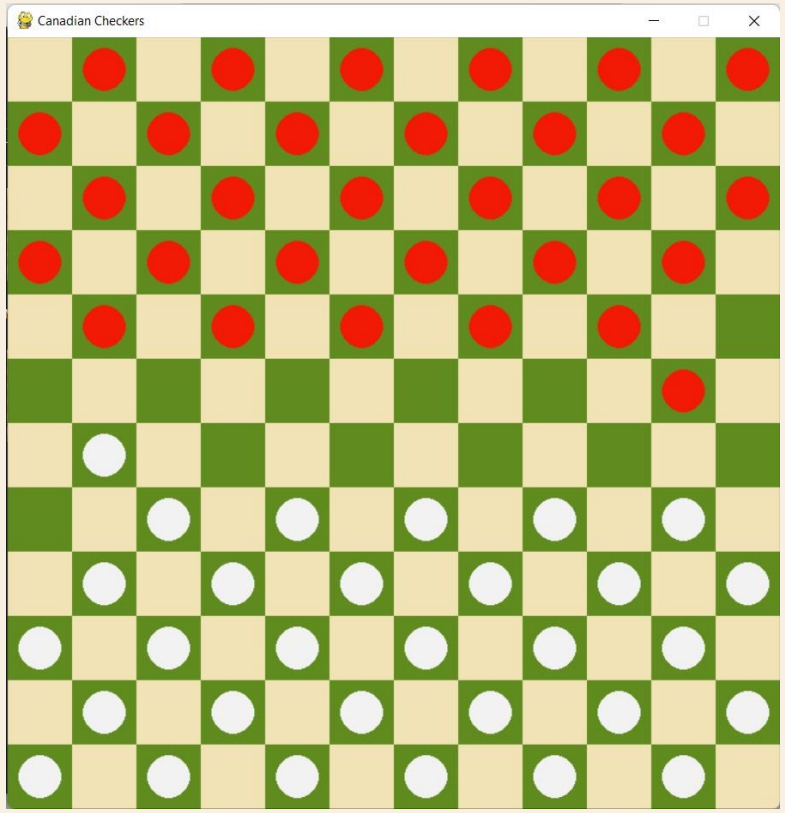
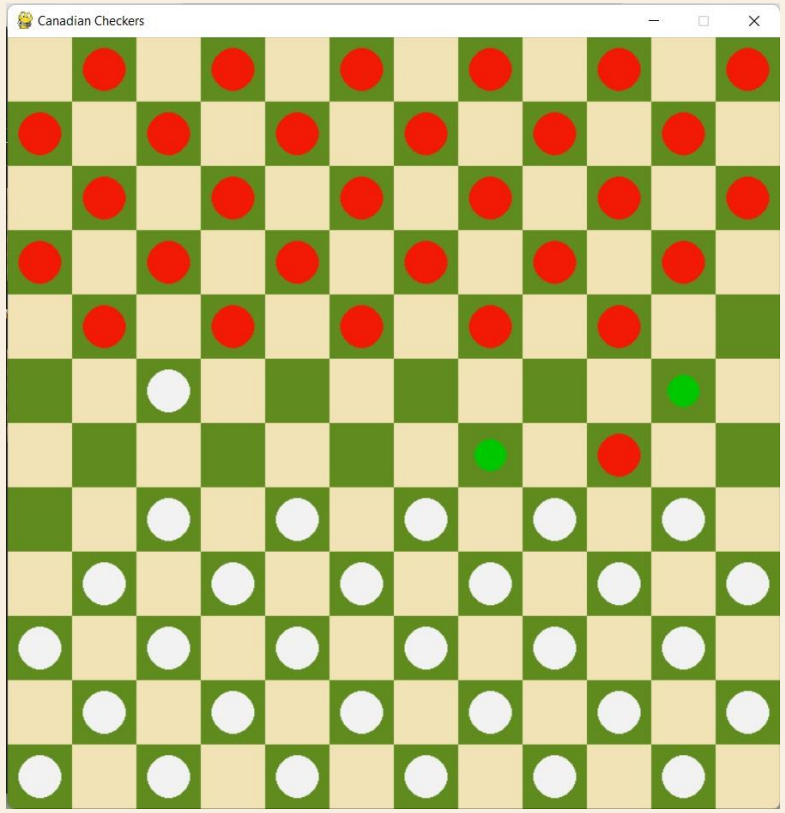


GAME RULES

CAPTURES

- Enemy pieces can and must be captured by jumping over the enemy piece, two squares forward or backward to an unoccupied square immediately beyond. If a jump is possible, it must be done, even if doing so incurs a disadvantage.
- A jumped piece is removed from the board at the end of the turn.



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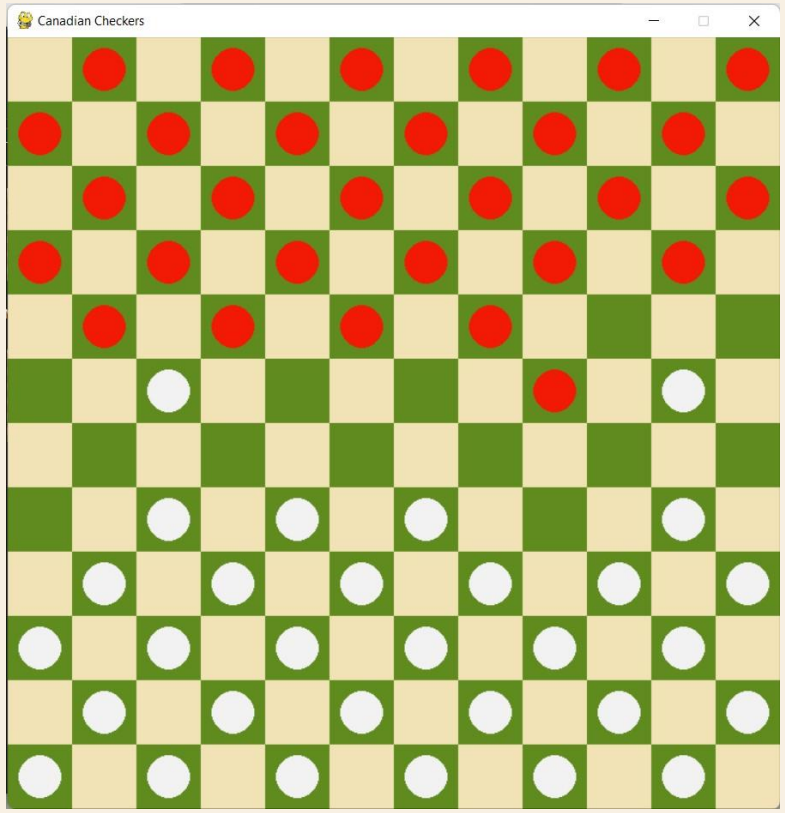

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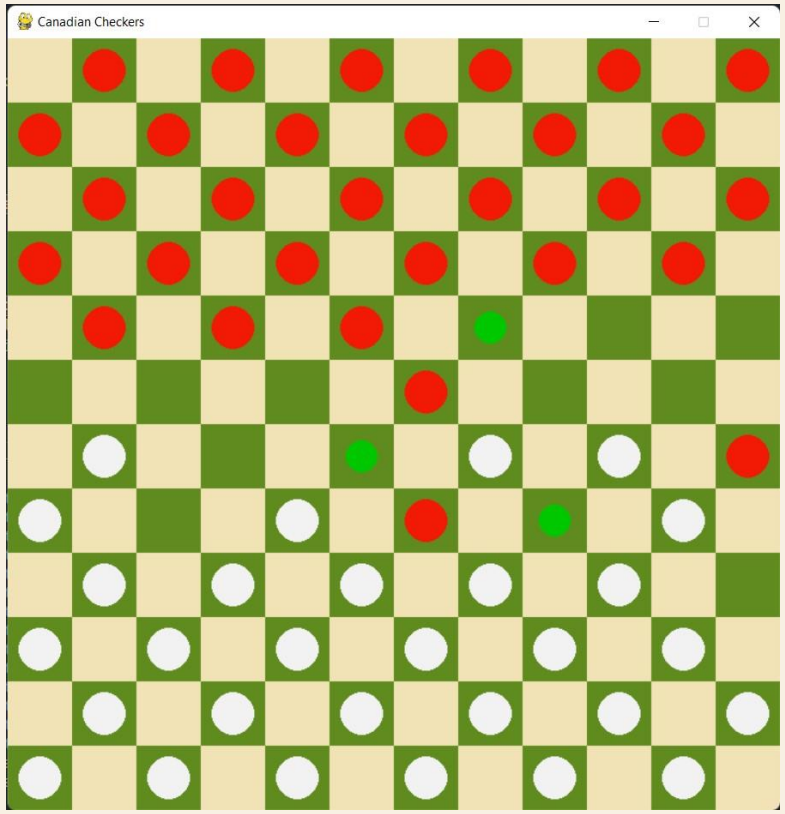
CAPTURES

- Multiple successive jumps forward or backward in a single turn can and must be made if after each jump there is an unoccupied square immediately beyond the enemy piece.
- It is compulsory to jump over as many pieces as possible. One must play with the piece that can make the maximum number of captures.



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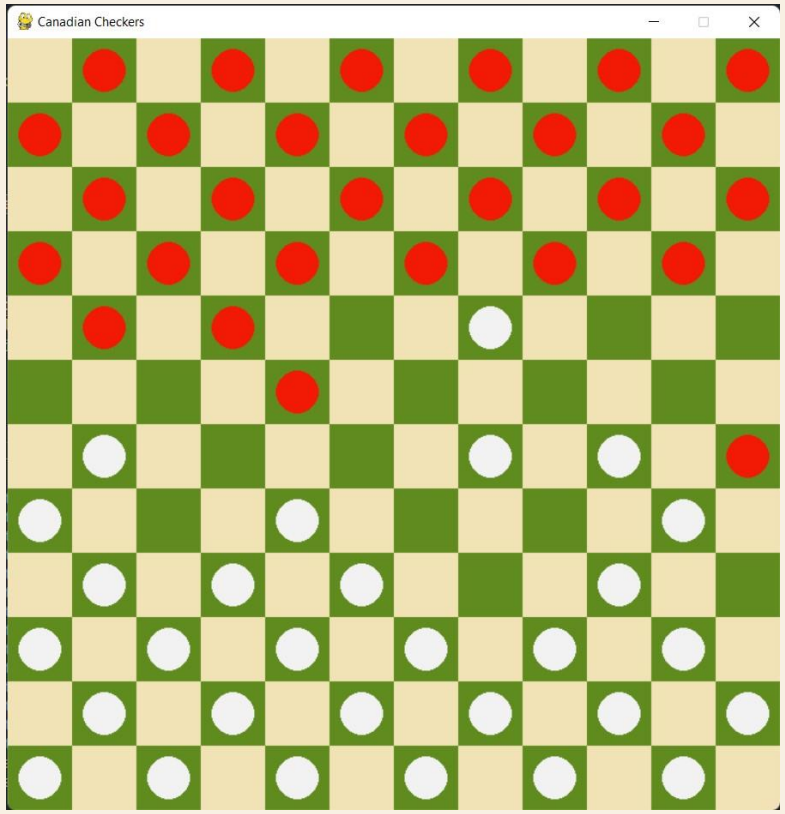
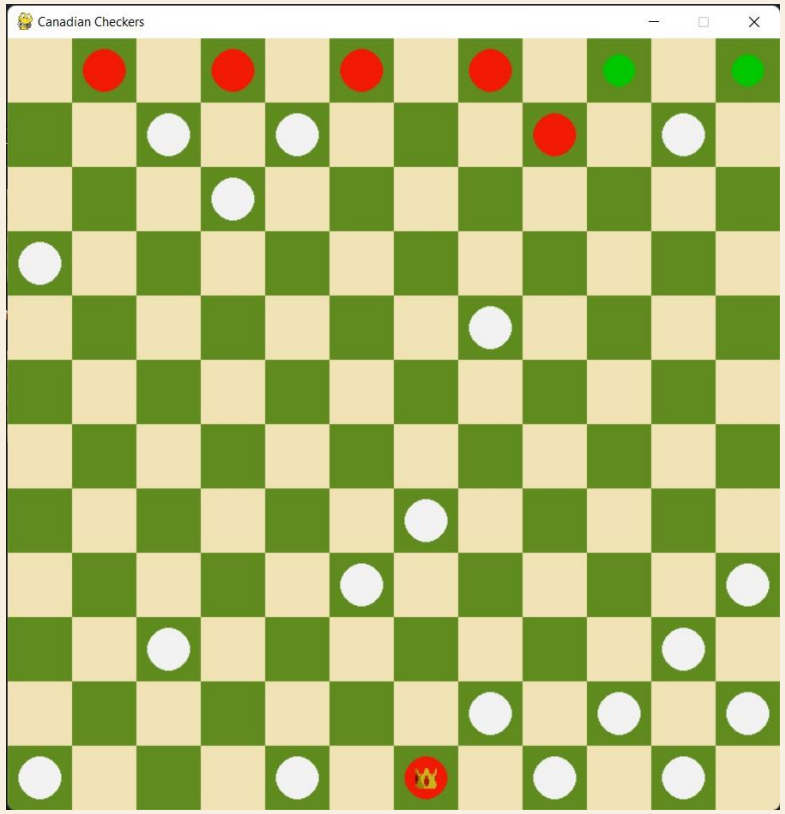


GAME RULES

CROWNING

- A piece is crowned if it stops on the far edge of the board at the end of its turn.
- Crowned pieces, sometimes called *kings*, can move freely multiple steps in any direction and may jump over and hence capture an opponent piece some distance away and choose where to stop afterwards, but must still capture the maximum number of pieces possible.



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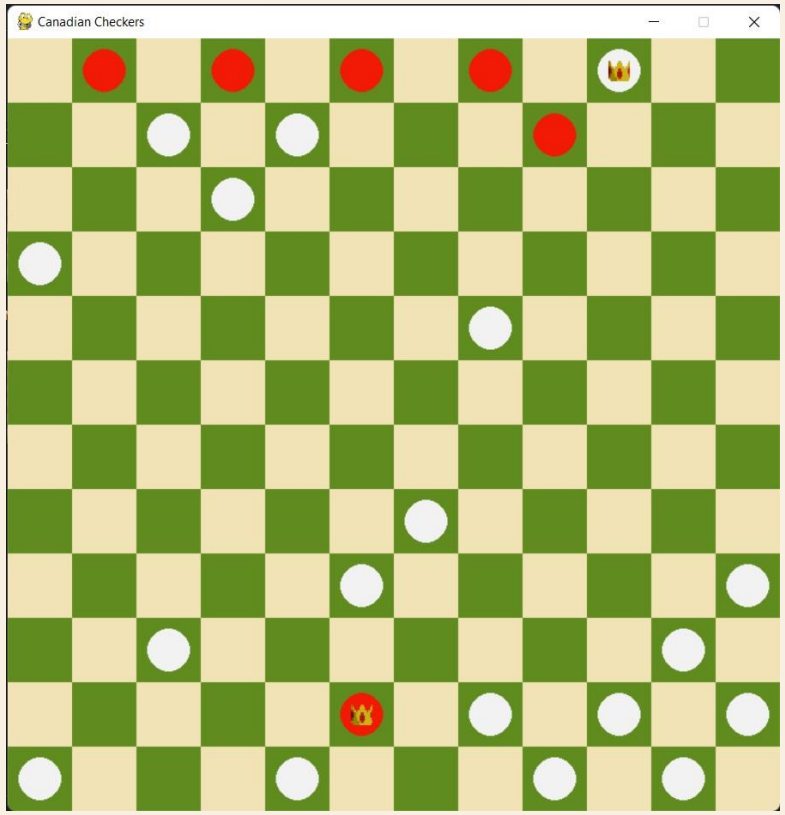

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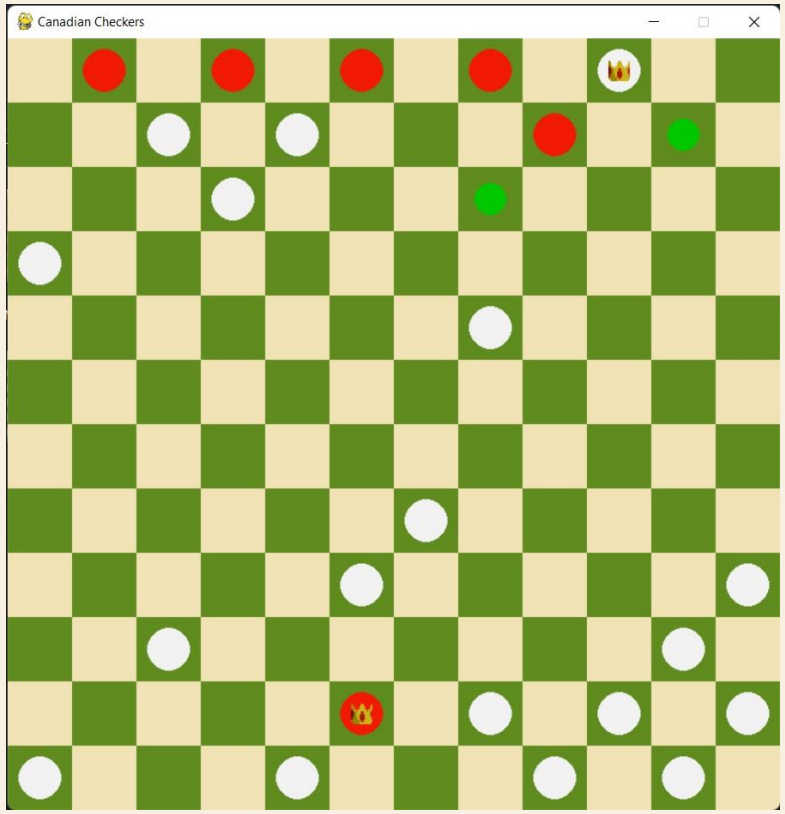

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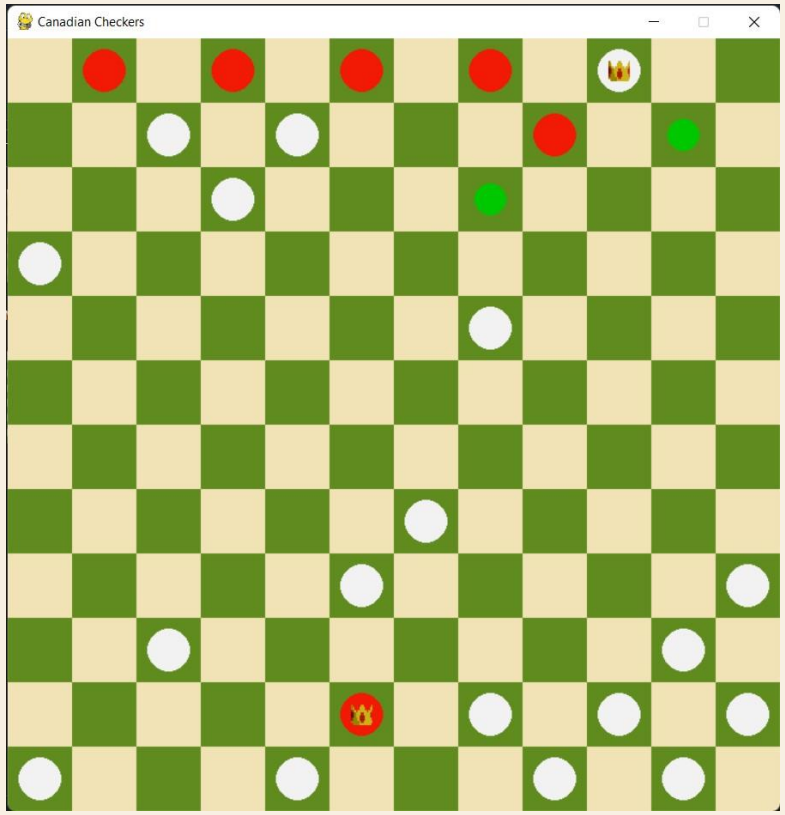


WIN vs DRAW

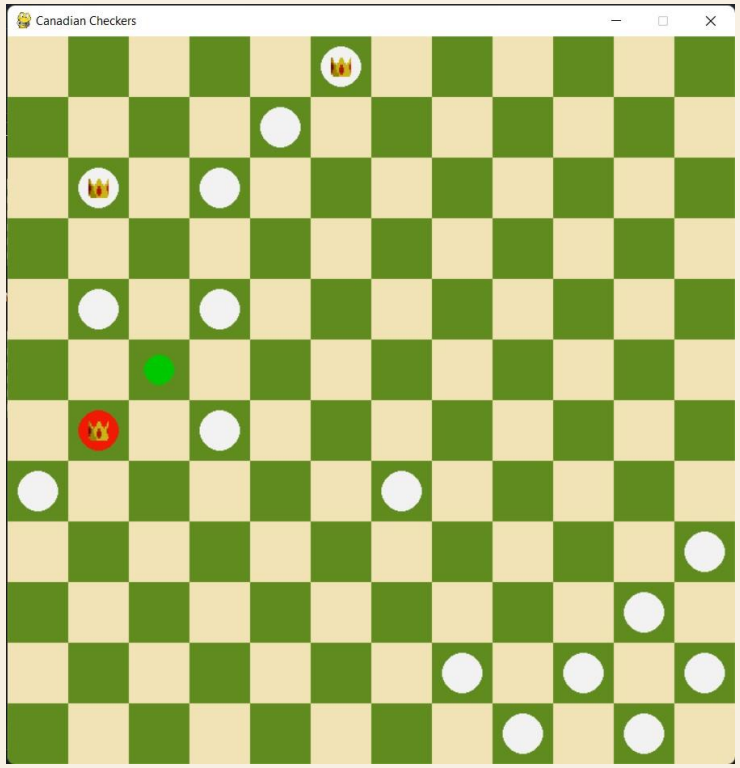
WIN

- A player with no valid move remaining loses. This occurs if the player has no pieces left, or if all the player's pieces are obstructed from moving by opponent pieces.

DRAW

- A game is a draw if neither opponent has the possibility to win the game.
- The game is considered a draw when the same position repeats itself for the third time (not necessarily consecutive), with the same player having the move each time.
- A king-versus-king endgame is automatically declared a draw, as is any other position proven to be a draw.

WIN vs DRAW



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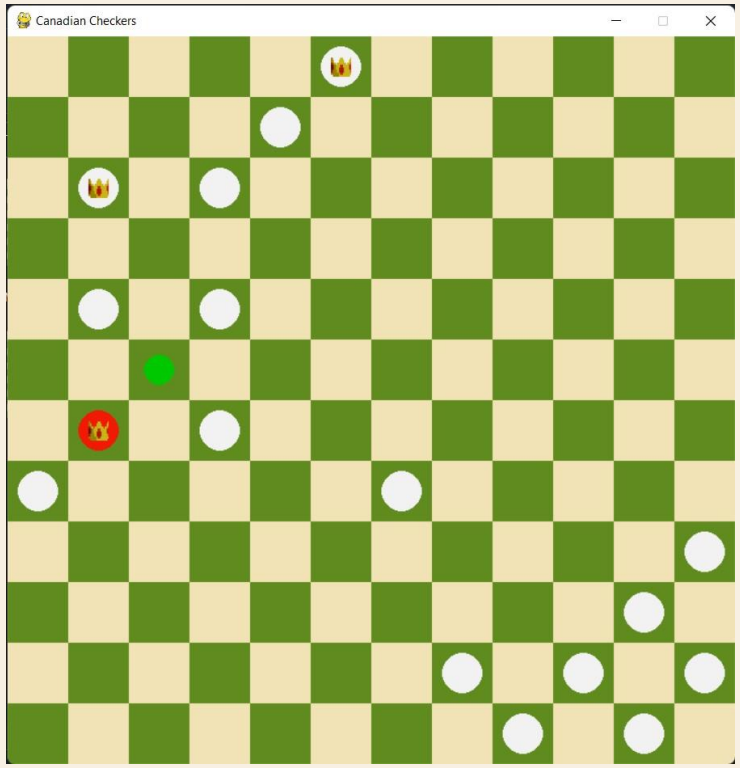


MAKING IT WORK WITH AI

Points

Point is increased when one captures opposites piece

Objective

The AI wants to win the game by maximizing its point and minimizing human's point

Algorithm

This objective can be achieved with help of Minimax Algorithm and α-β Pruning

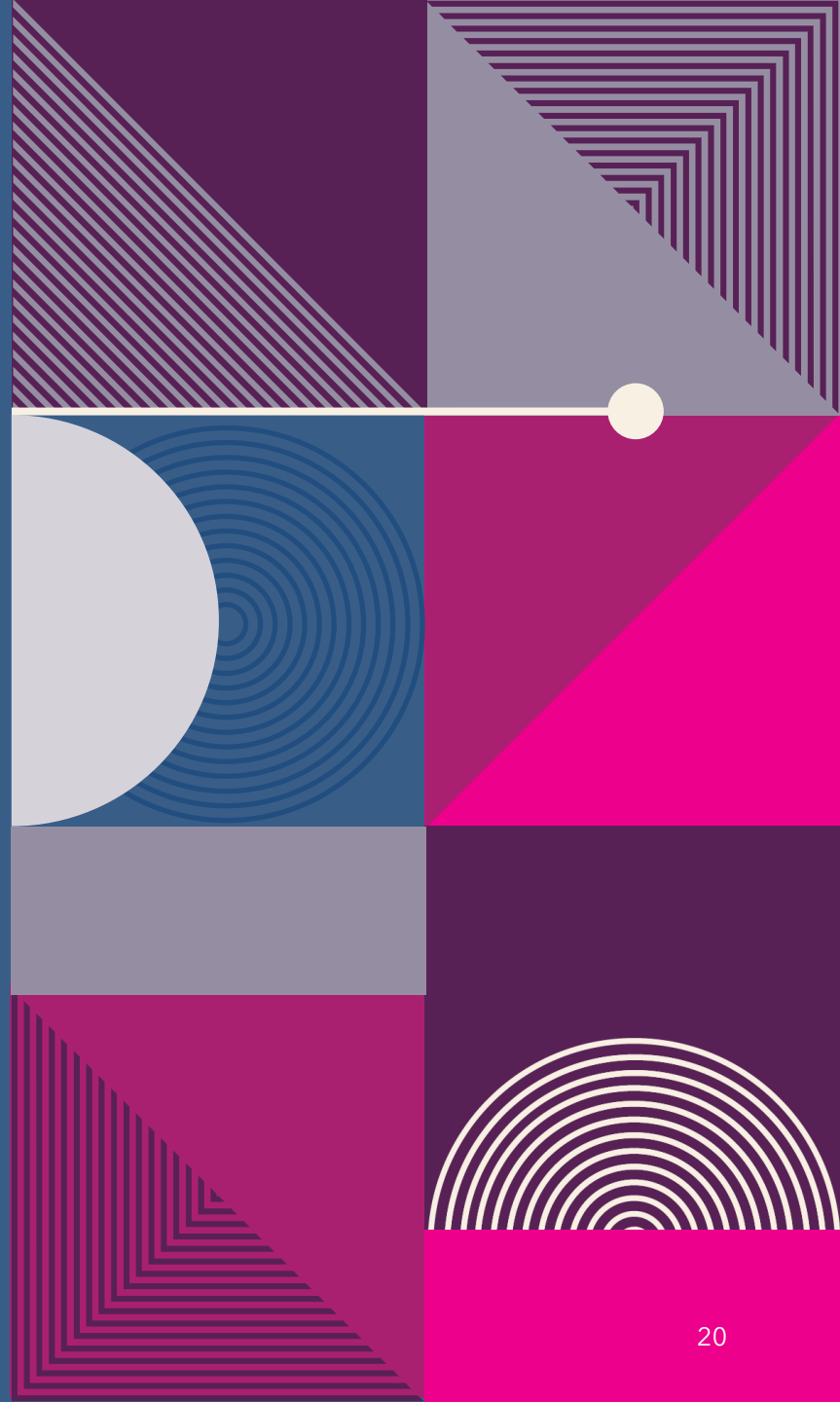
MINIMAX ALGORITHM

Minimax is a kind of backtracking algorithm that is used in decision making and game theory to find the optimal move for a player, if your opponent also plays optimally.

In Minimax the two players are called maximizer and minimizer.

The maximizer tries to get the highest score possible while the minimizer tries to get the lowest score possible.

Every state has a value associated with it. In each state if the maximizer has upper hand, then, the score of the board will tend to be some positive value. If the minimizer has the upper hand in that board state, then it will tend to be some negative value.



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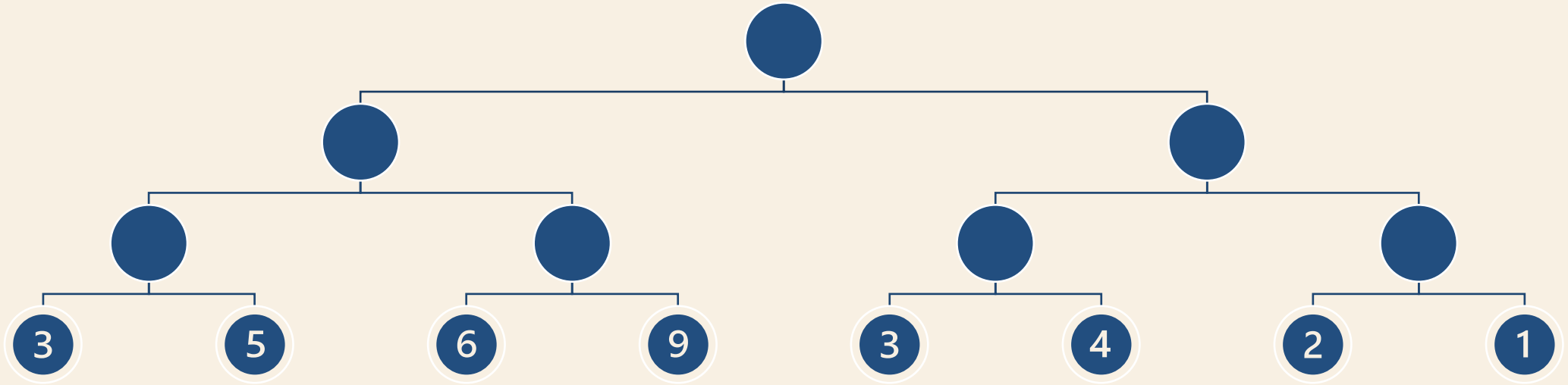

MAX

MIN

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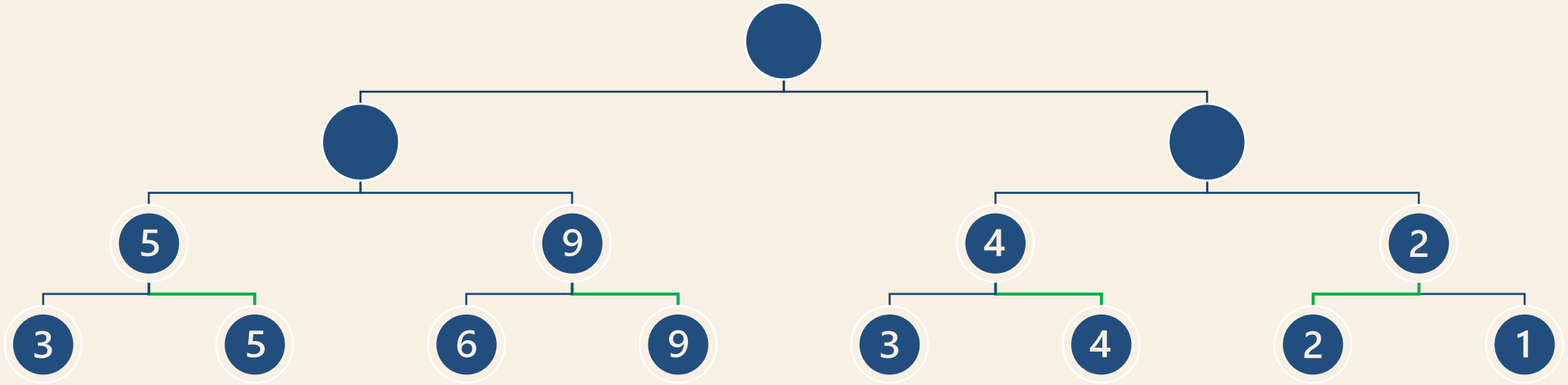

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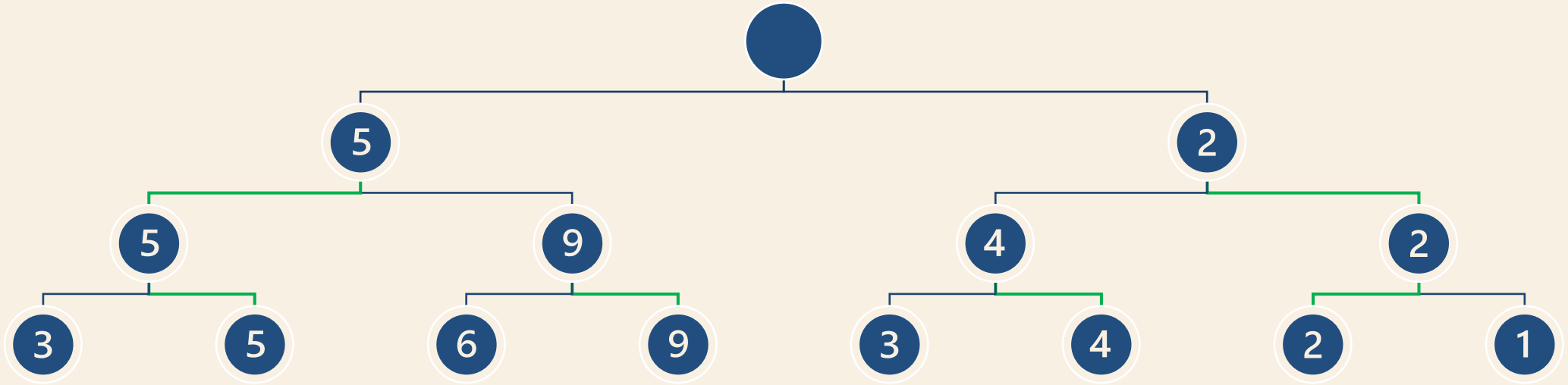

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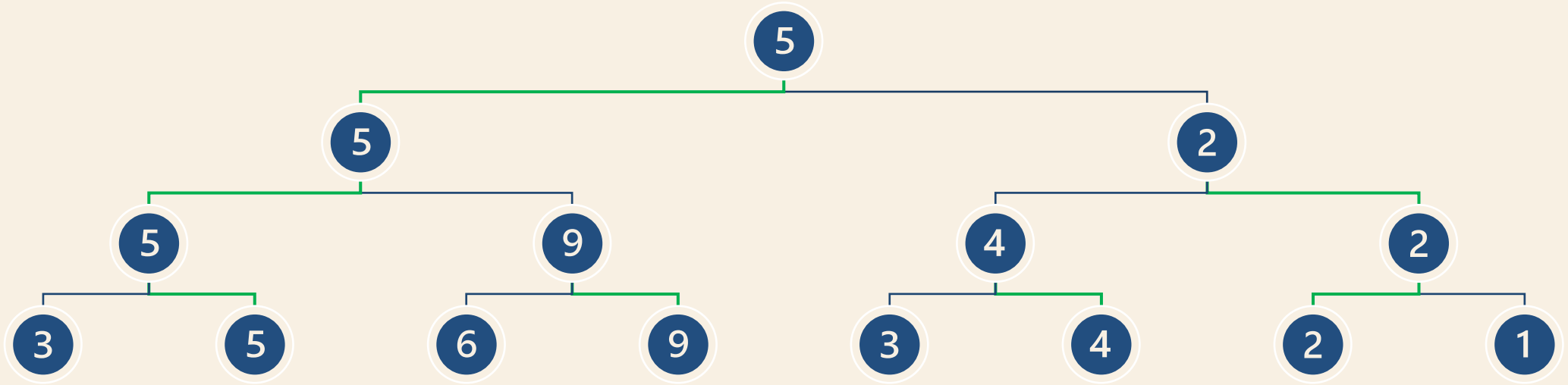


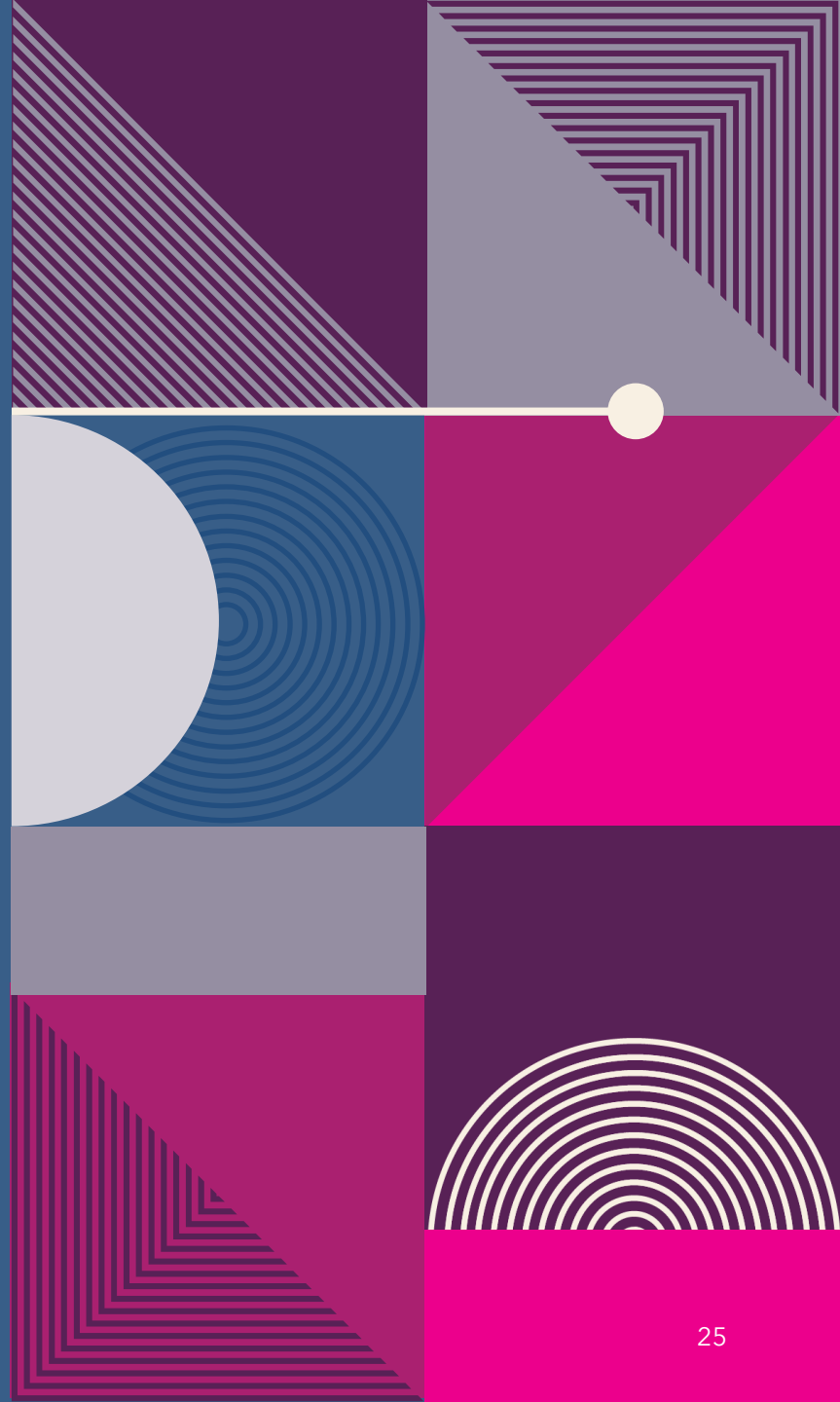
ALPHA-BETA PRUNING

Alpha-Beta pruning is not actually a new algorithm, rather an **optimization technique** for minimax algorithm.

It reduces the computation time by a huge factor. This allows us to search much faster and even go into deeper levels in the game tree.

It is called Alpha-Beta pruning because it passes **2 extra parameters** in the minimax function, namely *alpha* and *beta*.

Alpha is the best value that the **maximizer** currently can guarantee at that level or above. **Beta** is the best value that the **minimizer** currently can guarantee at that level or above.



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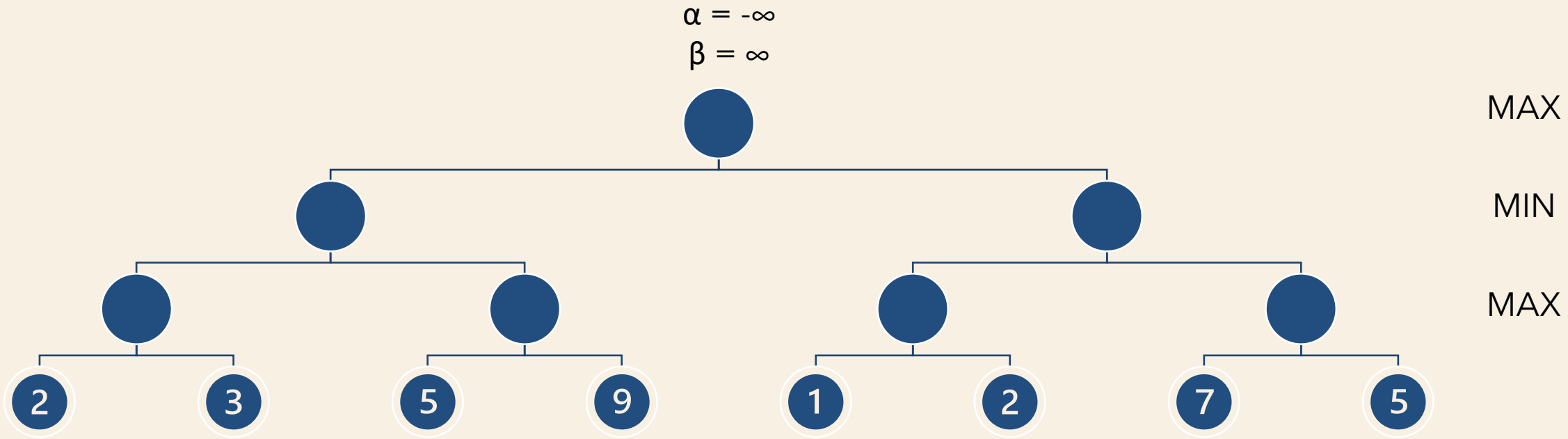

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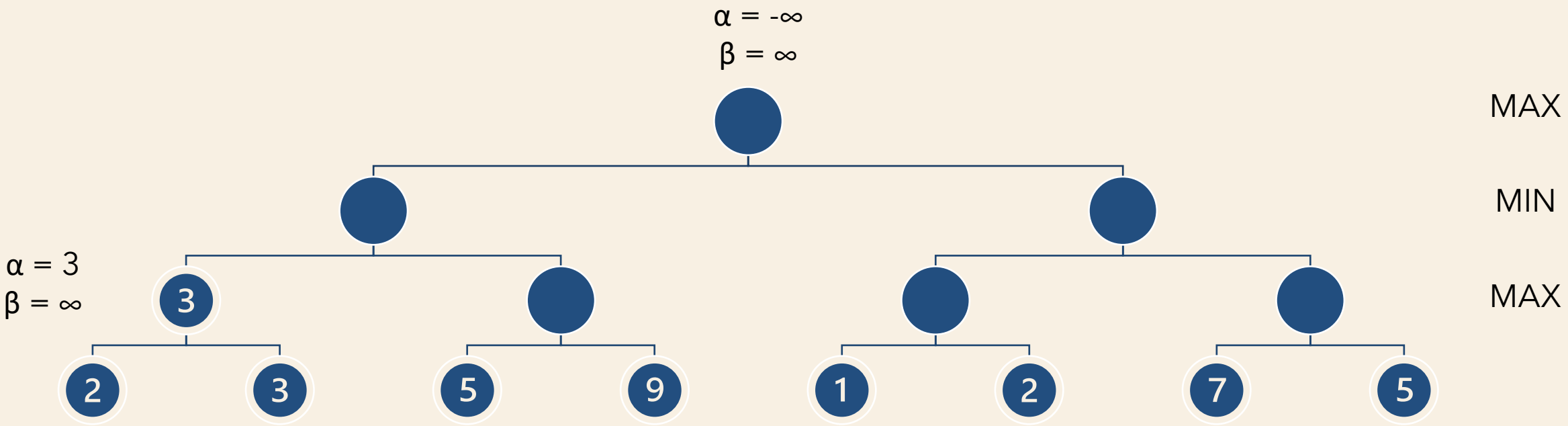

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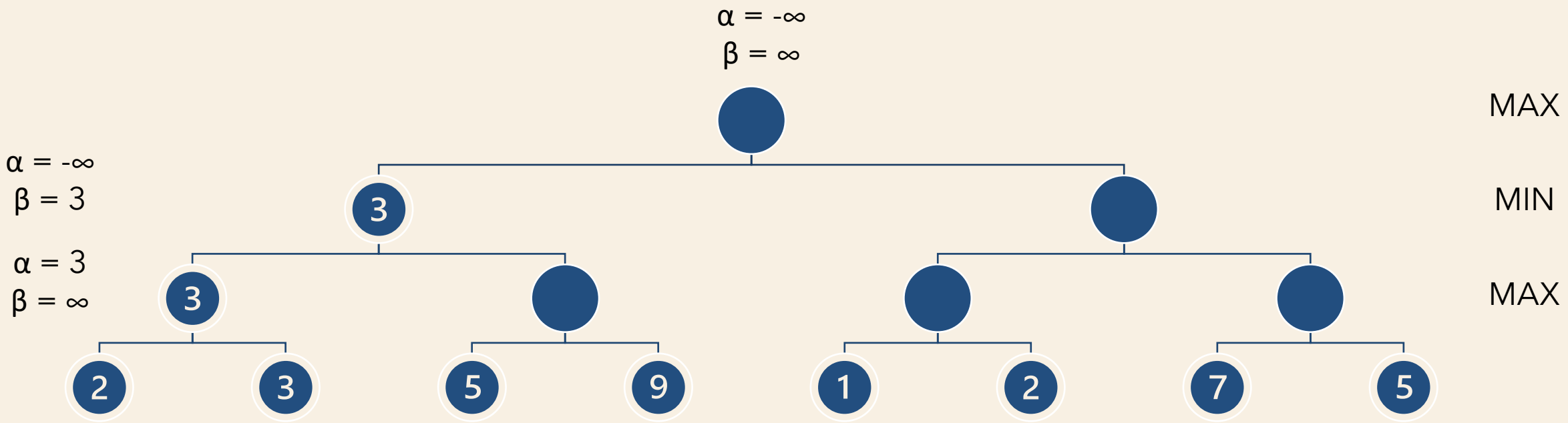

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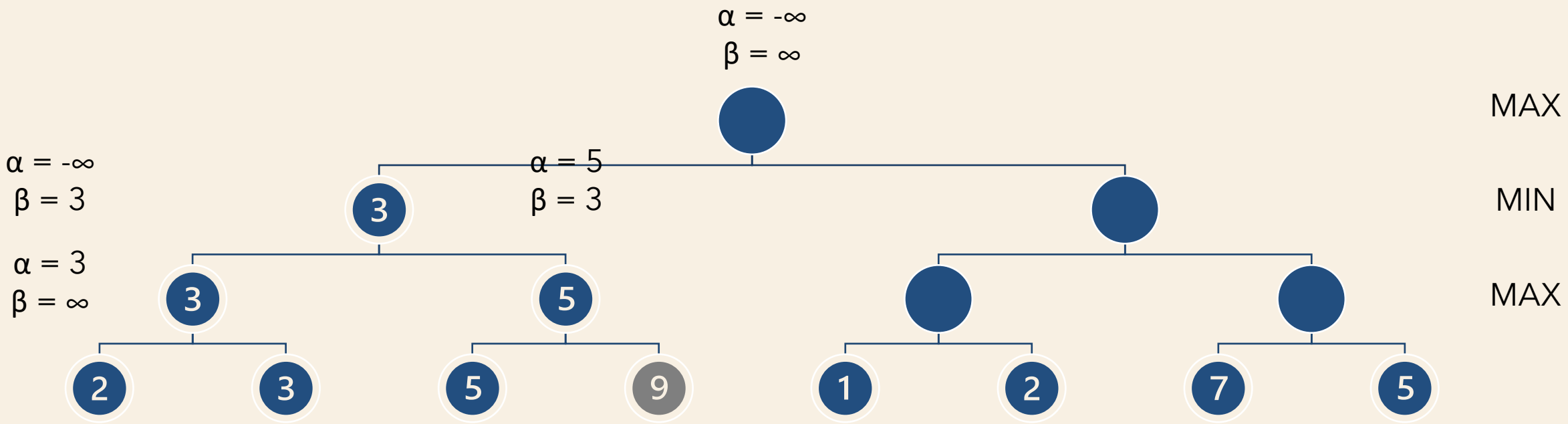

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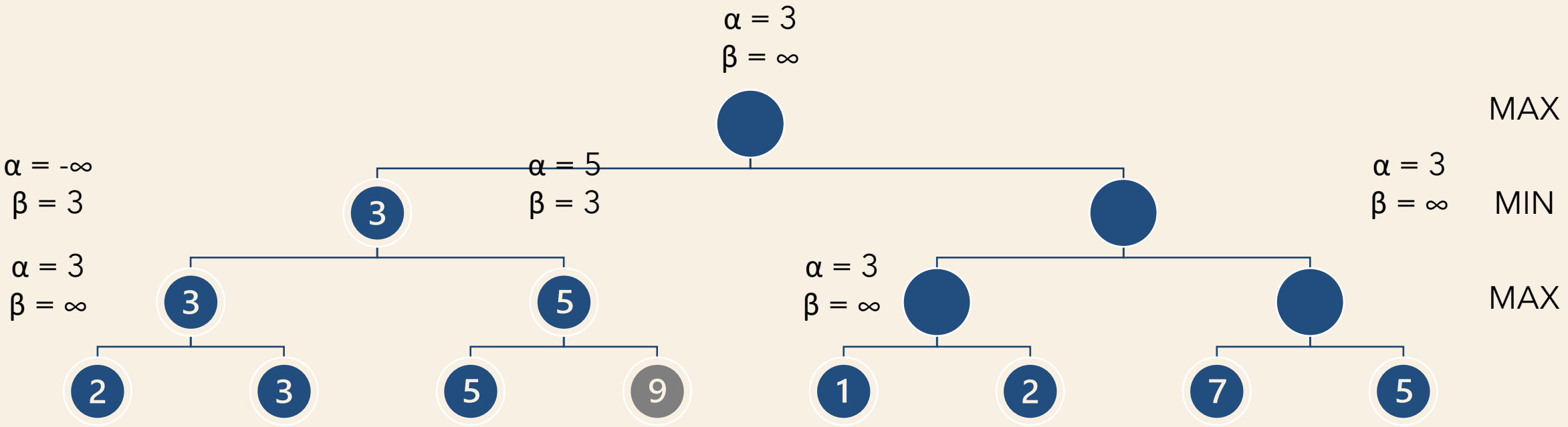

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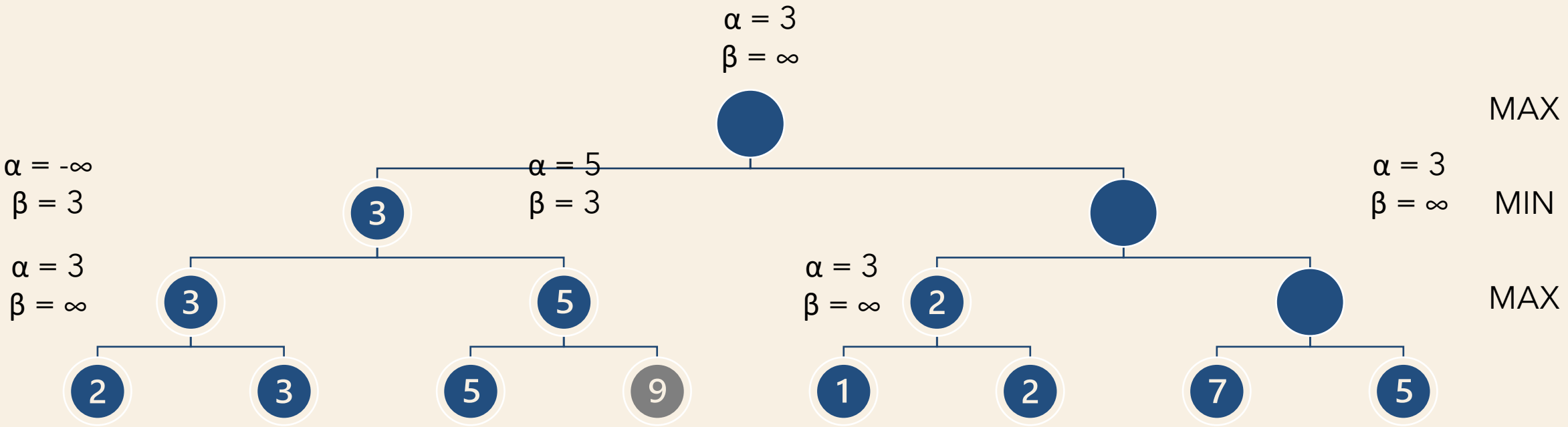

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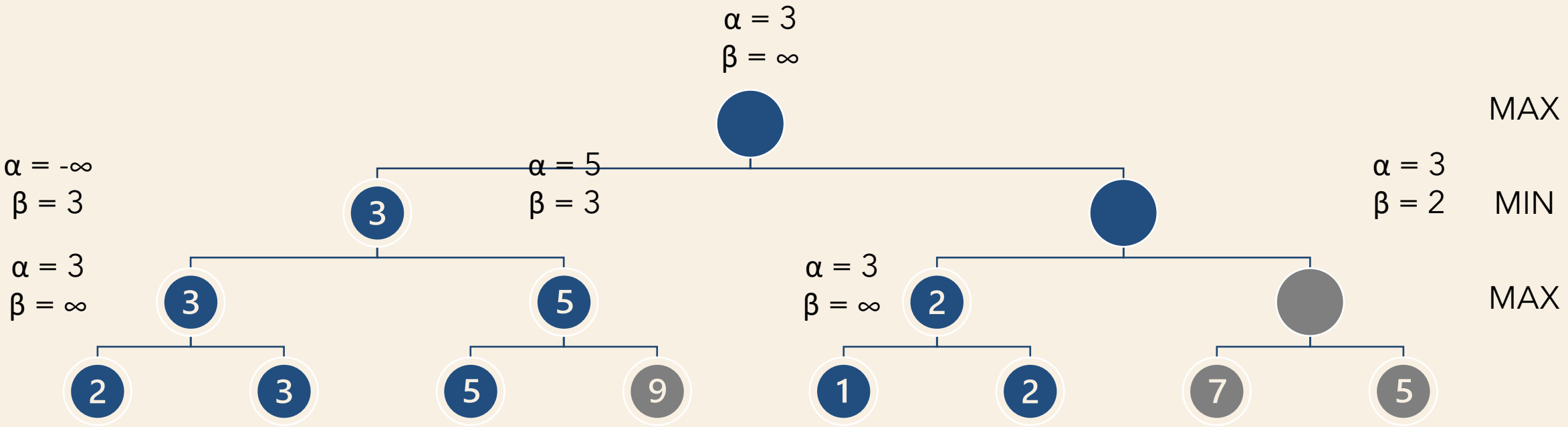

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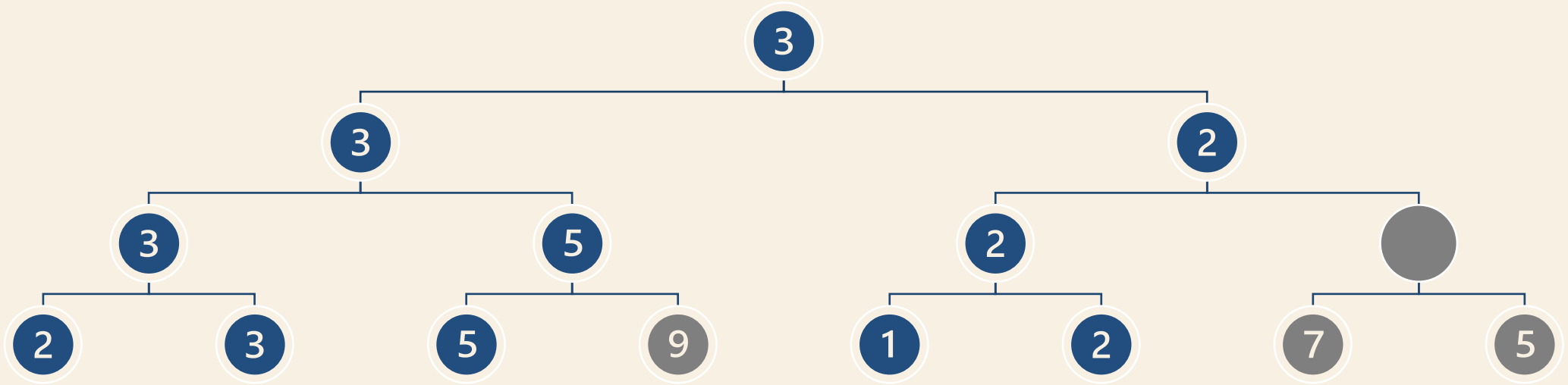

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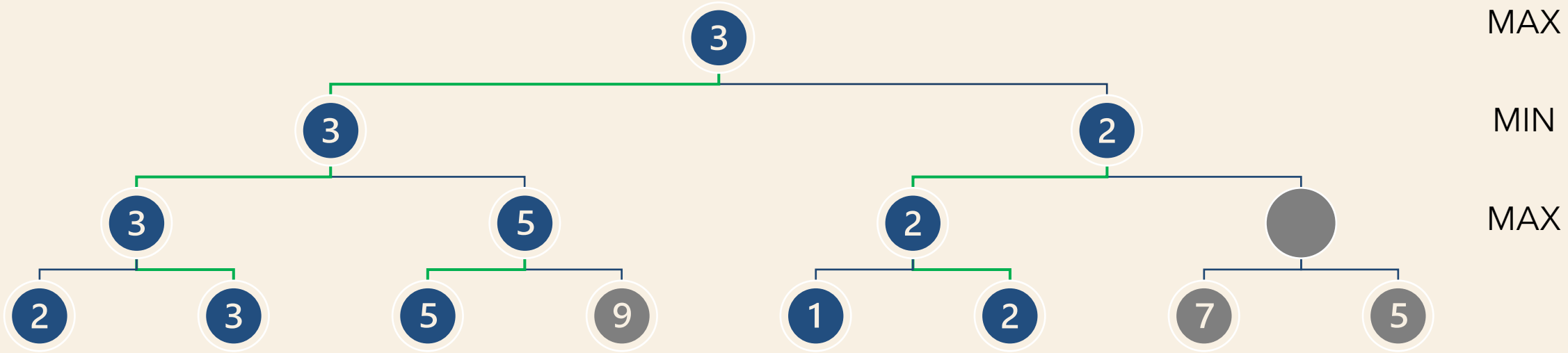

TECHNOLOGY USED

Platform:
Windows/MacOS/Linux

Game Engine: PyGame

Language Used:
Python (3.10)

THANK YOU

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