# GADE 7321 Concept Document

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## High Concept Statement

Crown Defense is a digital strategy board game where two players must cleverly use their board pieces to defend their crown while working to capture their opponent’s crown.

## Game Rules



Figure 1: Crown Piece (Blender, 2024)

The game is a two-player game set on an 8x8 checkered-tile board.

**Basic Rules:**

* The game is a turn-based game.
* When their turn begins, a player may move any number of pieces on the board.
* A turn ends when the player declares their turn is over.
* Each player has 13 game pieces:
  + 4 guards,



Figure 2: Guard Piece (Blender, 2024)

* + 5 mercenaries,
  + 3 shields, and
  + 1 crown.
* A guard can move linearly along any number of tiles.
* A mercenary can move diagonally along up to a maximum of 3 tiles.
* A shield can move linearly along up to a maximum of 2 adjacent tiles, or diagonally to 1 tile.
* The crown can only move to 1 adjacent block (not diagonally).
* Each player must attempt to capture their opponent’s pieces by moving to the tile behind the target piece.



Figure 3: Shield Piece (Blender, 2024)

* If the tile behind the target piece is occupied, the piece cannot be captured.
* If a piece is moved beyond the tile behind an enemy piece in the same turn, this does NOT capture the enemy piece.
* Players can move their game pieces over any other allied game pieces (except the Crown) to traverse the board.
* The game ends when a player captures the enemy crown.



Figure 4: Mercenary Piece (Blender, 2024)

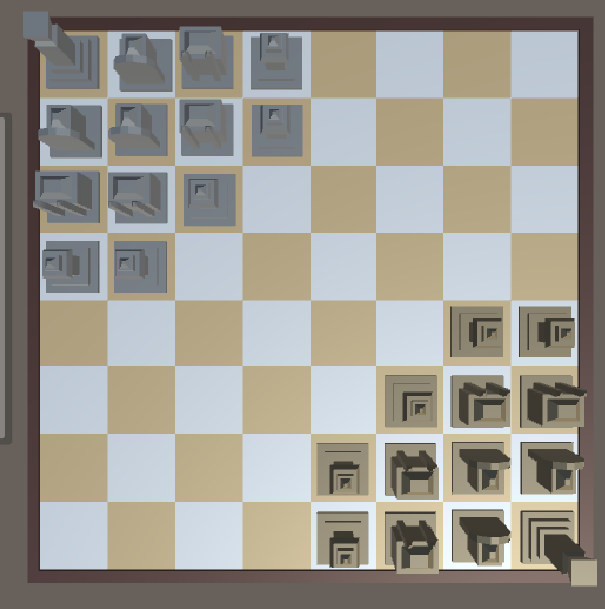


Figure 5: Starting Board (Unity, 2024)

**Board Layout and Set-up:**

At game start, the game board should always appear like the layout in figure 5 (right).

The game will always start on the gold player’s turn and the grey player will always play second.

The game is played from a top-down perspective to allow the players to both have a complete view of the board.

## Game State Representation

The game is going to rely on a 2D-array that will represent the tiles on the board. The array will store each game piece in the corresponding index of the array. For example, if a piece moves to tile 3x2 on the board, it will be stored in position [3,2] in the array.

When a player moves a piece to a tile on the board, the game manager algorithm must check for the following:

* Can the piece I am moving, move the required number of tiles?
* Is there a piece on that tile already?
* If yes, can I capture it?

The game will have two “states”: gold’s turn and grey’s turn. When it is gold’s turn, only the gold pieces can be selected and moved, and the same goes for grey’s turn.

## Utility Function

The utility function is the “training signal” of a machine learning algorithm by checking the “goodness” of the outcomes generated by the AI.

Utility Function Equation:

Where:

= the likelihood of a win if the game state is chosen

= the game state number

= the expected utility

Explanation: