

Design Patterns for Santorini Game

Factory Pattern

I have implemented the Factory method pattern to manage the creation of player objects. This pattern is used in the *Game.initialize_players()* method, where player instances are created based on the game configuration. Players can be of type *HumanPlayer*, *RandomAI*, or *HeuristicAI*, depending on the input from the command line arguments. This method abstracts the instantiation logic from the user, which makes it easy for modifications and additions of new player types without affecting the core game logic.

Strategy Pattern

I used the Strategy pattern to define the behavior of different types of AI players. Each AI player (*RandomAI* and *HeuristicAI*) encapsulates a strategy for selecting moves.

RandomAI.select_move() selects moves at random, whereas *HeuristicAI.select_move()* uses a scoring system based on height, centrality, and distance from opponents. These strategies can be swapped without altering the player's class, which makes it flexible and able to facilitate easy expansion or adjustment of AI behavior.

Command Pattern

The command pattern is used in the move execution logic. Each player's move and build activity encapsulated within the gameplay methods *Game.handle_human_turn()* and *Game.ai_play_turn()* can be stored, reversed, and reapplied through the *GameManager*. This is used to manage game history and provides capabilities for the undo or redo functionality which is implemented via *GameManager.undo()* and *GameManager.redo()*.

Iterator Pattern

I have used a custom Iteration logic within the *ScoringSystem* class, which iterates over the data structures in the *ScoringSystem.calculate_scores()* method. This method iterates over the game board and player positions to compute scores based on strategic positioning and proximity to opponents, which calculates *height_score*, *center_score*, and *distance_score*. This custom Iteration logic involves conditional checks and aggregation of scores based on the game rule, which provides an evaluation of each potential move's strategic value.