

Exercise: Tic-Tac-Toe

•Tic-tac-toe, also spelled tick-tack-toe, or noughts and crosses, as it is known in the UK, Ireland, Australia, New Zealand, is a pencil-and-paper game for two players, who take turns marking the spaces in a 3×3 grid with the symbols X and O respectively. The X player usually goes first. The player who succeeds in placing three respective marks in a horizontal, vertical, or diagonal row wins the game.

•Extend this by adding a narrative about playing the game on an Android device:

Tic-tac-toe for Android will implement the Tic-tac-toe paper game as an Android app. In it, human users will be able to play Tic-tac-toe against the computer. Multiple games may be played in each session, with either the computer playing first or the human playing first on an electronic board that will be displayed on the device's touch screen. Scores for each session will be accumulated. If the user quits the session, scores will be reset.

Identify nouns(Candidate objects and classes) and verbs (Candidate responsibilities)

Nouns and Verbs

•Nouns: *pencil, paper, game, nought, cross, player, X, O, space, symbol, grid, mark, vertical row, horizontal row, diagonal row, human user, human, computer, session, board, touchscreen, score*. (Candidate objects and classes)

•Verbs: *take turn, mark, goes, place, win, implement, play, playing first, display, accumulate, quit, reset*. (Candidate responsibilities)

Consolidate: Nouns

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•Remove *pencil, paper, touchscreen* – physical objects

•*Symbol* and *mark* identical – retain *symbol*.

•*User* vs. *player* – retain *player*

•Remove one of *board* and *grid*

•Remove *touchscreen* – physical

•*Row* is a component

•*Session* is an instance of *game*

Consolidate: Verbs

•*Take turn, goes, play* – retain *play*

•*Mark* vs. *place* vs. ...? Use *place* symbol

- Remove *implement* – irrelevant to game
- Retain *display*, *accumulate*, *exit* and *reset*

Candidate Classes, Responsibilities

- Classes: Symbol, Player, Human, Computer, Board, Row, and Game (with attribute Score)
- Instances: O, X of the class Symbol
- Responsibilities: play, place, display, accumulate (scores), quit, and reset.

Allocate Responsibilities to Classes

- Class Game is allocated the responsibilities: play, accumulateScores, quit, and reset.
- Class Board has Display responsibilities.
- Class GameGrid has Place.
- Symbol, Player, Human, Computer, and Row have no responsibilities yet. Keep?

Map Domain Model to Framework Patterns

- Controller classes map to Activities, e.g. GameSession
- Visual elements (if any, remember we're doing domain object design) map to views
- Pure domain objects map to "plain old Java object" (POJO) hierarchies

General Scenario

- Start a new game.
- Determine who plays first: the human or the computer. Assign the X symbol to the first player; assign the O symbol to the second player.
- The first player places his symbol at an empty location on the board. The second player does likewise. Repeat until one player has three of his symbols in a row, column, or diagonal, or no more squares are in play, in which case the game ends in a draw.
- Accumulate scores for the players. The winning player's score increments by 1; the losing player's score does not change. In a draw, both players' scores remain the same.
- If the user wishes, start a new game; else, quit.

Scenario Walkthrough – Verification, Identifying Collaborators

- No class to respond to starting new game. Create one:
– GameController?
- GameController and Game collaborate
- Symbol creation, placement? Symbol and Board.

- placeSymbol invokes Play?
- Game needs checkResult?
- Board, GameGrid and Game are collaborators.
- Etc.

Final Classes, Responsibilities

- Game: Represents a single Tic-Tac-Toe game.
 - Responsibilities: play, checkResult
 - Collaborators: GameSession, GameView, Grid.
- GameView: Represents the visual display of a Tic-Tac-Toe game.
 - Responsibilities: placeSymbol, showScores
 - Collaborators: Game
- GameGrid: Represents 3×3 Tic-Tac-Toe grid.
 - Responsibilities: placeSymbol, getEmptySquares
 - Collaborators: Game
- GameSession: Represents Tic-Tac-Toe play session (multiple games)
 - Responsibilities: playNewGame, quit, decidePlayers, accumulateScores
 - Collaborators: Game, GameView
- Symbol – represents a Tic-Tac-Toe symbol (i.e., an X or an O)
 - Responsibilities: None
 - Collaborators: Game

Contracts

- Game:
 - play(Grid, Symbol, x, y) returns Success, Failure
 - checkResultAndSetState(Grid) returns nothing
 - isActive() returns true or false
 - isWon() returns true or false
 - isDrawn() returns true or false
- GameView:
 - placeSymbol(Symbol, X, Y) returns Success, Failure
 - showScores(PlayerOneScore, PlayerTwoScore) returns nothing.