






## Design of the Battleship Program

### *Problem statement*

Our aim is to write a program in Java that will play the popular game of Battleship either against the computer, or against another player on a different computer, running a different program.

### *Problem description*

The game is played on two fields, each 10 X 10 squares. The columns are labeled A-J, and the rows are labeled 1-10. Each player's fleet of ships consists of one aircraft carrier, one battleship, one destroyer, one submarine and one cruiser. The size and shape of each ship is as follows:

- Destroyer (2 squares): 
- Submarine (3 squares): 
- Cruiser (3 squares): 
- Battleship (4 squares): 
- Aircraft Carrier (5 squares): 

Before the game starts, each player secretly places their ships anywhere on their own playing field. Ships cannot overlap one another, but may be placed either vertically or horizontally.

The first turn is determined by some random means (throwing a die). Players take turns to try to guess the location of the other's ships by naming a square (e.g. F7). The opponent declares the square to be a hit or a miss, depending on whether there is a ship occupying that square. When all the squares occupied by a particular ship have been guessed, the player must announce that that particular ship is sunk. A player keeps track of the hits and misses on a copy of the opponent's field.

The first player to sink all the other's ships is the winner.

### *Object analysis*

Objects mentioned are:

Game, Field, Square, Column, Row, Player, Fleet, Ship, Aircraft carrier, Destroyer, Cruiser, Submarine, Battleship, Size, Shape, Turn, Location, Opponent, Hit, Miss, Winner, Copy

Relationships are:

Game HASA setof Player

Player HASA Field

Player HASA Fleet

Game HASA Turn

Game HASA Winner

Field HASA setof Square

PlayersField ISA Field

OpponentsField ISA Field

Fleet HASA setof Ship

Carrier ISA Ship

Battleship ISA Ship

Cruiser ISA Ship

Destroyer ISA Ship

Submarine ISA Ship

Ship HASA Location

Location HAS Row

Location HAS Column

Square HASA Location

Square HASA Ship

Square HASA Trial

Hit ISA Trial

Miss ISA Trial

Reworking this gives:

Game

- Player one
- Player two
- int winner
- int turn

Player

- Field field
- Fleet fleet

Field

- Square[][] squares

Fleet

- Ship[] ships

Ship

- int size
- String name
- Location[size] location

## Location

- int row
- int column

## Square

- Location location
- Ship ship
- int hitOrMiss

## ***Operation analysis***

Operations mentioned are:

(the game is) Played

(each player) Places

(ships may not) Overlap

(first turn is ) Determined

(players) Take turns

(players) Guess

(player) Declares

(ship is) Occupying

(all squares for a ship are) Guessed

(players) Announce

(player) Keeps track of

(first player) Sink

Reworked this is:

## Game

- void play()
- Player determineFirstTurn()

## Player

- void placeShips(Field)
- Location makeGuess()
- void sendGuess(Location)
- Location receiveGuess()
- void record(Location)
- String announceSunk(Ship)
- String announceHitOrMiss(Location)

## Field

- boolean isHitOrMiss(Location)
- Ship isSunk(Location)
- void record(Location)

## Ship

- boolean overlaps(Ship)
- boolean occupies(Location)
- boolean isSunk()