[Project #3] Battleship

- Battleship game
  - 10 X 10 squares in the grid (Sea)
  - Each player secretly places own ships
  - Players bomb a target coordinate in turn
    - Opponent player tells “hit” or “miss”
    - When hit, opponent also tells the type of ship
- Battleships table

<table>
<thead>
<tr>
<th>Type of Ship</th>
<th>Size</th>
<th>#Ships</th>
</tr>
</thead>
<tbody>
<tr>
<td>Aircraft Carrier</td>
<td>6</td>
<td>1</td>
</tr>
<tr>
<td>Battleship</td>
<td>4</td>
<td>2</td>
</tr>
<tr>
<td>Submarine</td>
<td>3</td>
<td>2</td>
</tr>
<tr>
<td>Destroyer</td>
<td>3</td>
<td>1</td>
</tr>
<tr>
<td>Patrol Boat</td>
<td>2</td>
<td>4</td>
</tr>
</tbody>
</table>
Computer’s Board

- Computer positions ships and you bomb them with a given number of bombs

- Randomly initialize battleships on board
  - Coordinates are A-J and 1-10.
  - Use the size and the quantity of ships in “Battleships table”.
  - Secretly place ships either horizontally or vertically without overlaps
Pseudo code with random

```plaintext
loop(for each ship in range from 'Aircraft Carrier' to 'Patrol Boat') {
    var x = random in range [A..J]
    var y = random in range [1..10]
    var vh = random in range [0..1] // 0 = vertical  1 = horizontal

    if (isOverlap(x, y, vh) == false)
        Position the ship
        next loop
    else
        loop again
}
```
Bombing Battleships

- Player sets bombing targets and computer tells “hit” or “miss”
  - Mark the bombs with ‘X’
    - Mark a hit with ‘X’ specify the type of ship
    - E.g., Xp – hit on Patrol Boat, Xa – hit on Aircraft Carrier

- Player will be given $N$ bombs

- Player inputs the target coordinates $N$ times interactively, reviewing the results (hit or miss)

- Show the score at the end of the program
  - Score = $\sum$ (the size of ship for each hit)
Display the Board

```
A B C D E F G H I J
--- --- --- --- --- --- --- --- ---
1 | P P S B B B B
2 | S
3 | B S D D D P
4 | B P
5 | B
6 | B P S
7 | P S
8 | P S
9 | P
10 | A A A A A A
```

```
A B C D E F G H I J
--- --- --- --- --- --- --- --- ---
1 | P P S B B B B
2 | S
3 | B S D D D P
4 | B X P
5 | B X X
6 | B X P X Xs
7 | X P Xs
8 | X P Xs
9 | A A A A A A
10 | A A A A A A
```
Data Structures

- **Board (Recommend)**
  - `std::map<char, std::vector<ship*>>` for a board
  - `std::vector<ship*>` for a column

- **Ships defined with inheritance (Necessary)**
Program Flow

- Command Line Arguments
  - Random seed, The number of bombs, Program mode
  - Program mode: ’d’ for debug mode, ’r’ for release mode
  - E.g., 100 10 d

- Debug mode
  - Display board for every step

- Release mode
  - Display review only
  - Display the board at the end

<table>
<thead>
<tr>
<th>Command Line Arguments</th>
<th>Debug mode</th>
<th>Release mode</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>Display board for every step</td>
<td>Display review only</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Display the board at the end</td>
</tr>
</tbody>
</table>

E.g., 100 10 d

===== Game Start =====

<table>
<thead>
<tr>
<th></th>
<th>A</th>
<th>B</th>
<th>C</th>
<th>D</th>
<th>E</th>
<th>F</th>
<th>G</th>
<th>H</th>
<th>I</th>
<th>J</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>P</td>
<td>P</td>
<td>S</td>
<td>B</td>
<td>B</td>
<td>B</td>
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</tbody>
</table>

C4 miss

A8 hit on Patrol Boat

C4 Try again

<table>
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<tr>
<th></th>
<th>A</th>
<th>B</th>
<th>C</th>
<th>D</th>
<th>E</th>
<th>F</th>
<th>G</th>
<th>H</th>
<th>I</th>
<th>J</th>
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</thead>
<tbody>
<tr>
<td>1</td>
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</tr>
</tbody>
</table>

H8 miss

Score: 10
A8
hit on Patrol Boat

C4
Try again

H8
miss

Score: 10