

Winning the Battle:

Using Logic Puzzles to Teach Reasoning

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& Exposition

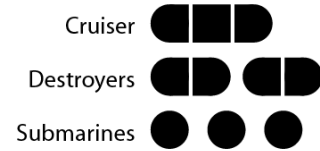
April 16, 2015
Boston, Massachusetts

Mini Battleships

You may already be familiar with the board game Battleships. There, your goal is to locate your opponent's fleet of ships before he or she locates yours. In Battleships puzzles, a fleet of ships has been placed on each grid and you are given clues about how many ship segments are located in each row and each column of the grid.

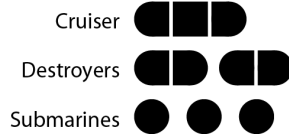
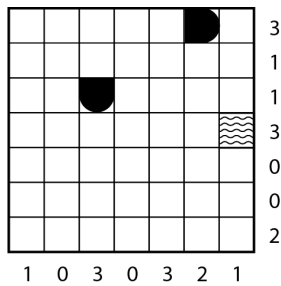
Goal:

Locate the 6 ships in each 7 x 7 grid—one cruiser, two destroyers, and three submarines:

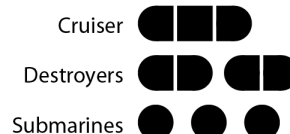
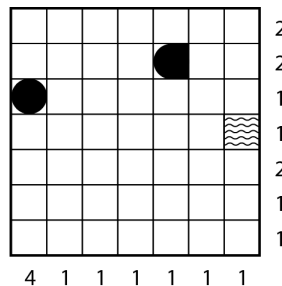


Rules:

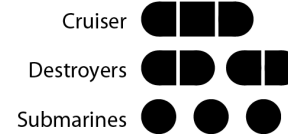
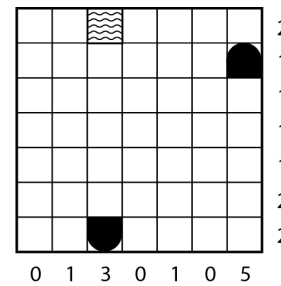
- Ships are placed horizontally and vertically
- Ships are placed so that they never touch each other, not even diagonally
- Number clues around the border indicate the total number of ship pieces that appear in that row or column
- Some initial clues, such as parts of ships or water placement, may be given in the grid



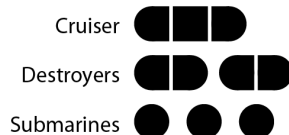
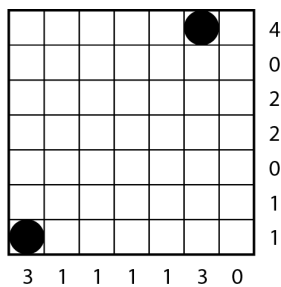
Mini Battleships 1



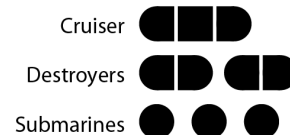
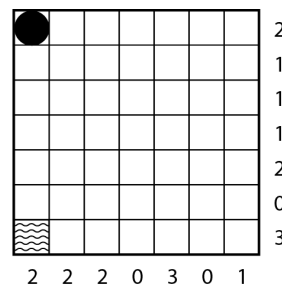
Mini Battleships 2



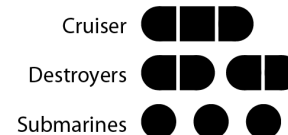
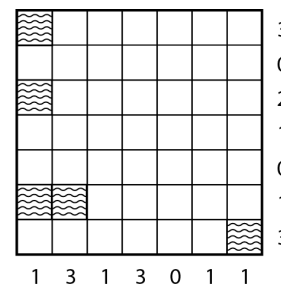
Mini Battleships 3



Mini Battleships 4



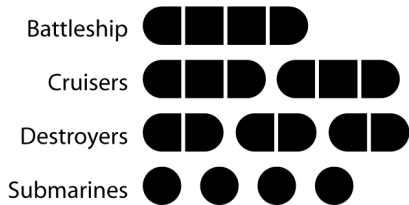
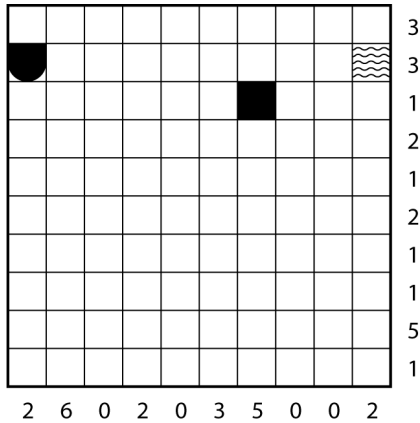
Mini Battleships 5



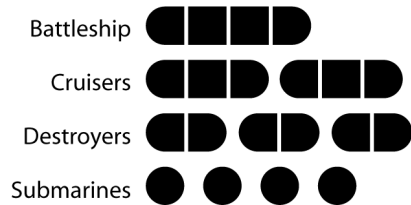
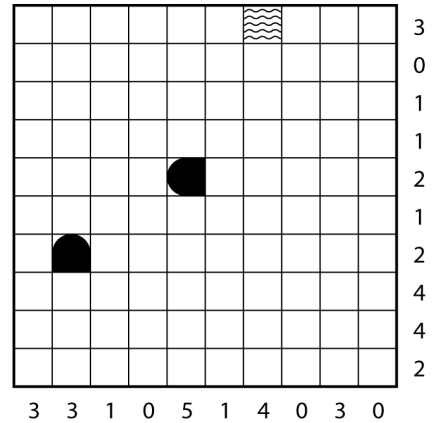
Mini Battleships 6

Battleships – Page 1

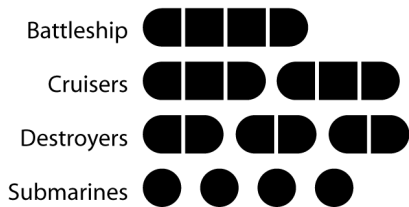
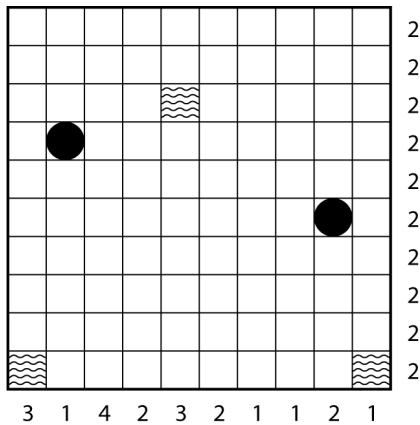
Solve the following Battleships puzzles. Each grid contains the ten ships shown below the grid. Each ship may appear horizontally or vertically, but no two ships can occupy adjacent grid cells, not even diagonally. The numbers along the grid's perimeter indicate the number of cells in the corresponding rows and columns that contain ship segments.



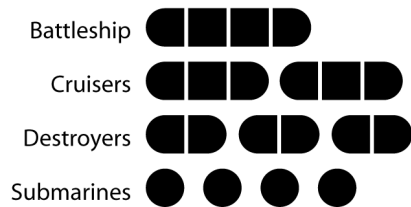
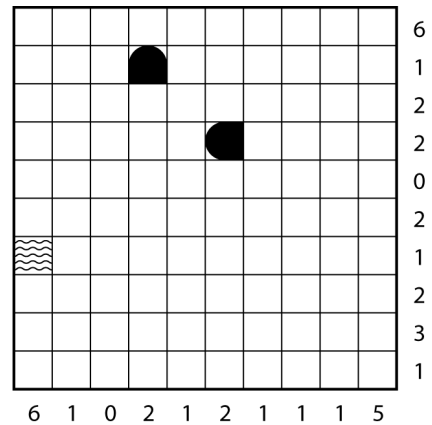
Battleships 1



Battleships 2



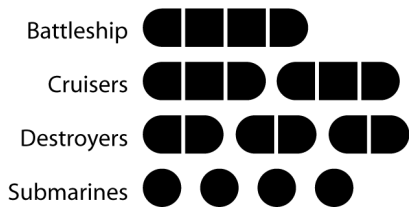
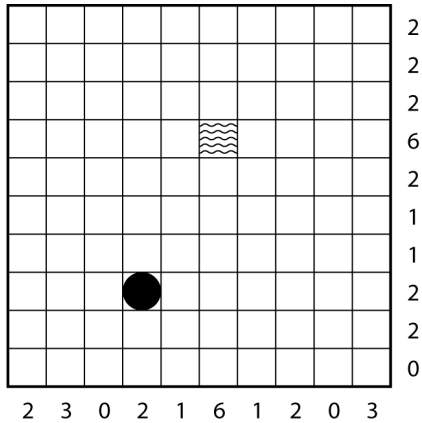
Battleships 3



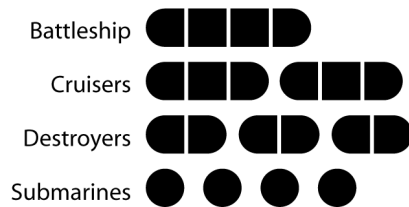
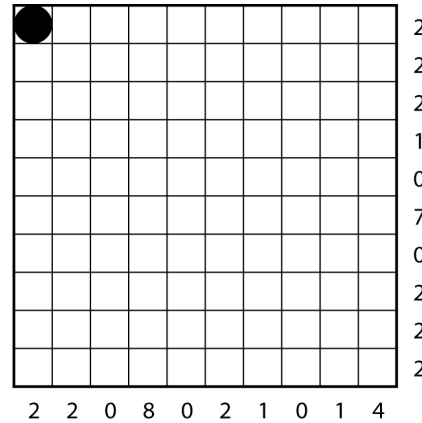
Battleships 4

Battleships – Page 2

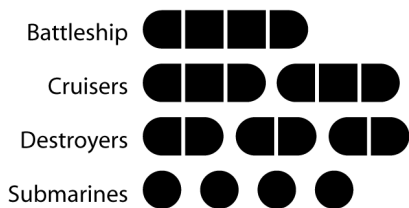
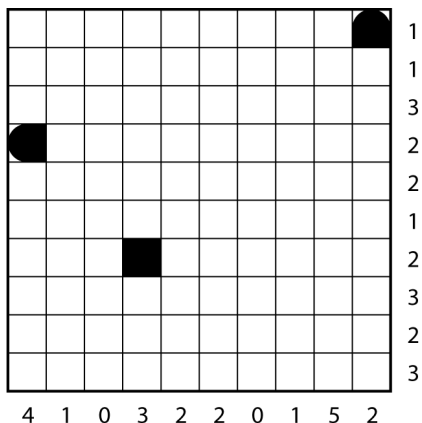
Solve the following Battleships puzzles. Each grid contains the ten ships shown below the grid. Each ship may appear horizontally or vertically, but no two ships can occupy adjacent grid cells, not even diagonally. The numbers along the grid's perimeter indicate the number of cells in the corresponding rows and columns that contain ship segments.



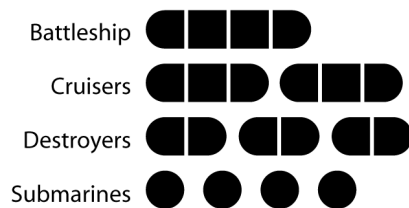
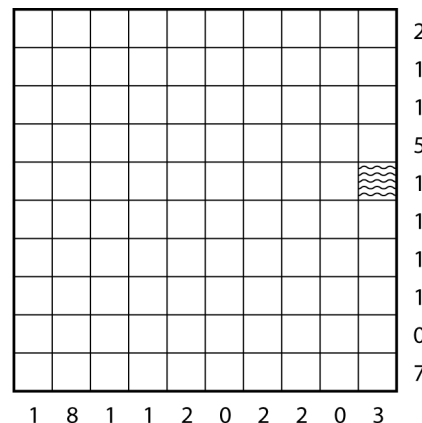
Battleships 5



Battleships 6



Battleships 7



Battleships 8

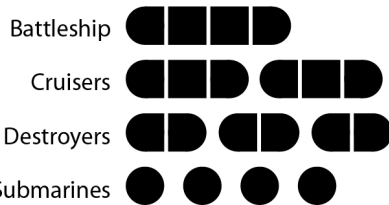
Digital Battleships – Page 1

You may already be familiar with the board game Battleships. There, your goal is to locate your opponent's fleet of ships before he or she locates yours.

In Battleships puzzles, a fleet of ships (ten in all) has been placed on each 10 x 10 grid and you are given clues about how many ship segments are located in each row and each column of the grid. A few ship segments or open water may also be placed in the grid as starting clues. Ships may be oriented horizontally or vertically, but no two ships can occupy adjacent grid cells, not even diagonally.

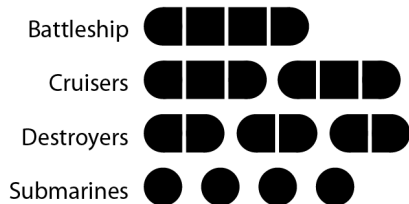
In this variation called Digital Battleships, each number outside the grid represents the sum of the numbers in all the ship segments that appear in each respective column or row.

8	4	1	7	7	7	1	6	8	8	14
7	1	8	9	8	7	2	7	5	3	9
9	7	8	1	5	6	2	1	9	8	8
2	3	5	1	9	3	4	8	1	3	2
6	7	6	4	4	1	2	3	2	1	4
5	7	3	2	4	3	3	5	2	3	8
2	4	8	9	7	3	9	3	3	7	13
7	7	3	7	1	4	7	9	8	1	3
6	3	4	9	8	7	2	7	1	2	2
6	2	1	6	3	1	5	2	6	3	3
2	1	22	1	3	13	8	6	8	2	



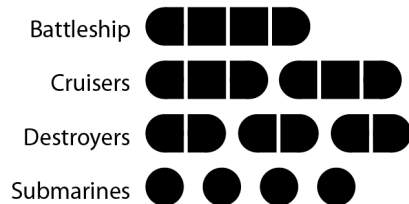
Digital Battleships Example

3	9	1	6	9	4	4	5	7	4	8
5	7	4	5	9	1	1	5	5	2	5
9	5	5	6	3	3	9	5	9	9	14
4	4	6	4	3	8	1	6	8	8	11
6	3	5	1	8	7	7	1	3	1	14
5	9	3	9	7	3	1	7	5	7	0
1	2	9	4	1	2	2	6	4	5	8
8	3	9	3	8	8	3	8	1	9	0
1	2	6	4	5	3	4	5	6	4	5
1	9	3	4	1	9	4	3	1	2	8
7	10	9	0	10	2	2	3	30	0	



Digital Battleships 1

1	6	6	4	5	5	4	6	6	9	6
4	1	3	8	7	9	3	6	9	5	9
8	4	8	2	4	9	3	2	8	9	16
5	1	1	8	5	9	9	1	1	9	1
9	4	4	2	2	9	1	6	5	1	12
6	5	5	9	5	6	8	9	1	2	1
4	7	8	4	9	1	6	6	3	7	1
3	6	7	3	4	3	9	7	7	8	3
7	5	4	9	2	4	3	7	5	3	12
6	7	2	6	7	9	9	9	8	2	15
6	15	20	2	6	8	3	6	7	3	



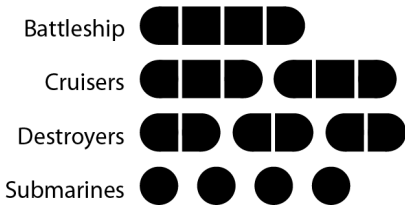
Digital Battleships 2

*All Digital Battleship puzzles created by Moshe Rubin, *Games* magazine (March, 2003)

Digital Battleships – Page 2

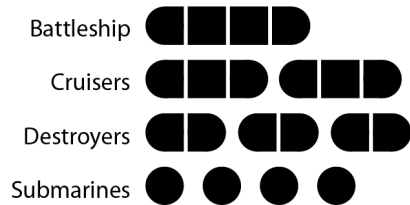
Solve the following Digital Battleships puzzles. Each grid contains the ten ships shown below the grid. Each ship may appear horizontally or vertically, but no two ships can occupy adjacent grid cells, not even diagonally. The numbers along the grid's perimeter indicate the sum of the numbers in all the ship segments that appear in each respective column or row.

9	1	3	2	3	8	7	4	7	3	6
7	4	4	1	9	4	9	9	2	6	15
2	6	2	2	2	9	9	6	6	2	8
4	9	7	6	5	3	3	7	6	6	6
4	8	2	2	1	5	1	8	4	4	9
3	9	3	1	1	5	4	4	5	1	3
1	3	3	3	1	4	4	7	5	7	9
2	3	6	5	8	5	9	1	3	4	8
9	6	1	6	5	8	8	2	7	3	7
3	3	5	3	6	2	5	7	2	1	2
5	3	5	2	3	6	14	8	10	17	



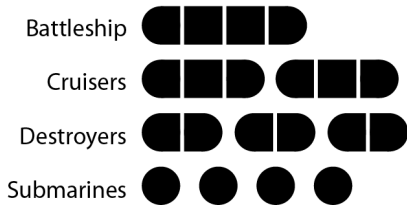
Digital Battleships 3

3	2	7	4	4	2	6	3	1	6	1
6	1	4	3	1	2	9	8	6	9	8
2	7	4	5	7	2	9	4	2	9	11
4	6	4	8	9	6	5	4	2	1	6
2	4	3	3	1	5	9	1	6	1	8
7	3	5	1	5	3	5	7	6	2	7
7	4	3	7	4	8	8	1	7	5	4
9	7	2	6	3	7	3	2	1	2	5
1	5	7	9	9	3	9	9	8	2	2
3	6	8	4	4	4	9	4	1	9	8
4	4	4	3	14	4	14	4	1	8	



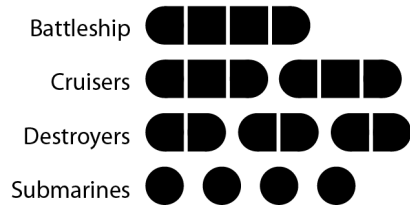
Digital Battleships 4

3	7	9	5	2	1	8	1	2	8	3
5	8	8	6	1	9	6	8	5	6	5
2	2	2	9	1	9	7	2	2	9	8
9	5	9	6	9	4	6	6	3	2	7
8	9	4	2	2	3	7	3	3	6	8
3	6	1	4	2	6	2	5	8	6	6
7	7	5	7	4	9	2	7	1	6	7
6	2	9	2	2	9	6	9	5	2	8
3	5	5	5	7	1	7	8	6	7	12
7	5	8	7	8	4	5	6	6	5	5
5	9	2	4	2	13	5	7	13	9	



Digital Battleships 5

9	7	6	4	2	6	7	7	8	3	7
3	2	2	1	2	3	9	3	6	1	7
3	7	4	2	6	4	6	9	9	2	8
9	6	7	9	8	1	4	9	7	7	13
4	7	3	1	3	2	7	5	3	2	1
5	6	8	2	6	5	7	6	6	2	2
1	9	5	2	9	5	8	3	3	4	8
8	1	3	9	4	1	6	7	4	3	9
7	4	1	2	3	2	5	3	3	4	7
3	2	2	8	4	4	6	4	8	9	8
8	9	2	8	5	2	6	10	11	9	



Digital Battleships 6

Battleship Sudoku – Page 1

As with Battleships puzzles, your goal in Battleship Sudoku is to place the ten ships in the grid. Remember that you are given clues about how many ship segments are located in each row and each column of the grid. A few ship segments or open water may also be placed in the grid as starting clues. Ships may be oriented horizontally or vertically, but no two ships can occupy adjacent grid cells, not even diagonally.

1									7
		3			9		2		0
	4			8		7			1
7			2				9		2
		8		5		4			0
	6				3			7	2
		4		7			8		2
	2		9			5			0
								2	6
	2	2	2	3	1	3	2	2	3

- Battleship 5 9 3 8
 Cruisers 4 1 5 4 6 7
 Destroyers 3 8 5 8 6 8
 Submarines 5 6 7 9

1	7	6	4	2	5	9	3	8
8	5	3	7	6	9	1	2	4
9	4	2	3	8	1	7	5	6
7	3	1	2	4	6	8	9	5
2	9	8	1	5	7	4	6	3
4	6	5	8	9	3	2	1	7
5	1	4	6	7	2	3	8	9
6	2	7	9	3	8	5	4	1
3	8	9	5	1	4	6	7	2

Battleship Sudoku Example and Solution

In addition, you are now using a 9 x 9 Sudoku grid with some starting numbers already placed. You are also trying to complete the Sudoku puzzle following standard Sudoku rules: each number 1-9 occurs exactly once in each column, each row, and each 3 x 3 box. One additional rule: each starting number in the grid must always represent water in the solution—not a ship piece.

Work back and forth between solving a Battleships puzzle and a Sudoku puzzle to find the solution.

	1	4							2
6									2
	3			4					3
		8	3		2				3
3	5		1		9		2	6	1
			4		5	1			2
				3			5		2
								3	2
						7	9		3
	1	6	0	0	7	0	1	2	3

- Battleship 8 7 6 9
 Cruisers 2 8 9 6 8 7
 Destroyers 1 4 1 9 2 5
 Submarines 1 2 2 6

Battleship Sudoku 1

									5
									3
									2
		1				9			2
				2		8			1
					5				2
				4		6			2
		3				7			1
									3
									1
	2	3	3	2	0	2	2	3	3

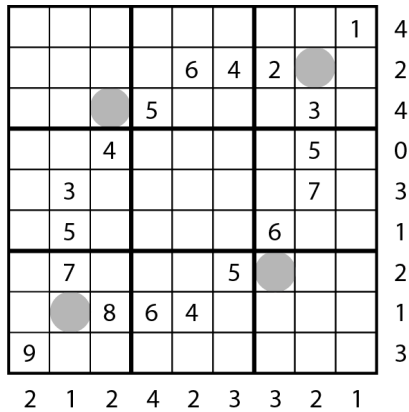
- Battleship 1 8 4 5
 Cruisers 2 8 7 3 9 5
 Destroyers 3 5 3 5 4 8
 Submarines 1 1 1 2

Battleship Sudoku 2

*All Battleship Sudoku puzzles appear in *Battleship Sudoku* by Thomas Snyder (2008)

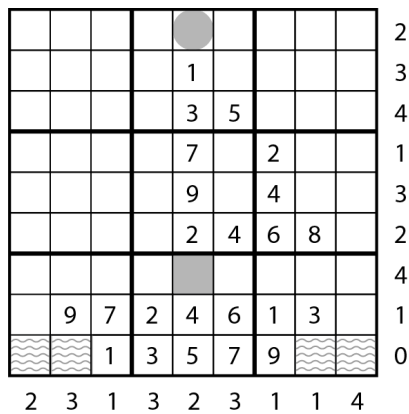
Battleship Sudoku – Page 2

Solve the following Battleship Sudoku puzzles. Each grid contains the ten ships shown below the grid. Each ship may appear horizontally or vertically, but no two ships can occupy adjacent grid cells, not even diagonally. The numbers along the grid's perimeter indicate the number of cells in the corresponding rows and columns that contain ship segments. As with Sudoku puzzles, each number 1-9 occurs exactly once in each column, each row, and each 3 x 3 box. Also, each starting number in the grid must always represent water in the solution—not a ship piece.



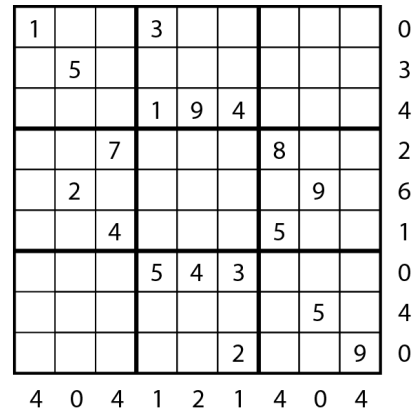
- Battleship **2 8 7 5**
 Cruisers **1 2 4 5 6 7**
 Destroyers **1 4 1 8 1 9**
 Submarines **2 2 4 8**

Battleship Sudoku 3



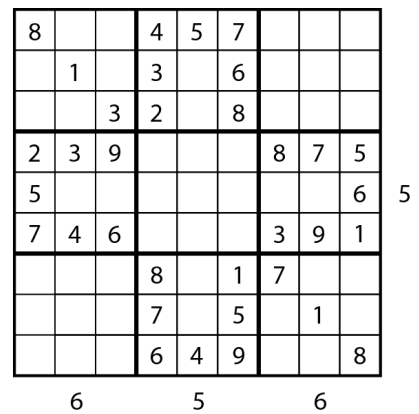
- Battleship **4 8 2 6**
 Cruisers **1 8 9 6 2 8**
 Destroyers **3 6 3 7 3 8**
 Submarines **5 6 7 8**

Battleship Sudoku 5



- Battleship **2 3 5 8**
 Cruisers **3 1 5 6 8 7**
 Destroyers **2 6 3 7 3 8**
 Submarines **1 1 2 7**

Battleship Sudoku 4

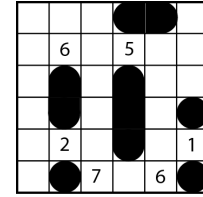


- Battleship **2 8 7 6**
 Cruisers **4 8 6 6 2 7**
 Destroyers **1 8 2 4 5 6**
 Submarines **3 5 9 9**

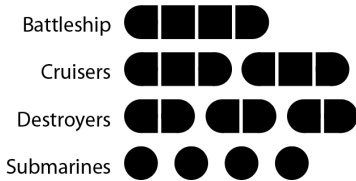
Battleship Sudoku 6

Ocean View Battleships

In the grids below, imagine that there is a fish with binoculars on each number. There are no ship segments on the numbered squares. Each number represents the number of non-ship pieces that are visible from that position horizontally and vertically (not including the number itself). Other standard Battleships rules apply. A small example is shown at the right. Can you locate all of the ships?

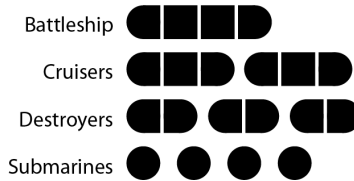


								11	
18									
					2				
	8								2
		4		2					5
						18			
				3					3
			18						



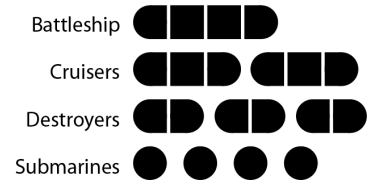
Ocean View Battleships 1

	3								
						18			
					7				
						18			
									6
		2			3				
18									



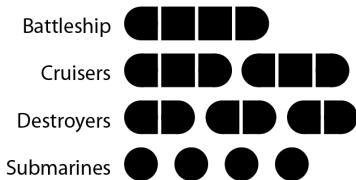
Ocean View Battleships 2

		8							4
						17			
							3		
									4
					3				
		2				1			8



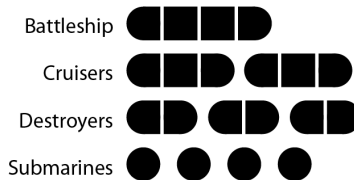
Ocean View Battleships 3

	9								
		8							3
					2				
								7	
		2							
3									



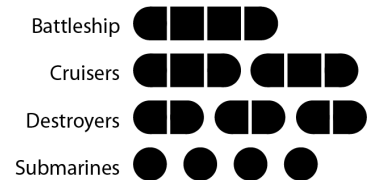
Ocean View Battleships 4

						5			
		2							
		6							
							2		
2									8



Ocean View Battleships 5

			5						6
9									
		3							
								4	
						5			
							9	8	
		3							

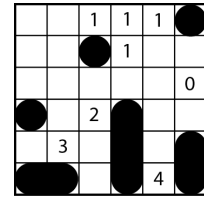


Ocean View Battleships 6

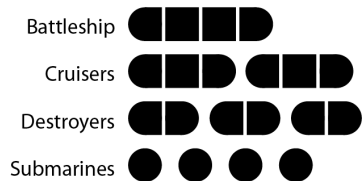
*All Ocean View Battleship puzzles appeared in *Games World of Puzzles* magazine (August, 2003)

Minesweeper Battleships

This is a combination of Battleships and Minesweeper, and it is similar to Ocean View Battleships in that the numbered squares represent water. Each numbered square indicates the number of the eight adjacent squares (horizontally, vertically, and diagonally) that contain ship segments. Other standard Battleships rules apply. A small example is shown at the right. Can you locate all of the ships?

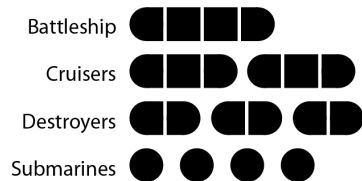


0									2
		5			1	1			3
1									
									0
					0				
				0	0				
1		2	1						
0	1						4	4	2
	2								
		1	0						0



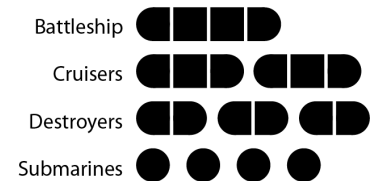
Minesweeper Battleships 1

		1	2	2	2				
1		4						3	
			2						
			1	0					
0	1	1					2		1
			3	3				1	
1						0			
							1		
		0	0					2	2



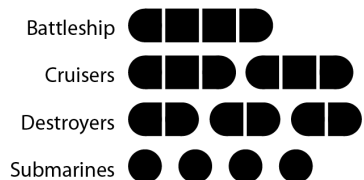
Minesweeper Battleships 2

		4			4	3			
			3			3		3	
								4	
								3	
	4								
			3						
	2								
						4			



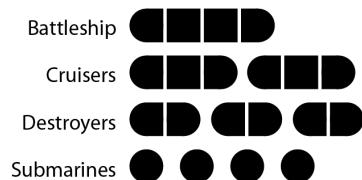
Minesweeper Battleships 3

1			1	1		2	3		
			3	4					1
	1								1
						0	1		
				0		1			
			2			2	2	2	
2			1	1					0



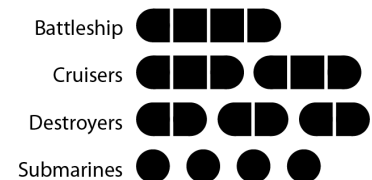
Minesweeper Battleships 4

		0						2	
			0				2	2	1
		1		3					
	3								
				3			0		
		4	3			1			
		3							
						0		2	
							2		
0		1							1



Minesweeper Battleships 5

									1
		0			1			3	
1							2		
					0	1			1
		2			2	2			
	1					1			
				1	1			2	
3							3		
				2					
					1				1

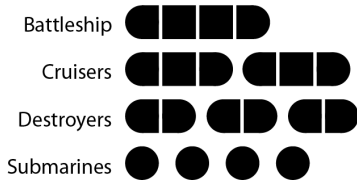
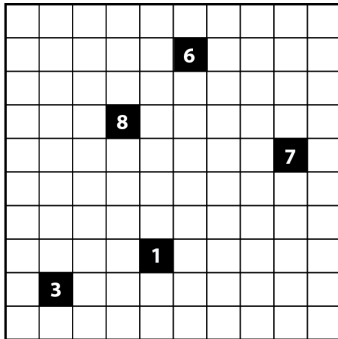
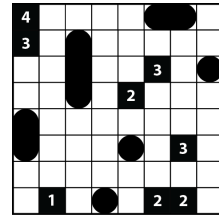


Minesweeper Battleships 6

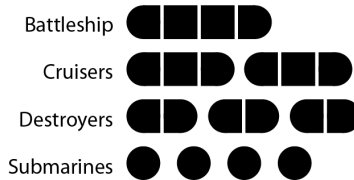
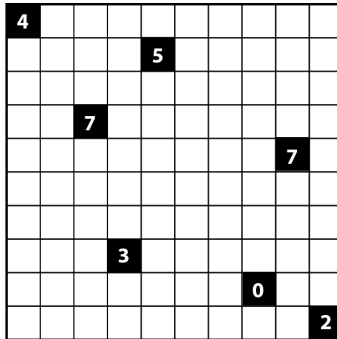
*All Minesweeper Battleship puzzles appeared in *Games World of Puzzles* magazine (August, 2003)

Lighthouse Battleships

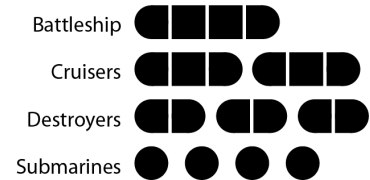
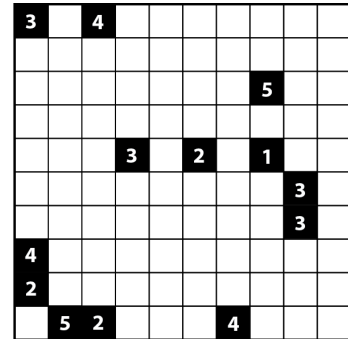
This is a combination of Battleships and the Lighthouse puzzles popularized by the Dutch *Brein Brekers* magazine. The numbered squares are lighthouses, and indicate the total number of ship segments that are lit by that lighthouse (that is, the number of parts of ships that are in the same row and column as the lighthouse). Ships cannot touch the lighthouses—not even diagonally. Other standard Battleships rules apply. A small example is shown at the right. Can you locate all of the ships?



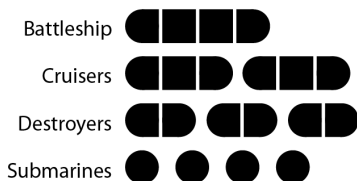
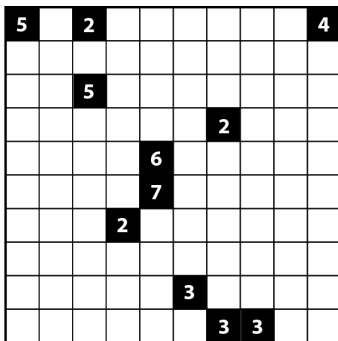
Lighthouse Battleships 1



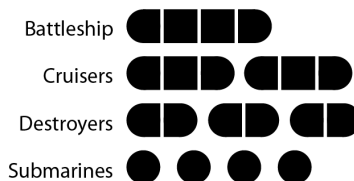
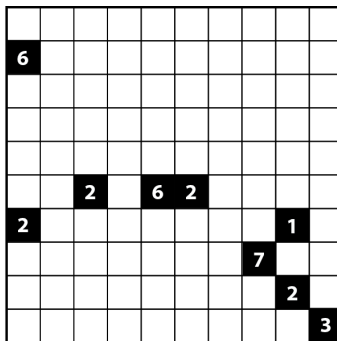
Lighthouse Battleships 2



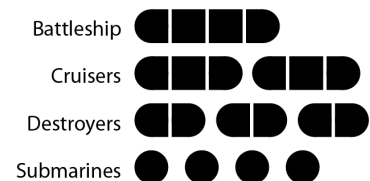
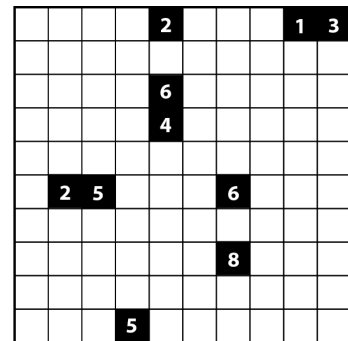
Lighthouse Battleships 3



Lighthouse Battleships 4



Lighthouse Battleships 5



Lighthouse Battleships 6

*All Lighthouse Battleship puzzles appeared in *Games World of Puzzles* magazine (August, 2003)

Resources

Interactive Websites

- Conceptis Ltd. (2015). Battleships. <http://www.conceptispuzzles.com/?uri=puzzle/battleships>
- Stone, K. (2015). BrainBashers Daily Battleships. <https://www.brainbashers.com/battleships.asp>
- DKM Software. (2015). Dkm Yubotu Online. <http://dkmgames.com/yubotu.htm>

Website

- Battleship Variations. (2015). <http://www.mountainvistasoft.com/variations.htm>

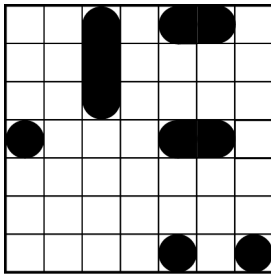
Books

- Clarity Media. (2012). Brilliant Battleships: 100 of the Best Battleship Puzzles. CreateSpace Independent Publishing Platform
- Gordon, P. & Shenk, M. (2008). BATTLESHIP Puzzles: 108 Challenging Logic Puzzles. Sterling.
- Snyder, S. (2008). Battleship Sudoku: The Classic Naval Combat Game. Sterling.

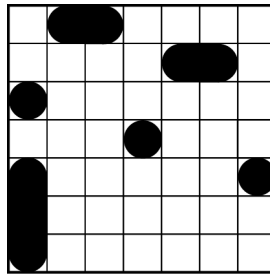
Apps

- Frozax Games: Battleship Solitaire Puzzles
- DKM Software: Yubotu Deluxe

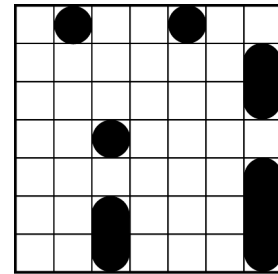
Mini Battleships Solutions



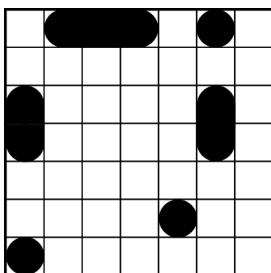
Mini Battleships 1



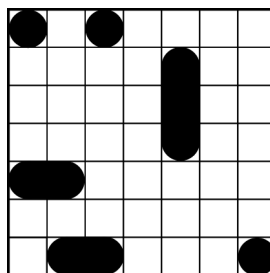
Mini Battleships 2



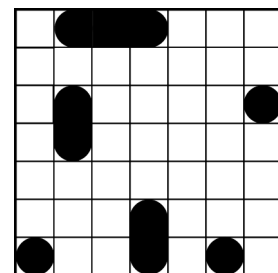
Mini Battleships 3



Mini Battleships 4

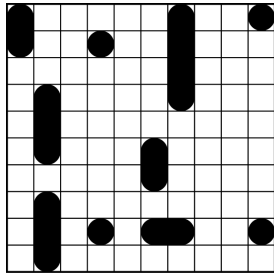


Mini Battleships 5

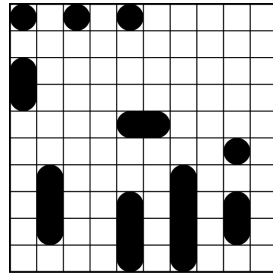


Mini Battleships 6

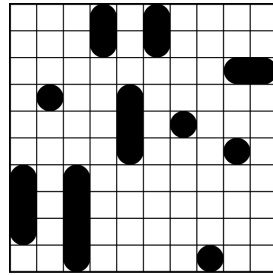
Battleships Solutions



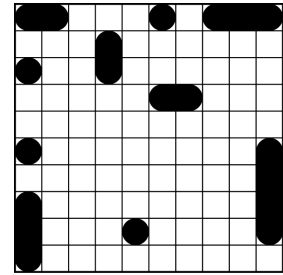
Battleships 1



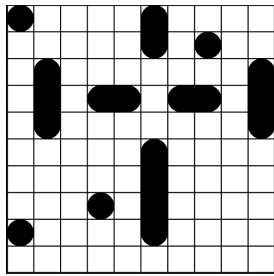
Battleships 2



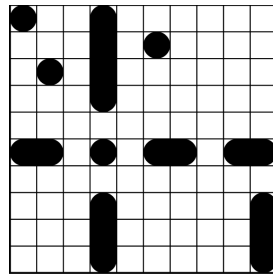
Battleships 3



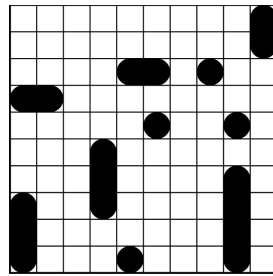
Battleships 4



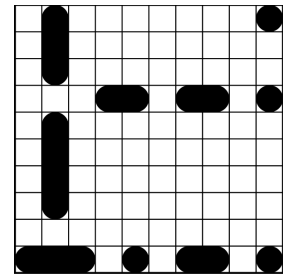
Battleships 5



Battleships 6



Battleships 7



Battleships 8

Digital Battleships Solutions

3	9	1	6	9	4	4	5	7	4
5	7	4	5	9	1	1	5	5	2
9	5	5	6	3	3	9	5	9	9
4	4	6	4	3	8	1	6	8	8
6	3	5	1	8	7	7	1	3	1
5	9	3	9	7	3	1	7	5	7
1	2	9	4	1	2	2	6	4	5
8	3	9	3	8	8	3	8	1	9
1	2	6	4	5	3	4	5	6	4
1	9	3	4	1	9	4	3	1	2

Digital Battleships 1

1	6	6	4	5	5	4	6	6	9
4	1	3	8	7	9	3	6	9	5
8	4	8	2	4	9	3	2	8	9
5	1	1	8	5	9	9	1	1	9
9	4	4	2	2	9	1	6	5	1
6	5	5	9	5	6	8	9	1	2
4	7	8	4	9	1	6	6	3	7
3	6	7	3	4	3	9	7	7	8
7	5	4	9	2	4	3	7	5	3
6	7	2	6	7	9	9	9	8	2

Digital Battleships 2

9	1	3	2	3	8	7	4	7	3
7	4	4	1	9	4	9	9	2	6
2	6	2	2	2	9	9	6	6	2
4	9	7	6	5	3	3	7	6	6
4	8	2	1	5	1	8	4	4	4
3	9	3	1	1	5	4	4	5	1
1	3	3	3	1	4	4	7	5	7
2	3	6	5	8	5	9	1	3	4
9	6	1	6	5	8	8	2	7	3
3	3	5	3	6	2	5	7	2	1

Digital Battleships 3

3	2	7	4	4	2	6	3	1	6
6	1	4	3	1	2	9	8	6	9
2	7	4	5	7	2	9	4	2	9
4	6	4	8	9	6	5	4	2	1
2	4	3	3	1	5	9	1	6	1
7	3	5	1	5	3	5	7	6	2
7	4	3	7	4	8	8	1	7	5
9	7	2	6	3	7	3	2	1	2
1	5	7	9	9	3	9	9	8	2
3	6	8	4	4	4	9	4	1	9

Digital Battleships 4

3	7	9	5	2	1	8	1	2	8
5	8	8	6	1	9	6	8	5	6
2	2	2	9	1	9	7	2	2	9
9	5	9	6	9	4	6	6	3	2
8	9	4	2	2	3	7	3	3	6
3	6	1	4	2	6	2	5	8	6
7	7	5	7	4	9	2	7	1	6
6	2	9	2	2	9	6	9	5	2
3	5	5	5	7	1	7	8	6	7
7	5	8	7	8	4	5	6	6	5

Digital Battleships 5

9	7	6	4	2	6	7	7	8	3
3	2	2	1	2	3	9	3	6	1
3	7	4	2	6	4	6	9	9	2
9	6	7	9	8	1	4	9	7	7
4	7	3	1	3	2	7	5	3	2
5	6	8	2	6	5	7	6	6	2
1	9	5	2	9	5	8	3	3	4
8	1	3	9	4	1	6	7	4	3
7	4	1	2	3	2	5	3	3	4
3	2	2	8	4	4	6	4	8	9

Digital Battleships 6

Battleship Sudoku Solutions

8	1	4	9	2	3	5	6	7
6	2	9	8	5	7	3	1	4
7	3	5	6	4	1	2	8	9
1	4	8	3	6	2	9	7	5
3	5	7	1	8	9	4	2	6
2	9	6	4	7	5	1	3	8
9	6	2	7	3	4	8	5	1
5	7	1	2	9	8	6	4	3
4	8	3	5	1	6	7	9	2

Battleship Sudoku 1

5	4	8	1	2	9	3	6	7
9	2	7	6	4	3	5	1	8
6	3	1	5	8	7	9	4	2
3	5	6	2	9	8	4	7	1
4	8	9	7	5	1	2	3	6
7	1	2	4	3	6	8	9	5
8	6	3	9	1	2	7	5	4
1	9	4	8	7	5	6	2	3
2	7	5	3	6	4	1	8	9

Battleship Sudoku 2

3	6	5	7	8	2	9	4	1
1	9	7	3	6	4	2	8	5
4	8	2	5	1	9	7	3	6
8	1	4	9	7	6	3	5	2
2	3	6	4	5	1	8	7	9
7	5	9	2	3	8	6	1	4
6	7	3	1	9	5	4	2	8
5	2	8	6	4	7	1	9	3
9	4	1	8	2	3	5	6	7

Battleship Sudoku 3

1	4	6	3	5	7	9	2	8
9	5	3	8	2	6	7	1	4
2	7	8	1	9	4	3	6	5
3	9	7	2	6	5	8	4	1
5	2	1	4	7	8	6	9	3
8	6	4	9	3	1	5	7	2
7	1	9	5	4	3	2	8	6
4	3	2	6	8	9	1	5	7
6	8	5	7	1	2	4	3	9

Battleship Sudoku 4

7	1	9	8	6	2	3	4	5
4	5	3	7	1	9	8	2	6
6	2	8	4	3	5	7	9	1
1	8	4	6	7	3	2	5	9
2	7	6	5	9	8	4	1	3
9	3	5	1	2	4	6	8	7
3	6	2	9	8	1	5	7	4
5	9	7	2	4	6	1	3	8
8	4	1	3	5	7	9	6	2

Battleship Sudoku 5

8	9	2	4	5	7	1	6	3
4	1	7	3	9	6	5	8	2
6	5	3	2	1	8	9	4	7
2	3	9	1	6	4	8	7	5
5	8	1	9	7	3	4	2	6
7	4	6	5	8	2	3	9	1
3	6	4	8	2	1	7	5	9
9	2	8	7	3	5	6	1	4
1	7	5	6	4	9	2	3	8

Battleship Sudoku 6

Ocean View Battleships Solutions

									11
18									

Ocean View Battleships 1

3									
18									

Ocean View Battleships 2

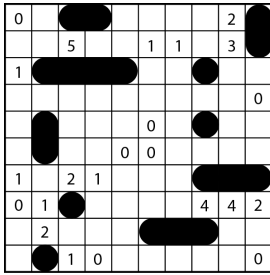
Ocean View Battleships 3

Ocean View Battleships 4

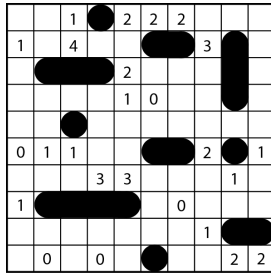
Ocean View Battleships 5

Ocean View Battleships 6

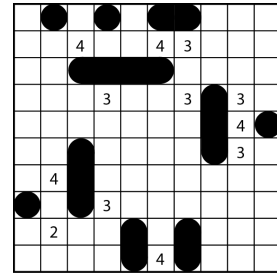
Minesweeper Battleships Solutions



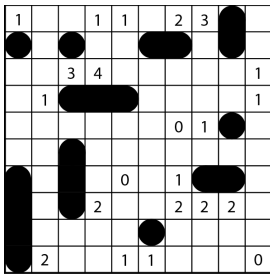
Minesweeper Battleships 1



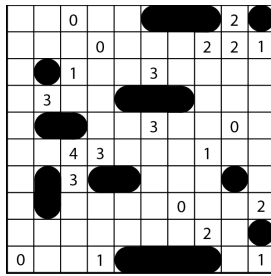
Minesweeper Battleships 2



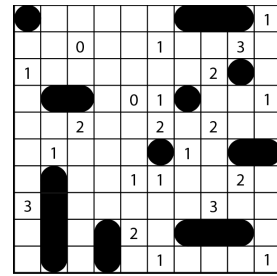
Minesweeper Battleships 3



Minesweeper Battleships 4

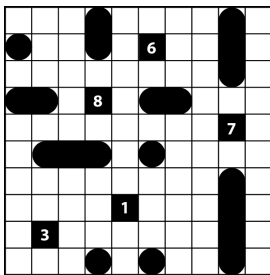


Minesweeper Battleships 5

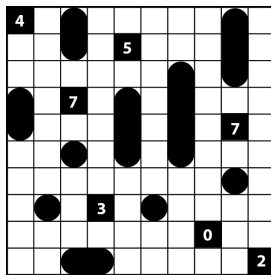


Minesweeper Battleships 6

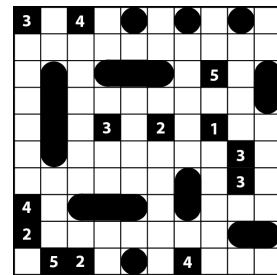
Lighthouse Battleships Solutions



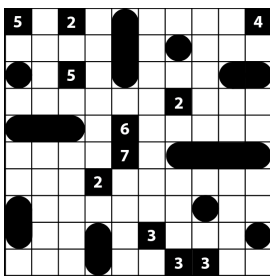
Lighthouse Battleships 1



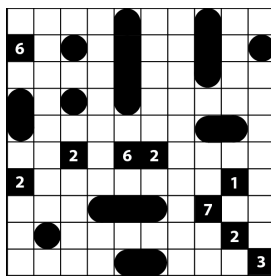
Lighthouse Battleships 2



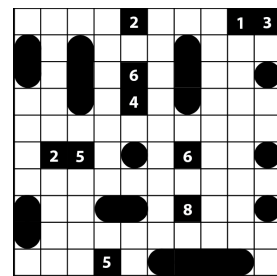
Lighthouse Battleships 3



Lighthouse Battleships 4



Lighthouse Battleships 5



Lighthouse Battleships 6