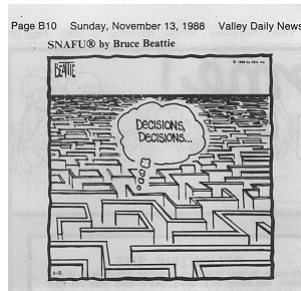


Games in the Classroom ~Examples~



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2006 Consortium for Computing Sciences in Colleges
- Northwestern Region

Selected Game Examples



2006 Consortium for Computing
Sciences in Colleges - NW
Games - Orr, 2006

- Craps - dice
 - War - cards
 - Mancala - board
 - Reversi - board
 - Sudoku - board
 - Mazes - board
- Good for cs1, cs2, or algorithms.
 - Can be played at one computer.
 - Can use simple text interface (GUI extra credit)

Craps



2006 Consortium for Computing
Sciences in Colleges - NW
Games - Orr, 2006

- Dice
- Based on chance.
- 1 player
- Data Structures: Encapsulation (Die class)
- Algorithms: random numbers (dice roll), conditionals



[Play game](#)

War



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Sciences in Colleges - NW
Games - Orr, 2006

- Cards
- 2 players
- Data Structures: Encapsulation (Cards and Deck), Lists, Queues, Stacks
- Algorithms: control structure, random numbers (shuffling cards)



[play game](#)

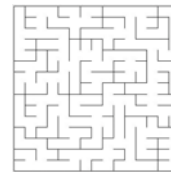
Mancala, Reversi, Sudoku, Mazes



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Games - Orr, 2006

Game Characteristics:

- Abstract
- Board
- No Hidden Information
- Deterministic
- 1 or 2 Players
- 1D or 2D or 3D Arrays

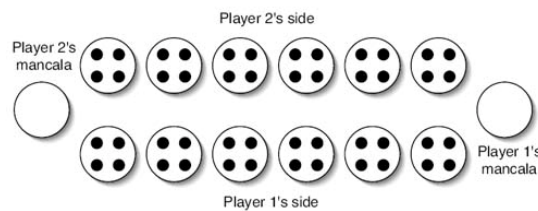


Mancala



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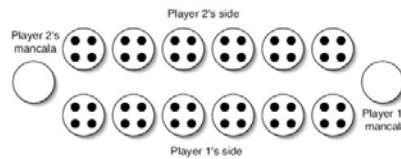
- 2 Players
- Data Structures: 1D array (List ADT)
- Algorithms: while loops, logic for rules, mod function, AI (if play against computer)



[play game](#)

Mancala Rules

- **Players:** 2
- **Object:** To have the most pebbles in your mancala (goal) at the end of game.
- **Board:** The Mancala board consists of 14 pits, each holding a number of pebbles. Initially, it looks like:



Mancala Rules (cont)

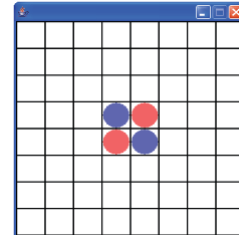
- **Play:** On your turn, pick up all of the pebbles in any non-empty pit on your side of the board. Proceeding counterclockwise, sow one pebble in each pit until you run out. When sowing, include your own mancala, but not your opponent's.
- **Free move:** If the last pebble you sow lands in your own Mancala, you get another move.
- **Capture:** If the last pebble you sow lands in a previously empty pit on your side of the board, you move that pebble, as well as any pebbles in the pit directly across the board, into your mancala.
- **End game:** The game ends when, after either player's move, one player has no pebbles left in any of the six pits on her side of the board. The other player moves all of the pebbles left on his side of the board to his mancala.

Reversi



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Games - Orr, 2006

- 2 Players
- Data Structures: 2D arrays
- Algorithms: logic for rules, challenging looping, operator overloading, AI (if play against computer)



[play game](#)

Sudoku



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Games - Orr, 2006

- 1 Player
- Data Structures: 2D array
- Algorithms: recursion or logic rules, interesting looping

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

459	245	245	3	2	49	157	57	169
579	35		1	8	79	6	4	235
167		346	1	479	5	379	8	368
	2	7						
	1	6	57	4	5	2	3	9
3	459	459	6	199	19	12	24	7
	2	9	46	7	19	3	1	6
168	7	234	9	46	8	26	1	234
48	134	9	9	5	14	7	6	234
459	145	245	2	3	14	579	457	49
8	8	88			9			

play game:

- [recurse](#)
- [recurse-animate](#)
- [rules](#)

All About Sudoku



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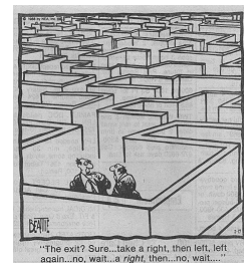
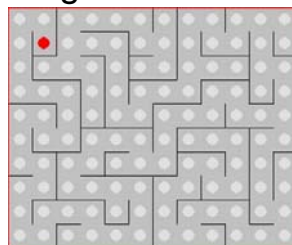
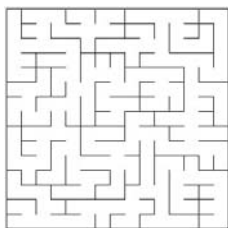
- Rules
<http://en.wikipedia.org/wiki/Sudoku>
<http://www.sciencenews.org/articles/20050618/mathtrek.asp>
- Solving
http://www.sudoku.org.uk/PDF/Solving_Sudoku.pdf
http://www.conceptispuzzles.com/products/sudoku/solution_examples.htm

Maze Creation



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Sciences in Colleges - NW
Games - Orr, 2006

- Data Structures: 2D array (or 3D)
- Algorithms: recursion, trees, graphs, union-find
- Starting point for game creation.



- create maze:
- [Tree recurse](#)
 - [Union-find](#)

All about Mazes

- Games:
 - <http://www.mazepuzzle.com/PuzzleIndex.htm>
 - <http://www.clickmazes.com/index.htm>
 - Crossword puzzles
<http://mrl.nyu.edu/~perlin/homepage2006/crossword/index.html>
- Maze Classification
<http://www.magitech.com/%7Ecruiser1/labyrnth/algrithm.htm>
- 3D Maze Example
<http://mrl.nyu.edu/~perlin/experiments/borg/>
- Maze Art
<http://www.dgp.toronto.edu/~karan/maze/>

Conclusion

- Games provide a fun context for learning computer science concepts.
- Games vary in complexity and in the type of algorithms and data structures that are required.
- For every algorithm or data structure, there is some game that uses it.

Craps Rules



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Games - Orr, 2006

- Players: 1
- Play: Declare how much money you wish to bet, then roll two dice. If the sum is 7 or 11, you win the amount of the bet. If the sum is 2, 3, or 12, you lose this amount. Otherwise, the sum is your point. Roll until either you roll your point again (and win) or you roll a 7 (and lose).

War Rules



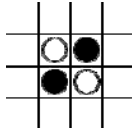
2006 Consortium for Computing
Sciences in Colleges - NW
Games - Orr, 2006

- Players: 2
- Object: To force other player to run out of cards.
- Setup: deal out the entire deck, 26 cards to each player. Cards are kept in a face down pile.
- Play: In each round, each player turns up top card on his pile. The player with the higher ranking card takes both cards and adds them to the bottom of his pile. A tie is resolved by "war": each player plays three cards from his pile face-down and then another face-up. The high card among these last two wins all ten cards. Subsequent ties are handled similarly.

Reversi Rules



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Sciences in Colleges - NW
Games - Orr, 2006

- Players: 2, black and white
- Object: To have the most pieces of your color on the board at the end of the game.
- Board: 8x8 square grid. Initially, has in center: 
- Play: On a turn, a player places one of her pieces on an empty board square. Every line (hor, vert, diag) of the opponent's pieces which is bounded on one end by the just-played piece and on the other end by another friendly piece is captured; all the captured pieces change color.
A player must capture if possible. If no capturing move is available, the player must pass.
- End game: The game is over when neither player has a legal move.

Sudoku Rules



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Games - Orr, 2006

- Players: 1
- Play: Fill in all of the squares on the board with the numbers 1 to 9 so that no number is repeated
 - Across any row.
 - Down any column.
 - Within any given 3x3 square identified by the bold outline.