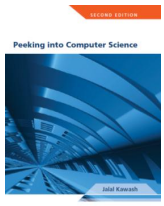
Introduction



Peeking into Computer Science

- Mandatory: Chapter 1
- Optional: None

Reading Assignment

Spreadsheet Design

Long-lasting spreadsheets

3

At the end of this section, the student will be able to:

1. Judge the design of a spreadsheet
2. Divide a spreadsheet into five sections
3. Understand the role of each section

Objectives

- Good character
- Easy to build
- Easy to read
- Easy to use
- Easy to change
- Error free

Spreadsheet Properties

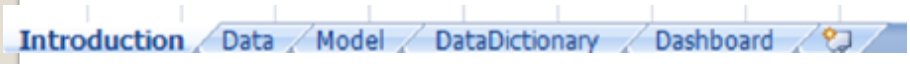
	A	B	C	D	E	F
1		Income	Rent	Income Tax	Other Tax	Net Income
2	Dad	$ 85,000.00	$12,000.00	$ 25,500.00	$ 400.00	$ 47,100.00
3	Mom	$ 90,000.00	$12,000.00	$ 27,000.00	$ 400.00	$ 50,600.00
4	Daugther	$ 12,000.00	$ 1,000.00	$ 3,600.00	$ 400.00	$ 7,000.00
5	Son	$ 3,000.00	$ 200.00	$ 900.00	$ 400.00	$ 1,500.00
6	Totals	$ 190,000.00	$25,200.00	$ 57,000.00	$ 1,600.00	$106,200.00

Example of Poor Spreadsheet

- Introduction:
  - Introduction, title, description, and contents
- Model:
  - Main form data
- Data Dictionary
  - Explains columns and calculations
- Data:
  - Data used in your sheet
- Dashboard
  - Visual reports (charts)

Contents of a Spreadsheet

- The actual data forms are determined by the purpose of the spreadsheet
  - What is the function of the sheet?
- Sections should be in different 'tabs' (sheets)
  - Especially for larger examples



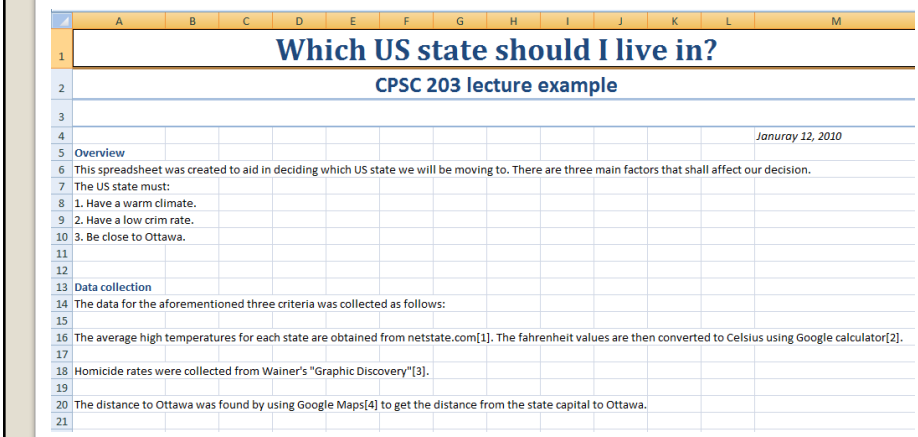
Notes

1. Make a formal introduction
2. Title of the sheet must be informative
3. Declare the purpose
4. Give clear instructions
5. Reference critical ideas
6. Map the content

Intro Section – Design Tips

- Intro section should give the user a clear idea of how the sheet ties with the real world
- Intro devices:
  - Include a title that passes critical info
  - Declare the purpose
  - Give directions on how to use the model
  - Include references
  - Include a table of contents

Intro – 1. Make a formal intro



	A	B	C	D	E	F	G	H	I	J	K	L	M
1	**Which US state should I live in?**												
2	**CPSC 203 lecture example**												
3													
4													*Januray 12, 2010*
5	**Overview**												
6	This spreadsheet was created to aid in deciding which US state we will be moving to. There are three main factors that shall affect our decision.												
7	The US state must:												
8	1. Have a warm climate.												
9	2. Have a low crim rate.												
10	3. Be close to Ottawa.												
11													
12													
13	**Data collection**												
14	The data for the aforementioned three criteria was collected as follows:												
15													
16	The average high temperatures for each state are obtained from netstate.com[1]. The fahrenheit values are then converted to Celsius using Google calculator[2].												
17													
18	Homicide rates were collected from Wainer's "Graphic Discovery"[3].												
19													
20	The distance to Ottawa was found by using Google Maps[4] to get the distance from the state capital to Ottawa.												
21													

Example Intro

- Title must at least include:
  - Name of the model
  - Date
  - Name of creator
- Properties of a title:
  - Short
  - Apt (to the point)
  - Memorable

Intro – 2. Informative Title

- Tell the spreadsheet user what the spread sheet is all about

5	**Overview**
6	This spreadsheet was created to aid in deciding which US state we
7	The US state must:
8	1. Have a warm climate.
9	2. Have a low crim rate.
10	3. Be close to Ottawa.
11	

Intro – 3. Declare the Purpose

- Give clear step-by-step Instructions on how to use the spreadsheet
- Especially important if the user needs to later make changes to the data or calculations
- Not necessary for small examples (such as our US States example)

Intro – 4. Give Instructions

- Cite all resources used to create the spreadsheet if any
- Use APA or other format for citation:
  - J. Nevison, *The Elements of Spreadsheet Style,* Prentice-Hall, 1987
  - http://pages.cpsc.ucalgary.ca/~tamj/2007/203W/assignments/references.html (if you have no clue as to what format to use)
- A Table of Contents (TOC) can be a good idea too

Intro – 5 & 6. Refs and TOCs

	A	B	C	D	E	F	G	H	I	J	K	L
21												
22												
23												
24	**Table of Contents**											
25	Model:	Explains the calculations conducted in the Data tab, as well as listing all formulas used.										
26	Data Dictionary:	Explains each set of data so that its type and description are given.										
27	Data:	Contains the raw data and calculations.										
28	Dashboard:	Contains charts based on the Data tab.										
29												
30												
31	**References**											
32	1. Nstate LLC. (2009, September 24). Retrieved September 25, 2009, from netstate.com: www.netstate.com											
33	2. Google. (2009, September 25). Google Calculator. Retrieved September 25, 2009, from google.com: www.google.com											
34	3. Wainer, H. (2004). Graphic Discovery: A Trout in the Milk and Other Visual Adventures. Princeton: Princeton University Press.											
35	4. Google. (2009, September 25). Google Maps. Retrieved September 25, 2009, from http://maps.google.com											
36												

Example Intro

- Includes raw and calculated data
- This is the actual spread sheet

Data

	A	B	C	D	E
1	**State**	**Avg high temperature**	**HomicideRate**	**Time to Ottawa**	**Objective Value**
2	Alabama	33	12	20.37	49.826
3	California	33.44	8.8	41	47.432
4	Connecticut	29.33	3.9	7.12	55.425
5	Georgia	33.44	8.7	18.26	52.03
6	Ilinois	30.6	9.8	15.19	51.242
7	Kansas	33.8	6.1	21.7	52.75
8	Louisiana	34	16.1	25	47.15
9	Maine	26	1.8	17.13	53.474
10	Maryland	30.6	10.9	9.13	51.904
11	Minnesota	28.55	2.8	19.7	53.225
12	Mississippi	33.6	14.2	22.27	48.526
13	Nebraska	31.94	3.9	20.11	53.61
14	New Hampshire	28.11	2.2	6.13	56.107
15	New York	29.61	6.3	5.25	54.683
16	South Dakota	30.27	3	25	52.581
17					
18					
19	**Weights**				
20	Temperature	30%			
21	Homicide	50%			
22	Time to Ottawa	20%			
23					

Example Raw Data

- Model includes assumptions and calculations
- Explain the model:
- Should provide three levels of explanation:
  - Explain the values appearing in the model
  - Explain tricky formulas
  - A complete listing of all used formulas

Model Section

	A	B	C	D	E	F	G	H	I	J	K	L	M	N
1	**Model**													
2														
3	There are three factors adding to our final preference: The average high temperature, the homicide rate and the time to ottawa.													
4	However, the three factors are not of the same importance. Thus, each of the factors is given a *weighting* based on how important we think it is.													
5														
6	The weight were decided as follows:													
7	AvgTempWeight		30%											
8	HomicideRate		50%											
9	Close to Ottawa		20%											
10														
11	Since lower homicide rates are clearly preferred, the weight is applied to 100 - HomicideRate.													
12	Also, since a smaller time to Ottawa is preferred, the Time to Ottawa needs to have a negative effect on the final objective value. Thus, a longer tr													
13														
14	The final formula for the Objective Value is thus:													
15														
16	**Formula for Objective Value**		AvgTemp*AvgTempWeight + (100 - HomicideRate) * HomicideWeight - TimeToOttawa*TimeOttawaWeight											
17														

Example Model

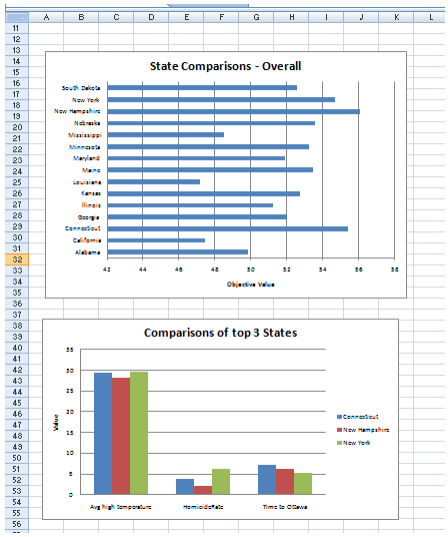
- Explains the meaning of your data
- Give each field:
  - A type: categorization, raw data, column calculation, row calculation
  - A data type: text, number, integer, percentage, etc…
  - A sheet/cell reference: the sheet where the field is and where in the sheet (cell range)
  - A description: brief narrative

Data Dictionary

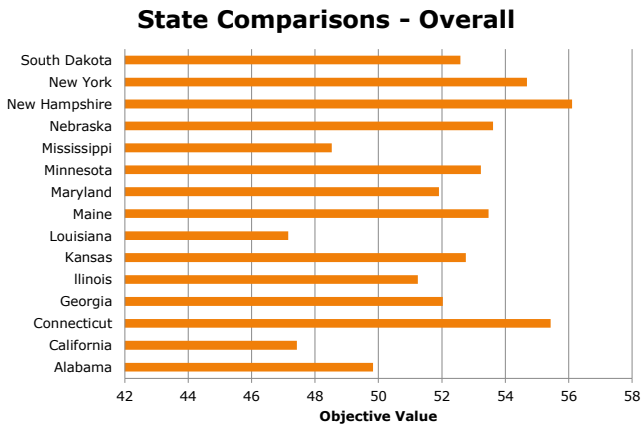
	A	B	C	D	E	F	G
1						Data Dictionary	
2							
3							
4	**Name**	**Field Type**	**Data Type**	**Sheet/Cell Reference**			
5	State	Categorization	Text	Data!A2:A16			
6	Avg high temperature	Raw	Float	Data!B2:B16			
7	Homicide Rate	Raw	Float	Data!C2:C16			
8	Time to Ottawa	Raw	Float	Data!D2:D16			
9	Objective Value	Row Calculation	Float	Data!E2:E16			
10	Weights	Raw	Percentage	Data!B20:B22			
11							

Example Data Dictionary

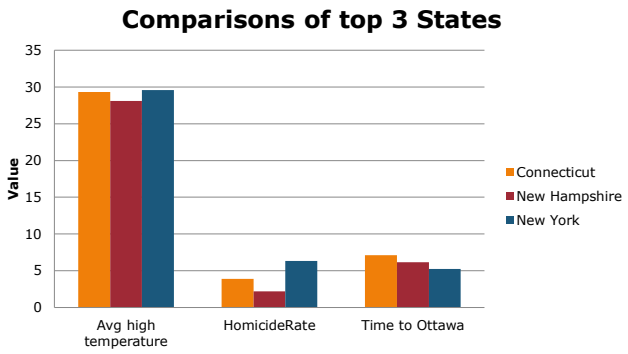
- Visual Charts and conclusions



Dashboard



Example Dashboard



Example Dashboard

- Analyze and comment on every chart
- Include a conclusion/discussion section

Dashboard (or Conclusion)

Abstraction

The power to simplify

27

- Problems (and solutions) can be overwhelming
  - Too much details
- Abstraction: hiding irrelevant details

Abstraction

- Library
- Very complex
- To an end-user, it can be abstracted by the circulation desk

Abstraction Example

- Car
- Also very complex
- To driver, it can be abstracted by how to operate it
- To a passenger, it is simply a commuting device

Abstraction Example

JT: Robot example (minor modifications to the Kawash example)

- Develop an algorithm for a simple robot (similar in movement capabilities to a Roomba™).
- Movement:
  - The robot can move forward one distance unit (a 'square').
- Rotation:
  - If forward motion is not possible then the robot can rotate left or right by 90 degrees.
- Short range sensors:
  - One is mounted forwards, the other is mounted on the right.
  - The sensors check for obstacles in the next square.

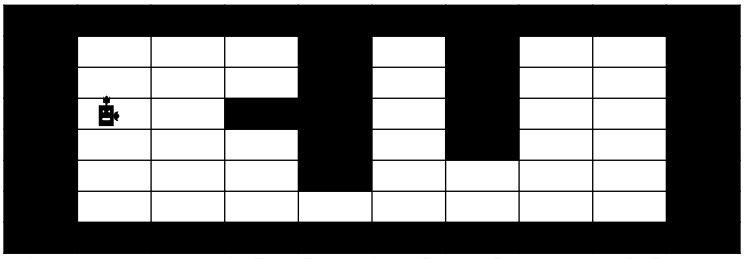
Another Problem: Robotic Movement[1]

1 From "Peeking into Computer Science" and the lecture notes of Jalal Kawash

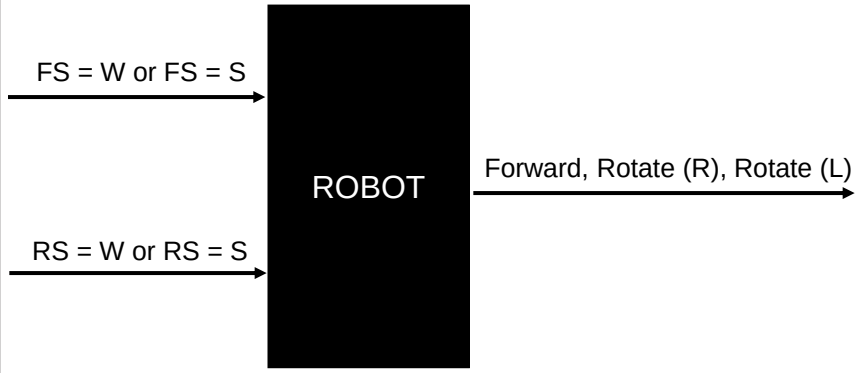
- What does the robot need to do:
  - Find a wall/obstacle.
  - Hug the wall, indefinitely moving forward.
- Input:
  - Whatever is detected by the sensors (front, right).
- Output:
  - The robot's movement

Specifying The Problem

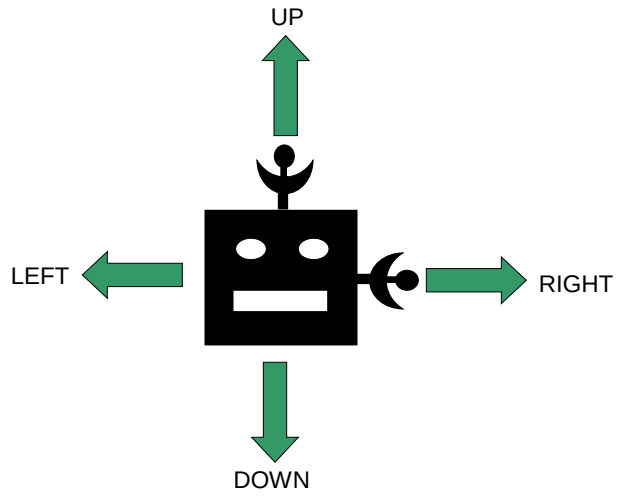
- Since the robot can either move onto a square that's empty or avoid a square that is occupied, the world can be simplified into two cases:
  - The destination square is empty: 'space'.
  - The destination square is not empty: 'wall' (contains a wall, furniture, person, pet etc.)
    - Details about exactly why the destination isn't empty isn't important so simplify the problem.



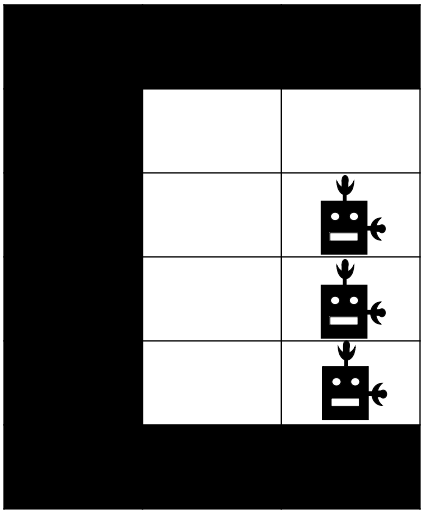
The Contents Of The Robot's World



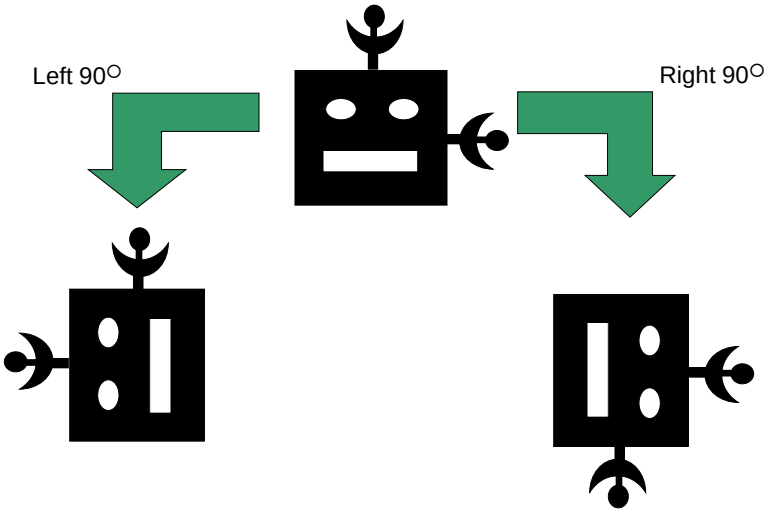
Inputs/Outputs Based On The World



Robot's Orientation



Robot: Moving Forward



Robot: Rotations

- Search for the wall
- Once found, keep it to the robot's right
- Move forward
  - Each move, make sure the wall is still to the robot's right.
  - (This means there should be a space in front and the wall to the right).
- Robot's modes:
  - Search for the wall
  - Hug the wall

Solution: The Generic Algorithm For Movement

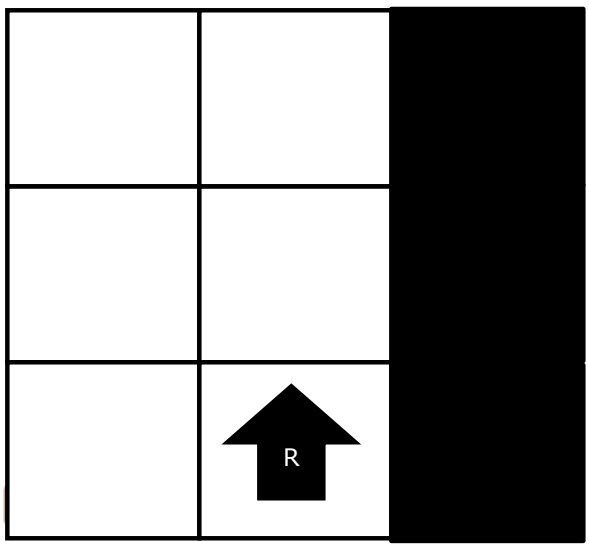
Repeat the following steps, until this phase is done (wall found, change to the wall hugging mode)

- If **RS = W**, then done this phase
  - Right sensor detects a wall
- If **FS = W**, then **L,** done this phase
  - Front sensor detects a wall, rotate left
- If **FS = S**, then **F**
  - Right sensor senses a space, take a step forward

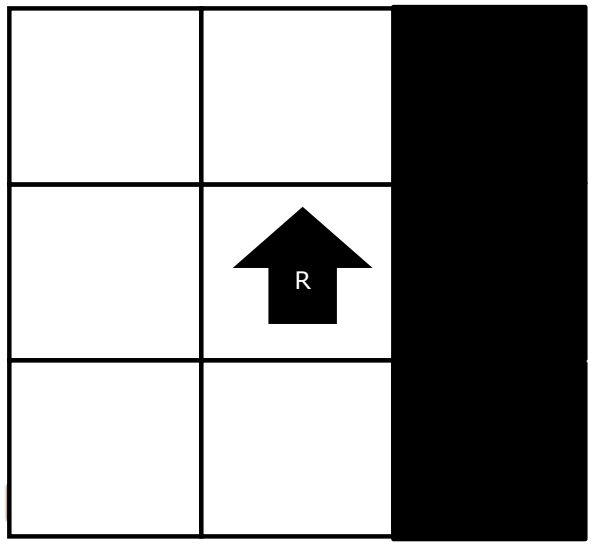
Algorithm: Search For The Wall

- Need to make sure that the wall is not "lost" during movement.
- Complexity: all cases must be considered.

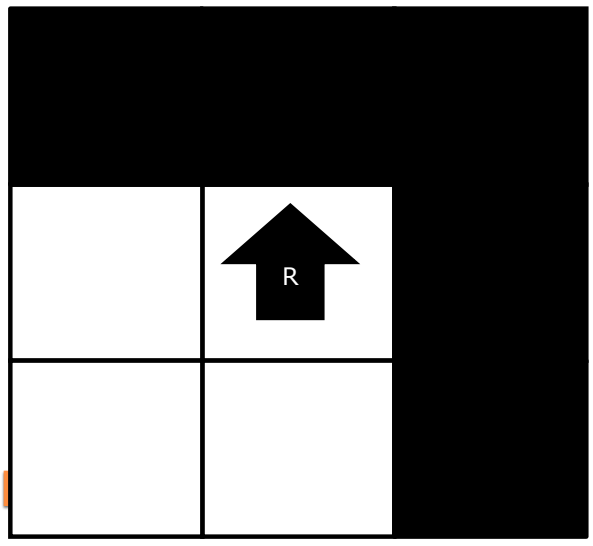
Algorithm: Hug The Wall



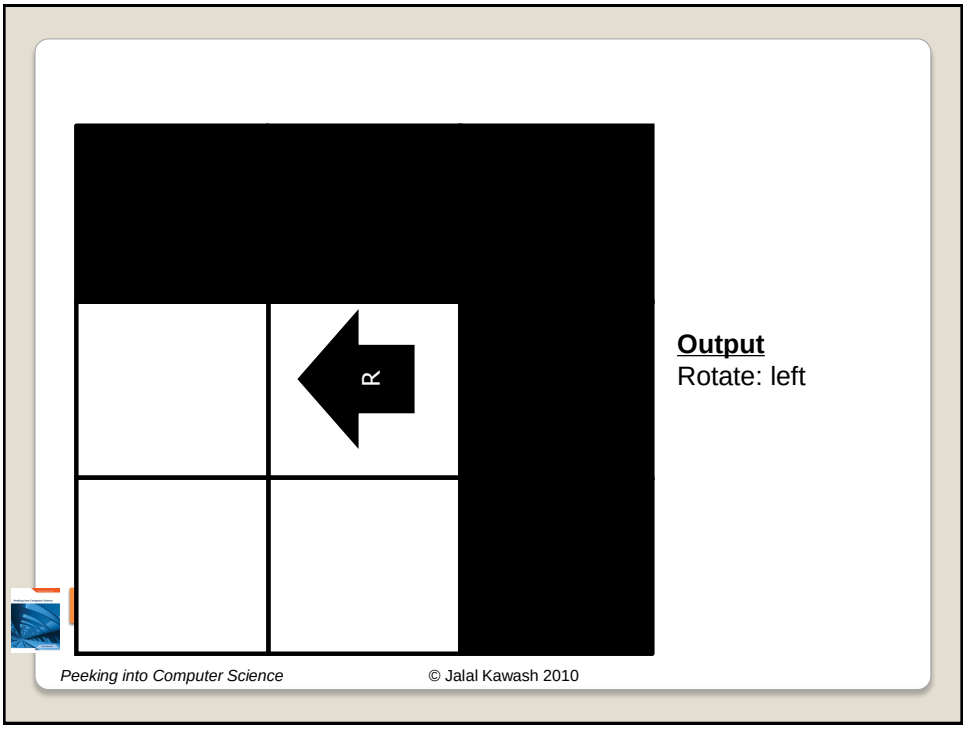
Input
RS = W
FS = S

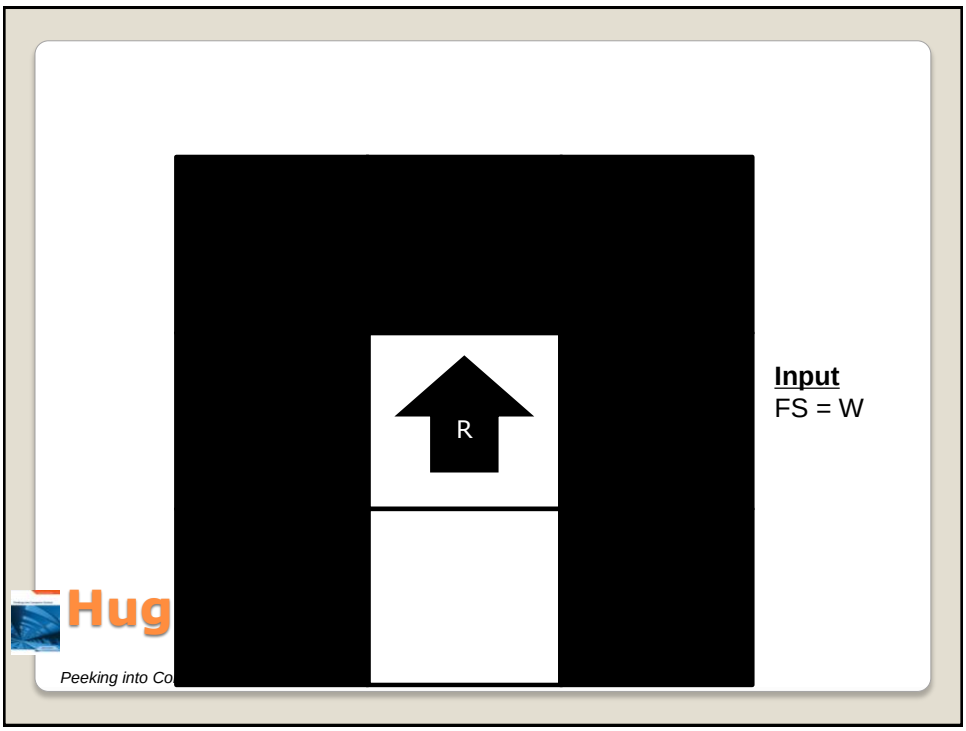


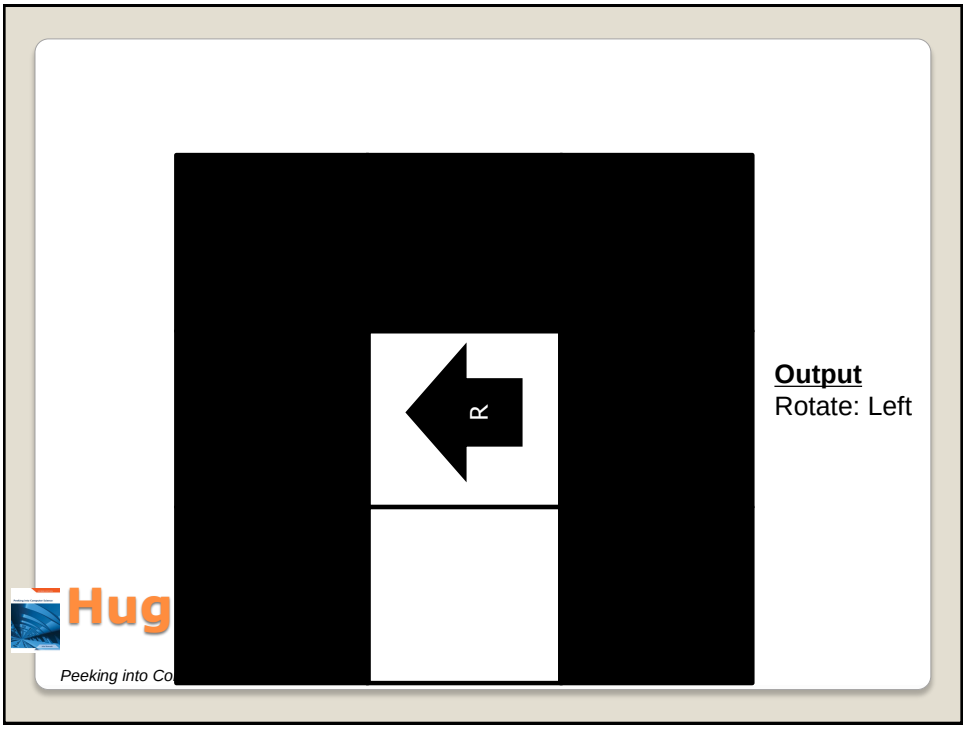
Output
Movement: forward

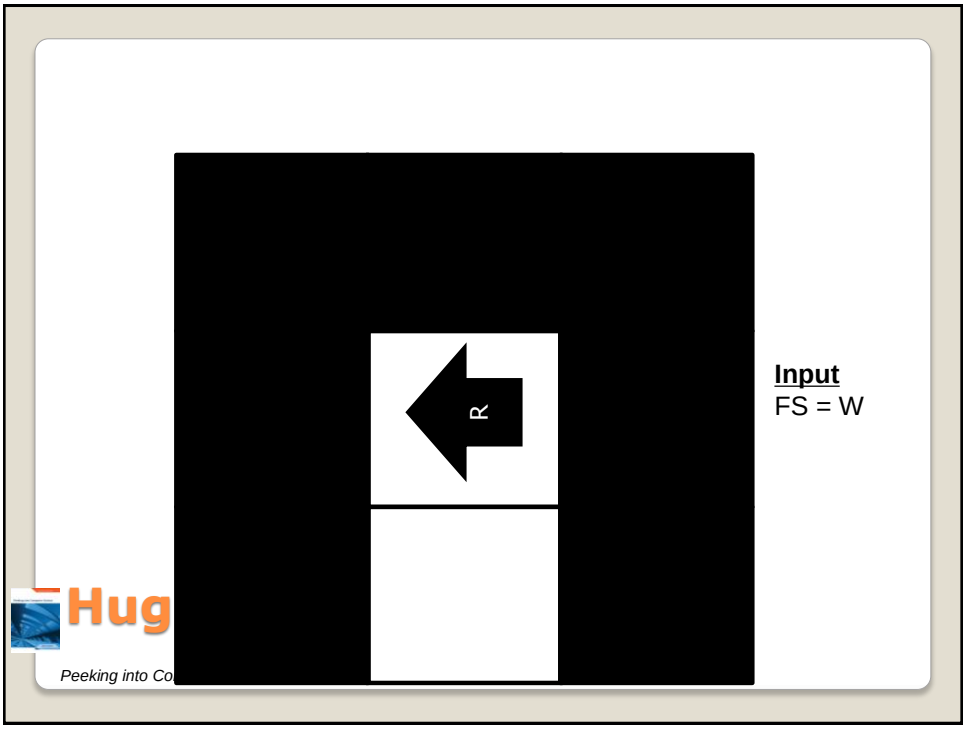


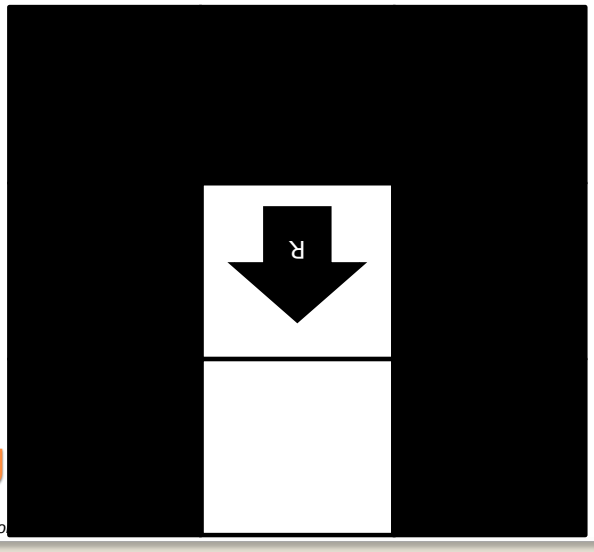
Input
FS = W


R
Output
Rotate: left
Peeking into Computer Science
© Jalal Kawash 2010


R
Input
FS = W
Hug
Peeking into Co

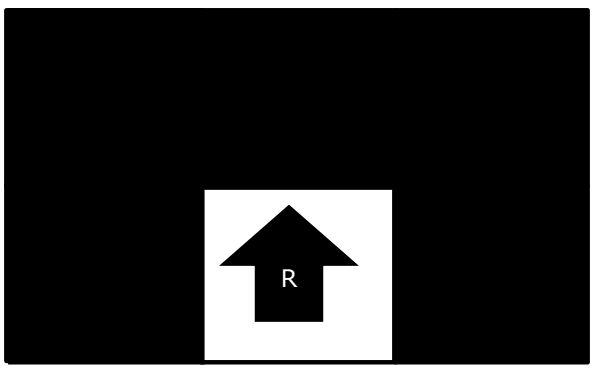

R
Output
Rotate: Left
Hug
Peeking into Co


R
Input
FS = W
Hug
Peeking into Co



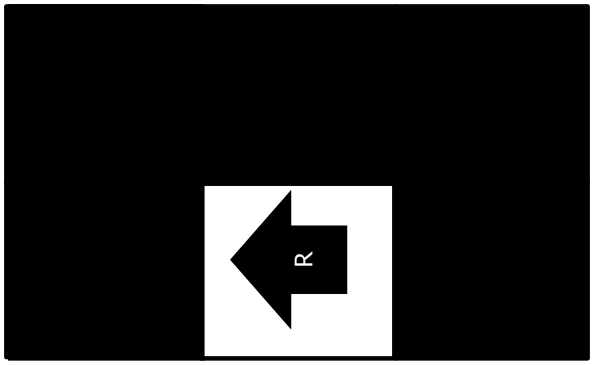
Output
Rotate: Left

Hug



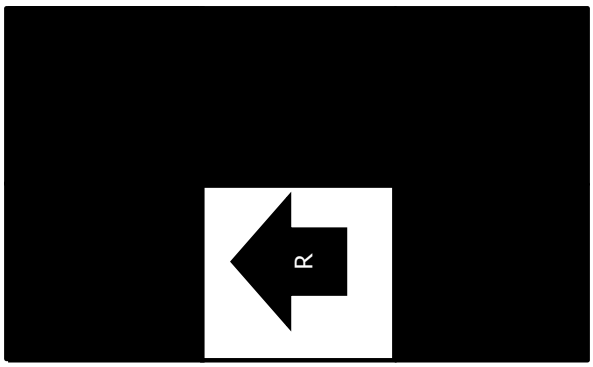
Input
FS = W

Hug The Wall: Case 3



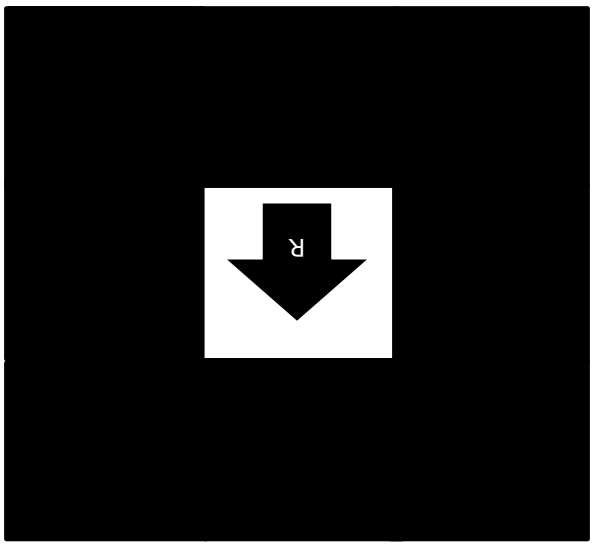
Output
Rotate left

Hug The Wall: Case 3

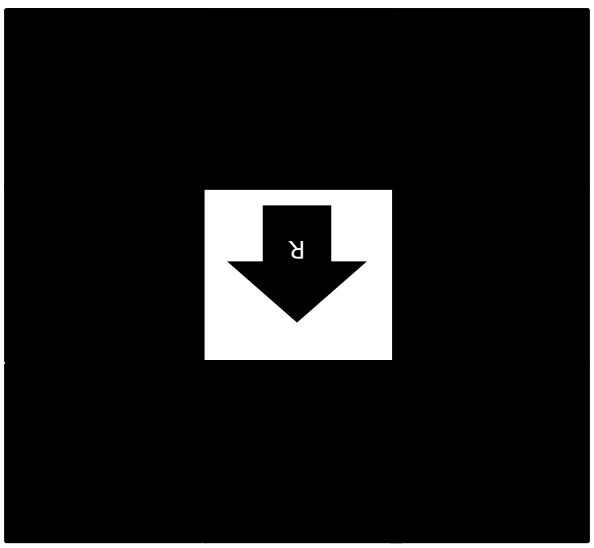


Input
FS = W

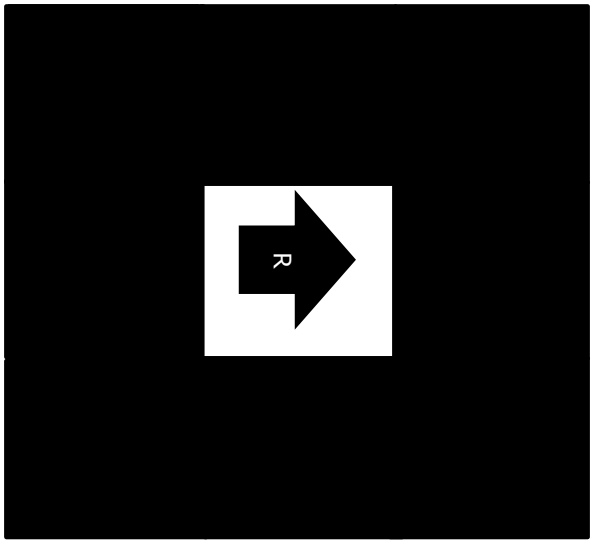
Hug The Wall: Case 3



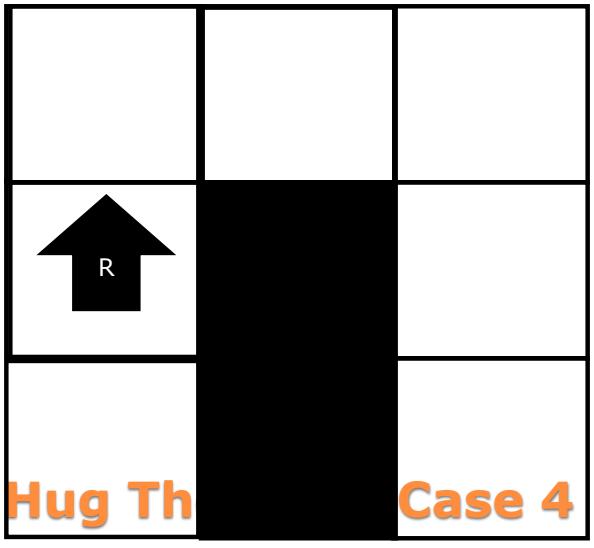
Output
Rotate left



Input
FS = W

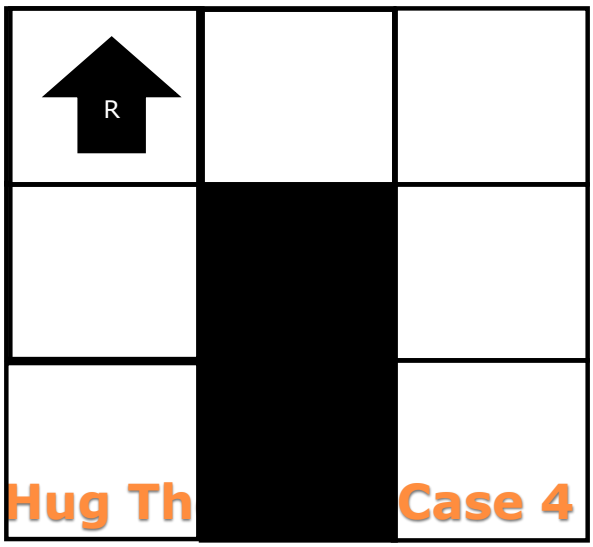


Output
Rotate left



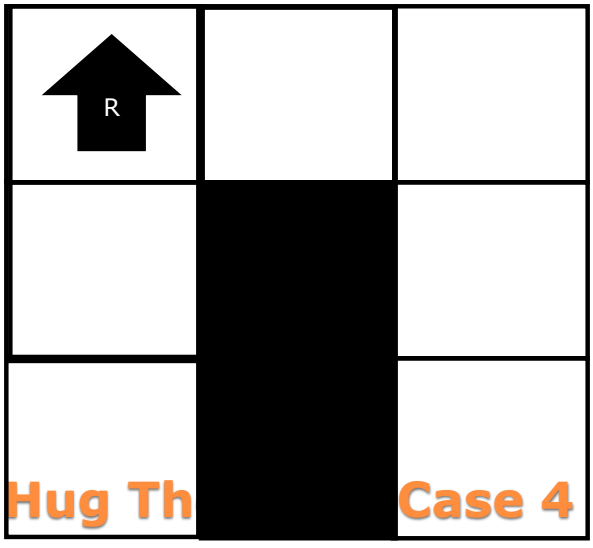
Input
FS = S
RS = W

Hug Th Case 4



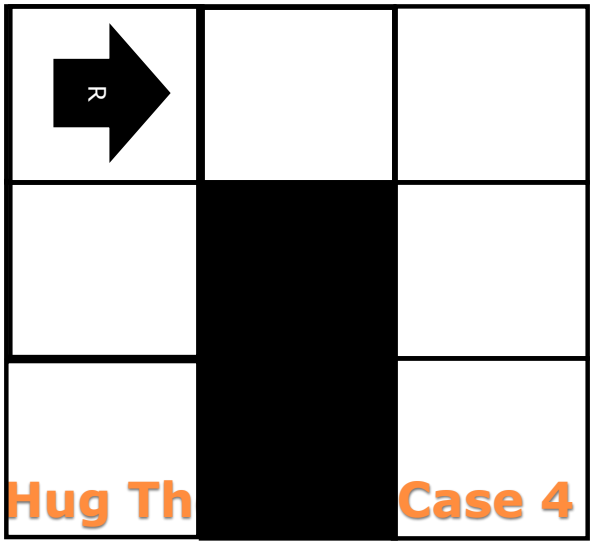
Output
Movement:
Forward

Hug Th Case 4



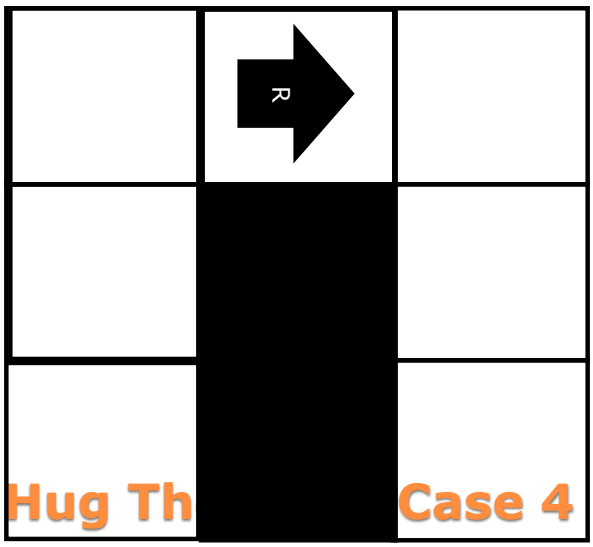
Input
FS = S
RS = S

Hug Th Case 4



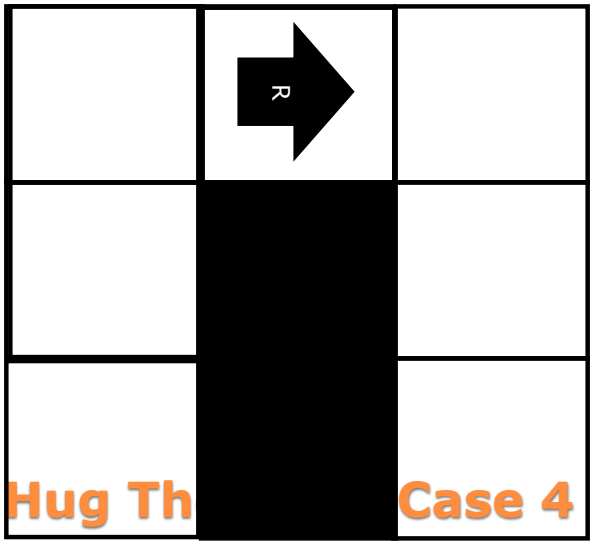
Output (Step 1)
Rotate: right

Hug Th Case 4



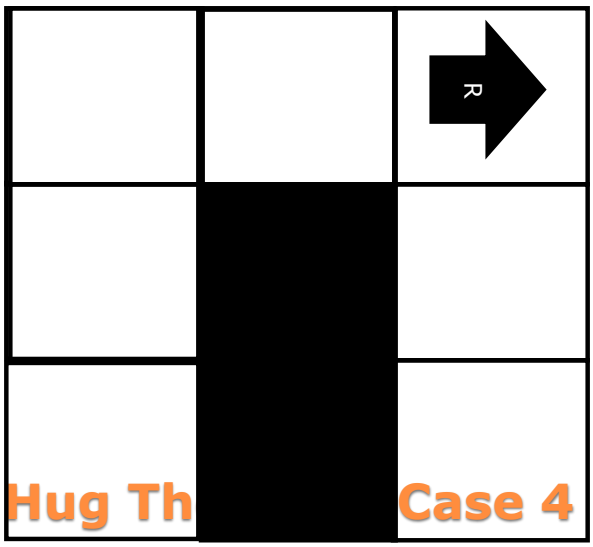
Output (Step 2):
Movement:
forward

Hug Th Case 4



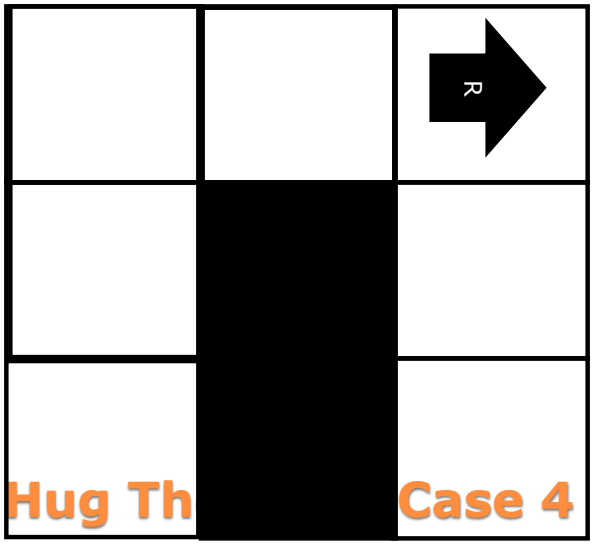
Input:
FS = S
RS = W

Hug Th Case 4



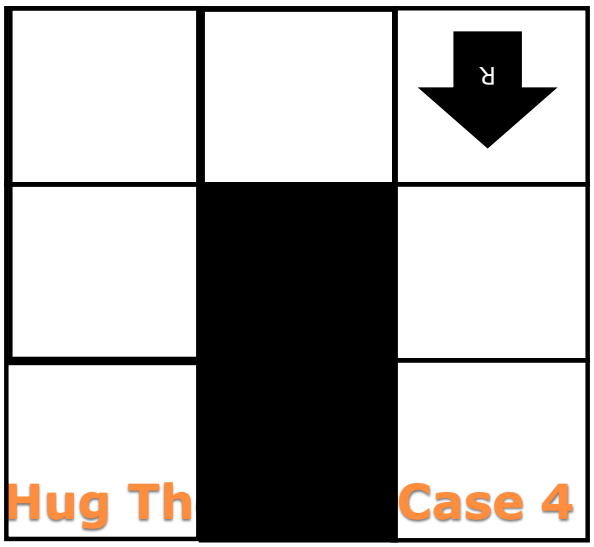
Output:
Movement:
forward

Hug Th Case 4



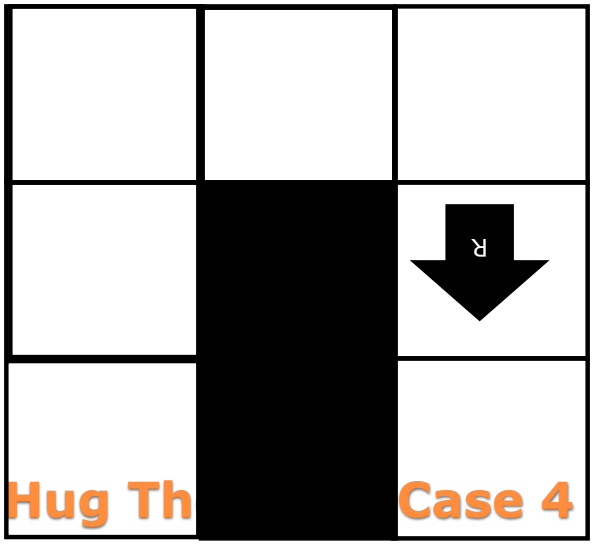
Input:
FS = S
RS = S

Hug Th Case 4



Output (step 1):
Rotate: right

Hug Th Case 4



Output (step 2):
Movement: foward

Hug Th Case 4

Repeat the following steps:

1. If **RS = W** and **FS = S**, then **F**
2. If **FS = W**, then **L**
3. If **RS = S** and **FS = S**, then **R** and **F**

Algorithm: Hug The Wall

