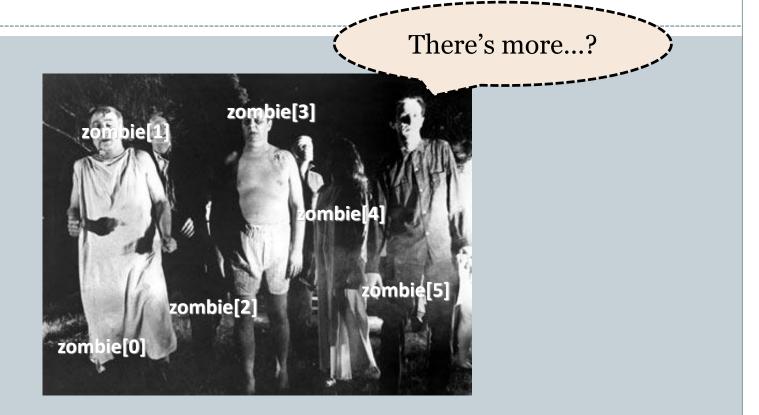
### Problem Decomposition Revisited (Again and Again...): Object Oriented Design



Fundamentals of Computer Science

# Outline

#### Object Oriented Design

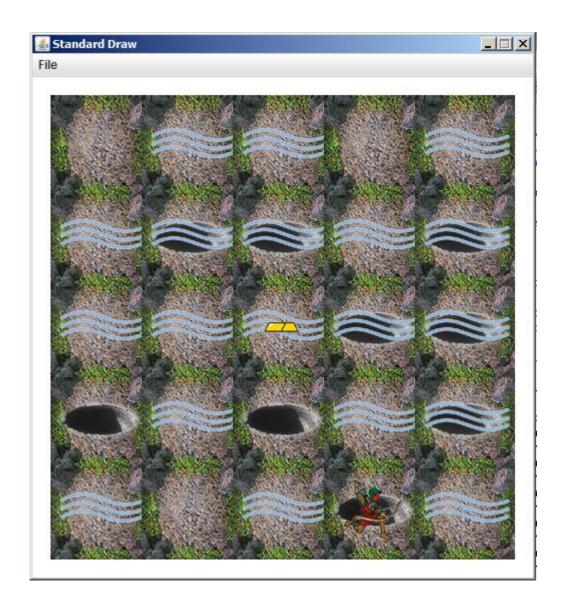
- Identify the Classes
- Identify what Information each Class Needs
- Identify what each Class Needs to Do



# Software Development Life Cycle

- 1. Understand the Problem = Requirements Analysis
- 2. Work out the Logic = Design
- 3. Convert it to Code = Implementation
- 4. Test/Debug
- 5. Maintenance

Today we will start to analyze and design the solution to a program.



## What are the Nouns?

**The Game.** The Wumpus World game takes place in a cave with different rooms in it. You can think of the cave as an NxM rectangular grid. The player always starts in position 0,0, which is guaranteed to be safe (but it may still be smelly or breezy or glittery).

The objective of the game is to find the gold. The player will know when he/she is in a room with the gold because there will be a "glitter" in that room. If the player detects a glitter, he/she can pick up the gold and the game is won.

Bottomless pits are present in some of the rooms. There is a 20% chance that any given room will have a pit. All rooms adjacent to a pit are breezy, that is, a player entering a room adjacent to a pit will detect a breeze. If the player moves into the room with a pit, he/she falls in and dies a horrible death.

There is only one wumpus in the cave, and he is also placed at random. Rooms adjacent to the wumpus are smelly, that is, a player will detect a stench in a room adjacent to a wumpus. The wumpus cannot move. If the player enters a room with the wumpus, he/she will be eaten, and, once again, die a horrible death.

There is also only one room in the cave that contains the gold. Unlike the other objects, the player has to be in the same room as the gold in order to detect a glitter. Like the wumpus, the gold is placed at random.

The player can move up, down, left, or right. The player also has one arrow. Once it's used up, it's gone. It can be used to shoot a wumpus, and can be shot in any direction the player can move in. If the player is successful in shooting the wumpus, the wumpus will emit a blood-curdling scream, and will no longer be a threat. The only other action the player can perform is to "grab gold".

When the player first starts the game, he/she does not know (and cannot see) where the location of pits, gold and the wumpus are. The only clues are whether the current room is breezy, smelly, or glittery.

## Test Cases I came up with --Class Suggestions on Next Slides

- Does the cave draw as NxM?
- Does player always start in 0,0?
- Does player win when he/she picks up gold?
- Do pits appear in 20% of the rooms (on average)?
- Are rooms adjacent to pits always breezy?
- Does player always die if he/she falls into a pit?
- Is the wumpus always placed randomly?
- Are rooms adjacent to the wumpus always smelly?
- Does player always die if he/she enters a room with a wumpus?
- Is the gold always placed randomly?
- Does the player always move in the correct direction?
- Will the program catch it if the player attempts to move outside of the cave?
- When the player shoots an arrow, is it removed from "inventory"?
- If the player shoots in the direction of a wumpus, and the wumpus is in a direct line, does it always die?
- If a wumpus dies, does the stench go away?
- Are unvisited tiles drawn as unknown?
- Are visited tiles drawn as "lit", or known?

. 1.) If Wumpus is in 0,0 - FAil 2) If pit is in 0,0 - FAIL 3) Uses correct dimensions 4) Player Starts in 0,0 always 5) If glitter then gold 6) If gold picked up, Player wins 7) # of pits should be 20% on average 8) All adjacent rooms must be breczy 9) Player dies if hosh falls in pit

10) On

11) Adi

12) If

13) If

14) Dn

15) I!

16) One

(7) No.

18) Kills

đ

10) Only one wumpus iL 19) Au 11) Adjacents rooms must be smelly iL 20) Une 12) If wumpus dies, stench goes away IS 21) If 13) If player encounters wumpus helshe die St ays 14) Only one gold 15) If keys pressed, player moves in that direction, IF it's in the boundaries of cave Jins 16) One arrow to start ?ray (7) No arrows after arrow is shot CZY 18) Kills wumpus if shot in that direction it

19) Arrow doesn't go out of bounds 20) Unexplored spaces are not shown 21) If player has been in room it is Shown

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Player X, y position Cave Fooms Width height arrow 20% of rooms are pits Wumpus location Gold Location Move draw init Shoot grab Gold get X gut Y gut Y initialize itself< toString draw Arrow

Room Class Cave visited or not draw (self) breeze Stench \_\_inif\_\_ (self, width, height) gold string to String (self) Wumpus pit draw fostring Set (onditions get (onditions in it

## Class API's

Class:	Returns	Method	Parameters	Description
Room		init		Construct a room
		setCondition	condition, value	Set the condition of a room (e.g. breexy, has a Wumpus, etc.)
	boolean value	getCondition	condition	Returns the value of a room condition
		draw	image size, x, y	Draws the room image with contents at the size and x, y location
Cave		init	width, height	Constructs an NxM cave and adds all objects (pits, breezes, etc.)
		draw		Draws the cave with all its rooms
Player		init		Constructs a player
	int x	getX		Returns the x location of the player
	int y	getY		Returns the y location of the player
	boolean	getArrow		Returns whether the player has an arrow left or not
	boolean	move	height, width, direction	Changes players location and returns True if successful, False otherwise
		shootArrow		Removes the arrow from inventory
		draw		Draws the player at his/her current location

13

#### More Tests?

• Write tests that will exercise the defined methods in the APIs

## Summary

#### Object Oriented Design

- Identify the classes
- Identify what information each class needs
- Identify what each class needs to do
- Identify use cases
- Define the API
- Define the instance variables
- Finally write some code!



