

The logo for Oracle Academy is centered on a light gray background. It features the word "ORACLE" in a bold, orange, sans-serif font. Below it, the word "Academy" is written in a smaller, dark gray, sans-serif font. The entire logo is framed by a thin black border, with dark gray horizontal bars at the top and bottom.

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Java Foundations

2-1

The Software Development Process

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Objectives

- This lesson covers the following objectives:
 - Understand the Spiral Model of development
 - Recognize tasks and subtasks of the Spiral Model
 - Recognize what happens when steps are ignored
 - Identify software features
 - Understand how features are gradually implemented



Exercise 1, Part 1



- Your buddy, Clinton, has plans for the weekend
- Check out his email and think about what steps would be necessary to make these plans happen:

Hey buddy,

There's a special Computer History exhibit at the City Museum this month. A few of us are thinking of going Friday at 5:00 PM. Would you want to join? I think the subway would be the best way to get there.

Clinton

Exercise 1, Part 2



- Complete the chart by writing at least one item for each section

Requirements

- What is Clinton's email asking?

Designing a Plan

- What do you need to consider before going out?

Testing

- How do you know the plan worked?

Implementing the Plan

- What actions do you take?

Friday at the Museum



- You may have written something similar to this:

Requirements

- What is Clinton's email asking?
 - Be at the City Museum at 5:00 PM on Friday.

Designing a Plan

- What do you need to consider before going out?
 - Find a time to meet at the campus subway station before 5:00 PM.
 - Look up subway and street maps.

Testing

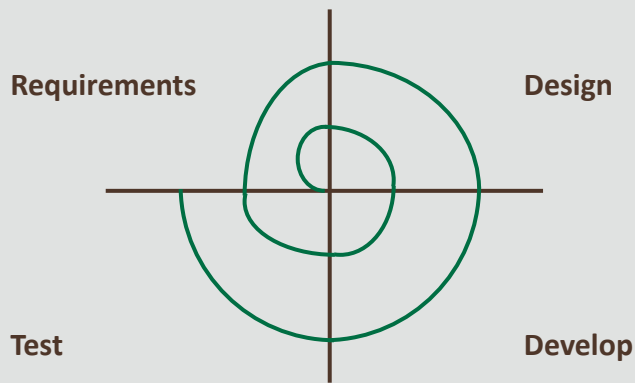
- How do you know the plan worked?
 - Did you get off at the right stop?
 - Are the streets and buildings named what you expect?
 - Do you see any computers?

Implementing the Plan

- What actions do you take?
 - Take the red-line train to South Station.
 - Walk east for 3 blocks.

Introducing the Spiral Model of Development

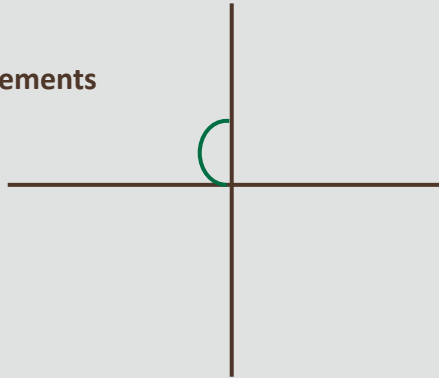
- Developing software requires a similar thought process
- This is represented by the Spiral Model
- There are other models, but the Spiral Model best reflects what you'll be doing in this course



Requirements

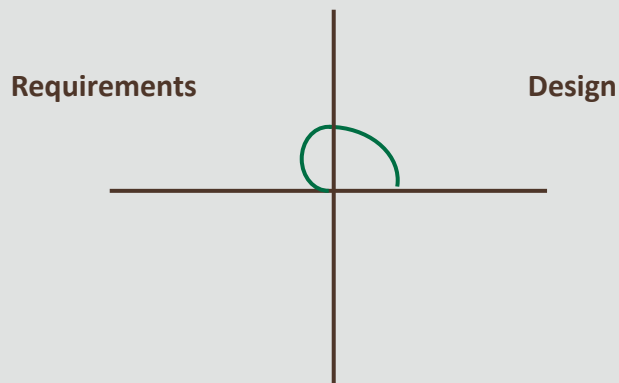
- Carefully read any instructions:
 - What should your program do?
 - What problems is it trying to solve?
 - What features must your program have?

Requirements



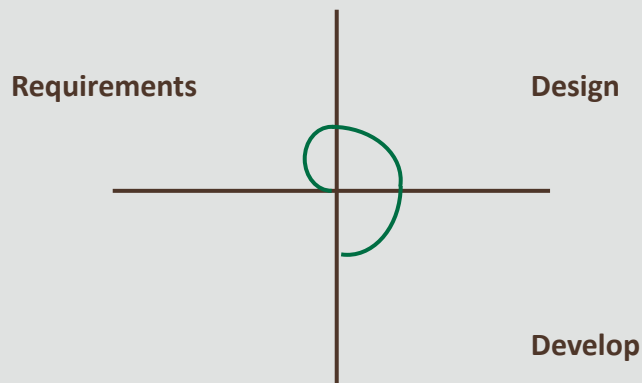
Design

- Plan your approach:
 - Are there data or behaviors your program must model?
 - Will certain parts of your program need to be finished before work can begin on other parts?



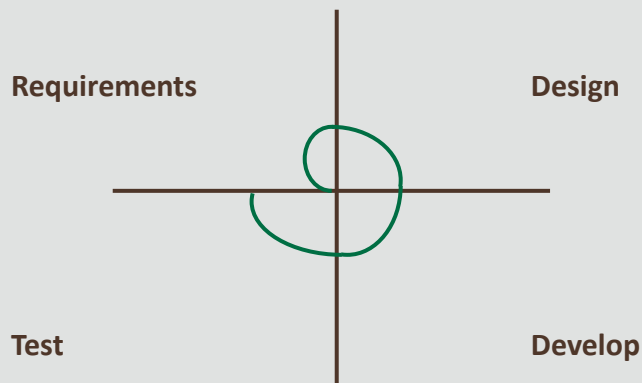
Develop

- Start coding:
 - Create a simplified version of your program
 - Focus on a small number of simple or important features



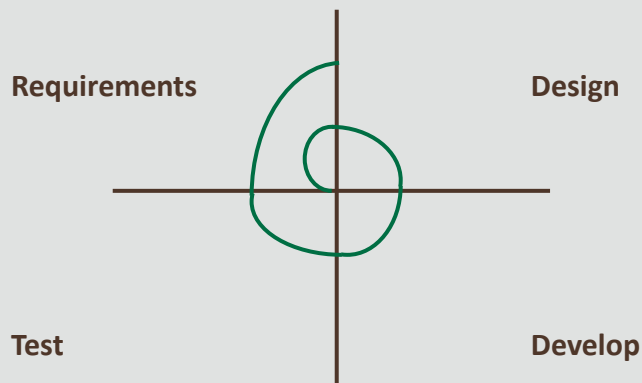
Test

- Test your code:
 - Does the program give the results that you expect?
 - Can you find scenarios that produce unwanted results?
 - Depending on their impact, these bugs may need fixing



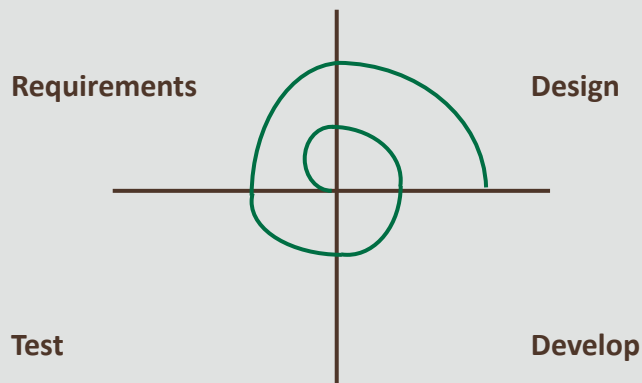
Requirements Iteration

- Check the requirements again:
 - Does the program's behavior match the requirements?
 - Are there additional requirements or features to build?
 - Should some requirements change?



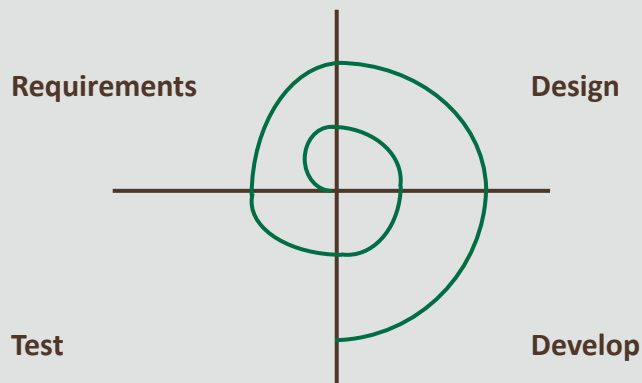
Design Iteration

- Plan your changes:
 - How should you model additional features?
 - Should the existing design change to better support expanding current features or adding new features?



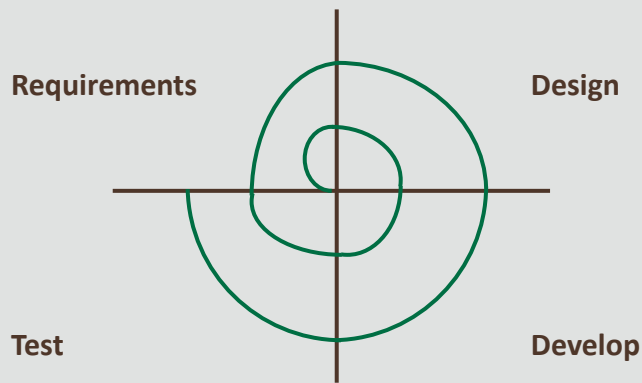
Development Iteration

- Continue developing:
 - Add new features
 - Modify or enhance existing features, if necessary



More Testing

- Continue testing:
 - Does new code work as you expect?
 - Will old code still work properly?
 - Depending on the severity, bugs may need fixing



Developing, Testing, and Fixing

- The process of developing, testing, and fixing bugs is sometimes frustrating:
 - Code often doesn't work
 - Unexpected bugs reveal themselves
 - Solutions seem difficult and elusive



Programming Is like Solving Puzzles

- It may take time...
 - Thinking
 - Experimenting
 - Researching and iterating
- But it feels very rewarding to...
 - See your code finally working (or behaving slightly better)
 - Watch your program evolve and become more robust
 - Find yourself becoming more skillful
 - Mischievously find ways to produce bugs



How to Research

- Are you still confused after tinkering? There are many resources to help you make progress:
- Lecture notes and completed small exercises
 - Do they use commands or techniques you're looking for?
- Oracle's Java documentation
 - They outline available Java commands
 - <https://docs.oracle.com/en/java/javase/17/docs/api/java.base/module-summary.html>
- Internet
 - Other people may have asked questions similar to yours.
 - You may uncover helpful examples or promising new commands
 - But your solutions should be your own, not copied code

The hyperlink in the slide to Oracle's Java Documentation is for Java SE 17. If you are using a later version, change the 17 in the URL to the release number of your JDK.

Exercise 2, Part 1

- Here is Clinton's email again, in case you need it for this exercise

Hey buddy,

There's a special Computer History exhibit at the City Museum this month. A few of us are thinking of going Friday at 5:00 PM. Would you want to join? I think the subway would be the best way to get there.

Clinton

Exercise 2, Part 2

- Complete this chart
 - Imagine what might happen to your night at the museum if a particular step were forgotten:

Requirements

Designing a Plan

Testing

Implementing the Plan

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Forgotten Friday

- You may have written something similar to this:

Requirements

- You do something else on Friday

Designing a Plan

- Everyone is on the train but nobody knows where they're going
- You ride the train for hours but never reach the museum

Testing

- You walk past the museum
- You arrive at the wrong building
- The museum is closed

Implementing the Plan

- Despite a wonderful plan, nobody goes to the museum
- Clinton is sad

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Forgetting Steps in the Spiral Model

- Similarly, bad things can happen when a particular step of the Spiral Model is forgotten

Requirements

- The program works, but doesn't solve the right problem
- Features are missing

Design

- Code is messy
- Bugs are difficult to fix
- Features are difficult to enhance

Testing

- The program keeps crashing
- The program gives incorrect results
- Users are frustrated
- Users can't stop laughing

Development

- There is no program

Sometimes buggy programs are very funny.

What Is a Software Feature?

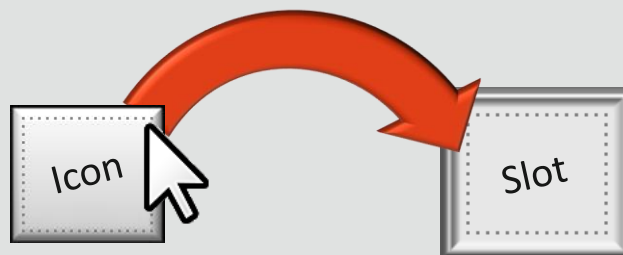
- Think of a feature as:
 - Something that a program can do
 - Something that you can do with a program
- Examples:
 - Printing text
 - Playing a sound
 - Calculating a value
 - Dragging and dropping an icon
 - Posting a high score to an online leaderboard
 - A new type of enemy in a videogame

ROAR! I'm an enemy! I'll bite you!



Implementing a Feature

- Some features are easier to implement:
 - You can code them in a few simple lines
 - For example, printing text to your IDE's output window
- Some features are difficult to implement
 - They rely on a combination of other features
 - For example, being able to "drag and drop" an icon



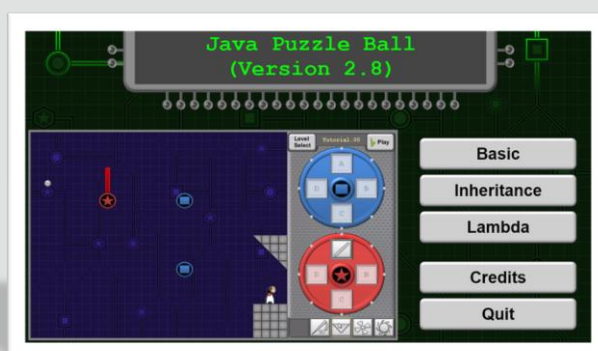
Implementing "Drag and Drop"

- A "drag and drop" feature requires several smaller features:
 - Adding a graphic to the screen
 - Finding the mouse position
 - Detecting a mouse click
 - Detecting a mouse release
 - Changing the position of the graphic
- Implementing just one of these items can feel like a big accomplishment



Case Study: Java Puzzle Ball

- This game is written entirely in Java FX
- It's designed to teach programming concepts
- We've saved all the old versions of this game so that you can explore how features were gradually implemented!



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Java FX will be covered in more detail later in the course.



The Game's Development Process

- These are the steps we tried to take:
 - Brainstorm and prototype game ideas
 - Document goals and requirements for the best idea
 - Break requirements into tasks/features and add them to a schedule
 - Develop
 - Test
 - Iterate and reevaluate requirements

Hmm... These steps sound familiar

Exercise 3, Part 1



- Download `OldGameVersions.zip`, unzip, and play these recordings of different versions of the game during its development:

- August 16, 2013 (08-16-13.mp4)
- August 22, 2013 (08-22-13.mp4)
- September 27, 2013 (09-27-13.mp4)
- October 16, 2013 (10-16-13.mp4)
- November 21, 2013 (11-21-13.mp4)



Exercise 3, Part 2

- Spend a couple minutes reviewing each version
- Note any new features, bugs, or changes between versions



August 16, 2013

- Goals of this version:
 - Have the developer learn Java FX
 - Implement a few basic features
- Notable features:
 - Display images on screen
 - Detect mouse events
 - Rotate BlueBumpers
 - Drag and drop an icon into slots (N, E)



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August 22, 2013

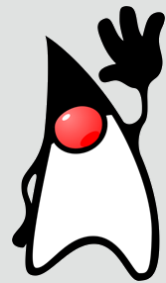
- One week later:
 - This version still isn't a game
 - But it's looking more impressive
- Notable features:
 - User Interface (UI) wheels and icons positioned on the right
 - A RedBumper
 - Colorized attachments
 - More icons to drag and drop



September 27, 2013



- About one month later:
 - This version could be called a game
 - The goal is to deflect the ball to Duke
 - A different developer created the code



Duke

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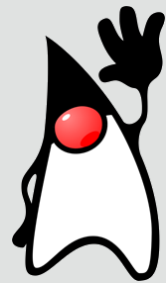
Wheels snap every 45 degrees because the code responsible for ball movement wasn't designed to calculate only eight possible collision/angle scenarios.

September 27, 2013



- Notable features:

- A Play button and a goal (Duke)
- A ball that can move and be deflected
- More shapes that can be attached
- Yellow lines (for collision detection)
- Wheels that snap to the nearest 45-degree increment



Duke

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Wheels snap every 45 degrees because the code responsible for ball movement wasn't designed to calculate only eight possible collision/angle scenarios.

October 16, 2013



- A few weeks later, we created additional game modes (Inheritance & Geometry Test)
- There is a pop-up for choosing levels
 - Because we didn't know how to unload/swap between levels
 - You have to close the program to load a different level
 - Levels are for testing features, and aren't quite puzzles for players





October 16, 2013

- More notable features:
 - Level geometry
 - A GreenBumper and GreenWheel
 - Level-building instructions are read from a text file (but you couldn't have known that)



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November 21, 2013



- Over one month later:
 - We figured out how to unload levels!
 - Only a single file is necessary to run the game
- Use the Options button to choose levels
 - It's a temporary solution until we learned to create menus
 - Levels are actual puzzles instead of tech demos

November 21, 2013

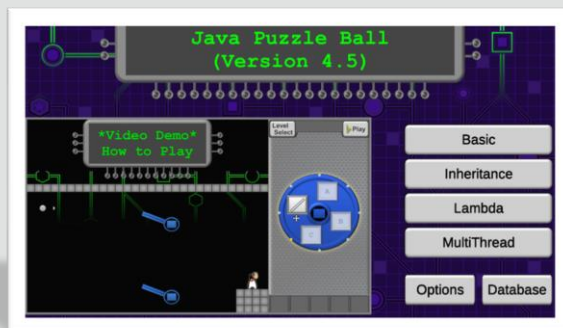


- More notable features:
 - Fancy new background art
 - More levels
 - Slots are labeled ABCD instead of NESW (People thought their solutions were wrong if the N slot didn't face north)



The Current Version

- Development continued several more months into 2014 and updates were made in 2020
- You'll notice new features and changes in the latest version
- <https://objectstorage.uk-london-1.oraclecloud.com/n/lrvrlgaqj8dd/b/Games/o/JavaPuzzleBall/index.html>



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There were features that never made it into the game, either because we didn't have time or we thought they would be a bad idea; for example, puzzles with more than one ball (super difficult multi-threading puzzles). There are also a few bugs with the current version.

We'll encounter Java Puzzle Ball next in Lesson 3 of this section.

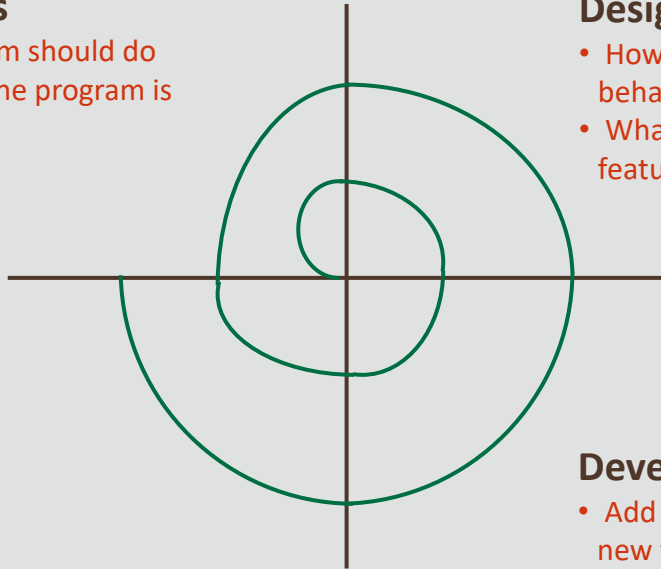
Spiral Model Summary

Requirements

- What the program should do
- What problem the program is trying to solve

Design

- How to model data and behaviors
- What order to implement features



Test

- Find bugs
- Fix bugs

Develop

- Add simple versions of new features
- Enhance existing features

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Summary

- In this lesson, you should have learned how to:
 - Understand the Spiral Model of development
 - Recognize tasks and subtasks of the Spiral Model
 - Recognize what happens when steps are ignored
 - Identify software features
 - Understand how features are gradually implemented



