in real life

Design Patterns

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April 21, 2017

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Responsibility-Driven Design

Responsibility for Doing

- Doing something (e.g. a calculation)
- Creating other objects
- Initiating an action in another object
- Controlling and coordinating other objects

Responsibility for Knowing

- Knowing about private encapsulated data
- Knowing about related objects
- Knowing about things it can derive or calculate

Levels of Patterns

Different levels:

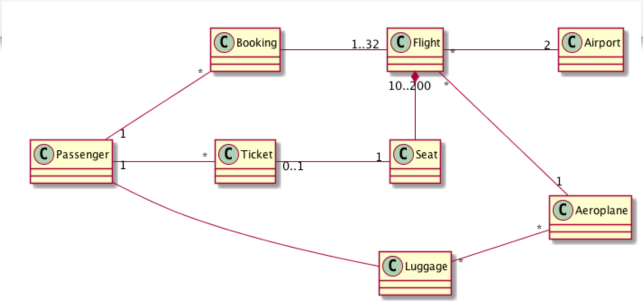
- Architecture
  - Systems, subsystems
- Design
  - Classes, groups of classes
- Idioms
  - One class, functions within one class
- GRASP
  - In some sense orthogonal
  - Learning aid for OO Design
  - Advice for Assigning Responsibilities

GRASP Patterns

(Listed on the inside of the book cover)

- Information Expert
- Creator
- Controller
- Low Coupling
- High Cohesion
- Polymorphism
- Pure Fabrication
- Indirection
- Protected Variations

Example: GRASP Patterns



Discuss

- Who should calculate the cost of a `Booking`?
- Who should be responsible for creating a `Ticket`?
- Why should a `Passenger` not be aware of the `Flight`?
- How should a `Passenger` interact with this system when booking a trip?
- How would you implement first, business, and third class?

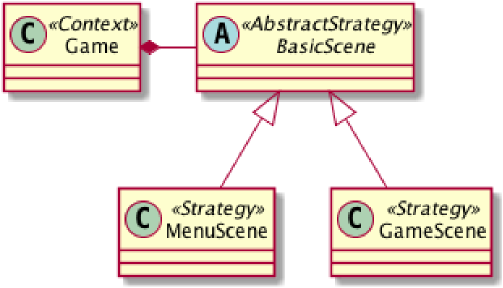
Example: Design Patterns in Pacman

A look at the game:

- The game consists of scenes (Main Menu, Actual Game, High-Score List)
- Each scene consists of a number of [different] objects (graphical as well as audio)
- Some objects need awareness of other objects
- Some objects in each scene needs to deal with UI input

Different Scenes

- Problem: The game consists of several scenes (Main Menu, Actual Game, High-Score List)
- Design Pattern: Strategy
- Involved Classes: Context, `«abstract» Strategy`, ConcreteStrategy*
- Pacman: Game, `«abstract» BasicScene`, MenuScene, GameScene



Creating Objects for different Scenes

- Problem: Set up all objects necessary for each Scene
- Design Pattern: Builder
- Involved classes: Director, `«abstract» Builder`, ConcreteBuilder*
- Pacman: MenuScene/GameScene, `«abstract» WorldCreator`, GameCreator, MenuCreator

- Design Pattern: Factory Method
- Involved classes: Creator (with `«abstract»FactoryMethod()`), ConcreteCreator (with instantiated FactoryMethod())*
- Pacman: Scene (with `«abstract»createObjects()`), GameCreator (with instantiated createObjects()), . . .

Behaviour of Ghosts I

- Problem: Each ghost behaves in a different way.
- Design Pattern: Strategy
- Involved Classes: Context, `«abstract» Strategy`, ConcreteStrategy*
- Pacman: Ghost, `«abstract» GhostMovementStrategy`, BlinkyStrategy, InkyStrategy, PinkyStrategy, ClydeStrategy

Only one Audio/Graphics/World

- Problem: Avoid creating more than one instance of AudioManagement, GraphicsManagement, World
- Design Pattern: Singleton
- Involved Classes: Singleton (with static getInstance(), private constructor)
- Less Optimal Alternative: Coding Pattern: Only create stuff in one place, keep central repository with pointers to these objects.

Redirecting Input

- Problem: Different objects are interested in UI input
- Design Pattern: Observer
- Involved Classes: Observable, Observer
- Pacman: InputManager, PacmanObject, MainMenuObject

Behaviour of Ghosts II

- Problem: When pacman eats supercandy, the behaviour of the ghosts change
- Design Pattern: State
- Involved Classes: Context, `«abstract» State`, ConcreteState*
- Pacman: Ghost, `«abstract» GhostState`, GhostNormalState (see above, GhostStrategy), GhostChasedState

Architecture Patterns

Examples of Systems:

- Data processing, e.g. a Compiler
- Interactive System, e.g. a Time Management Program
- Pluggable Architecture, e.g. a Service System

Discuss: Suitable Architectures

Discuss suitable architectures for these types of systems

Architecture Patterns

Examples of Systems:

- Data processing, e.g. a Compiler
- Interactive System, e.g. a Time Management Program
- Pluggable Architecture, e.g. a Service System

… imposed with different quality requirements:

- Performance: High Throughput
- Flexibility / Continuous Deployment

Discuss: Suitable Architectures

Discuss suitable architectures for these types of systems

Discuss: When to worry about Design Patterns

When should you introduce patterns into your system?

- GRASP patterns
- Design Patterns
- Architectural Patterns