# CS 351
# Design of Large Programs
# Design Patterns

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# What is a Design Pattern?

- A *pattern* is a solution to a problem in a context.
  - context – recurring situation in which pattern applies
  - problem – goal to achieve plus any constraints
  - solution – general design which resolves problem
- Language for communicating solutions with others
- Pattern languages exist for many problems, but we focus on design

# References

- Design Patterns: Elements of Reusable Object-Oriented Software
  - Erich Gamma, Richard Helm, Ralph Johnson and John Vlissides
  - Gang of Four (GoF)
- Head First Design Patterns
  - Available free online with edu email
- Portland Pattern Repository
  - `http://wiki.c2.com/`

# Caution!

- Design patterns are not a substitute for thought
- Class names and directory structures do not equal good design
- Design patterns have tradeoffs
  - For example, the *mediator* pattern does not remove complexity in interactions but just provides a structure for centralizing it
- Design patterns depend on the programming language
  - Certain language restrictions may necessitate certain patterns, e.g., patterns related to object creation and destruction

# Motivation for Design Patterns

- Provide an abstraction of the design experience
    - Can often serve as a reusable base of experience
- Provide a common vocabulary for discussing complete system designs
- Reduce system complexity by naming abstractions
    - increasing program comprehension
    - reducing learning time for a new piece of code
- Provide a target for the reorganization or refactoring of class hierarchies

# Parts of a Design Pattern Description

- Pattern name and classification
- Intent (Justification)
- Applicability
- Structure
- Participants and Collaboratioons
- Implementation
- Sample Code
- Known usages
- Related Patterns

# How to Use Design Patterns

- Keep it simple
- Use a pattern when it solves a problem in your design
- Refactor with patterns
- Don't be afraid to remove patterns
- Don't add unneccessary complexity
- Focus on design, not on patterns