Data Models
What Are data Models

• Separation of Concerns
  • Separating the Data from its representation
• Data models define how data is connected to each other
• Models are complemented with textual constraints
Basic Relations

\[ R \subseteq A \times B \]

over time, each A is mapped by R to the same Bs

over time, R maps the same As to each B

R maps each A to n Bs
R maps m As to each B

+ one or more
* zero or more
! exactly one
? at most one
omitted = *
Relations

A relation could mean any of the following:

- Property
- Containment
- Association
- Naming
Sets and Subsets

\[ A \subseteq B \]

\[ \text{once an } A, \text{ always an } A \]

\[ A_1 \subseteq B, A_1 \subseteq B \]
\[ A_1 \cap A_2 = \emptyset \]

\[ B = A_1 \cup A_2 \]
Classification: Disjoint Subsets

A shared arrow is used to indicate disjoint subsets
Examples

- Shape
  - Rectangle
    - Square
  - Oval
    - Circle

- Language
  - Functional Language
    - Haskell
  - Imperative Language
    - Pascal
Abstract Sets

• All its elements are contained by subsets that extend it.
  • Subsets are Exhaustive
• The names of abstract Sets are italicized
Exercises

• Your solution should include:
  • The data model diagram
  • Textual constraints
  • Explanations of any sets or relations whose meaning is not obvious from the name alone
  • A list of insights (one to three items in total, each a sentence long) that you gained about the subject from constructing the model.
Exercise 1

• Assume you have a blank canvas where you can draw any number of shapes
• Shapes could be rectangles, circles or textboxes only.
• The user can have multiple drawings
• How would you represent this?
Solution
Exercise 2

- Design an app that tracks a student’s progress towards a degree, by tracking classes students have taken. The App must also be able to determine whether or not a student has met a degree requirement.
A Degree requirement is met when all required classes have been completed
Exercise 3

• Now assume you could have visiting and regular students, how would you change your model, if only regular students can be enrolled in a degree?
Solution
Exercise 4

• Design a calendar app with the following features:
  • Send users reminders about events.
  • Event are associated with dates (and not particular times)
  • On event day, a reminder should be sent to the user with the associated message.
  • Users should be able to search for events by date and by message, and of course add, delete and modify events.
Solution
Exercise 5

• Construct a model for an online forum app
• The forum has members who join discussion groups
• Members can post in these groups
• Some groups are moderated by moderators who approve/decline posts by members
Solution