Existence Dependency: The Key to Semantic Integrity between Structural and Behavioral Aspects of Object Types
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The Problem

- Links (arcs) between objects mean different things in different circumstances
- Associations are ambiguous
- Aggregation is ambiguous

Existence Dependence

- P is existence dependent on Q (P<-Q) iff the life of each occurrence p of type P is embedded in the life of one single and always the same occurrence q of type Q
- p is called the existence dependent object and q is called the parent

TTYP1 - Library Example

- Group the following objects by the existence dependency relationship
  - library, copy, book, catalog, member, loan

Library Object Model

TTYP2 - Family Tree example

- Group the following objects by the existence dependency relationship
  - person, marriage, wife, husband, child
Group Task - Factory

- Arrange the following classes in existence dependency relationships
  - factory, customers, orders, products, schedule

Object Model for Factory

Object Events

- $S_A P$ is the subset of event types associated with an object type
- $c(P)$ is the subset of creation events
- $m(P)$ is the subset of modification events
- $e(P)$ is the subset of end events

Object Event Table

- A row for each event type
- A column for each object type

Propagation

- “a parent object type has to participate in all event types in which one of its existence dependent object types participates”
- prop rule - if $P$ is existence dependent on $Q$, the alphabet of $P$ must be a subset of the alphabet of $Q$

FSM

- Every object has a FSM that shows allowed sequences of events
More deterministic

- An object type P is more deterministic than an object type Q (P=<=Q) if the alphabet of P is a subset of the alphabet of Q and if the scenarios of P are all acceptable for Q.

Restriction Rule

- If P is existence dependent of Q, then P must be more deterministic than Q.

State Diagram for Loan

- The states include borrowed, renewed, returned, and lost.

State for Copy

- The states include incirc, acquire, renew, retire, return, and lost.

State for Member

- The states include member, join, and quit.

borrow, renew, return, lost