3.4. Type Inheritance and EER diagrams

In this lecture we look at...
[Section notes PDF 117Kb]

3.4.01. Introduction

- Design/schema side (Entity types)
- Object-orientated concepts
  - Java, C++ or UML
  - Sub/superclasses and inheritance
- EER diagrams
- EER to Relational mapping

3.4.02. OO

- Inheritance concept
  - Attributes (and methods)
- Subtypes and supertypes
- Specialisation and Generalisation
- ER diagrams
  - show entities/entity sets
- EER diagrams
  - show type inheritance
  - additional 8th step to ER→Relational mapping

3.4.03. Objects

- Basic guide to Java
- Object, classes as blueprints
- Object, collection of methods and attributes
- Miniworld model of real world things
- Object, entity in database terms

3.4.04. Abstract

- Similar objects
- Car Park example
- Student example
- Shared properties/attributes
- Generalisation
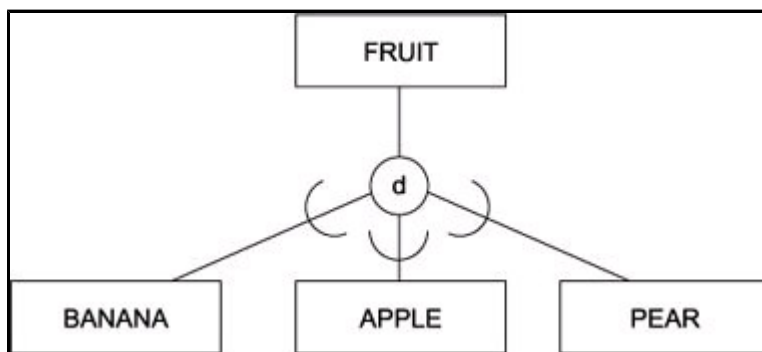
- Reverse, specialisation

3.4.05. Relationships

- Using English as model
- 'Is a' (inheritance)
- 'Has a' (containment)
- Nouns as objects
- Verbs as methods
- Adjectives as variables (sort of)

3.4.06. Classes

- Superclasses (Student)
- Subclasses (Engineer, Geographer, Medic)
- Inheritance
- Subclass inherits superclass attributes
    - Union of specific/local and general attributes
- Inheritance chains
   - Person → Student → Engineer → Computer Scientist

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3.4.07. EER Fruit example

- Partial participation
- Disjoint subclasses
- A fruit may be either a pear or an apple or a banana, or none of them. A fruit may not be a pear and a banana, an apple and a banana, an apple and a pear …

3.4.08. EER Wine example

- Total, disjoint
- Equivalent to Java Abstract classes
- A Wine has to be either Red, White or Rosé cannot be both more
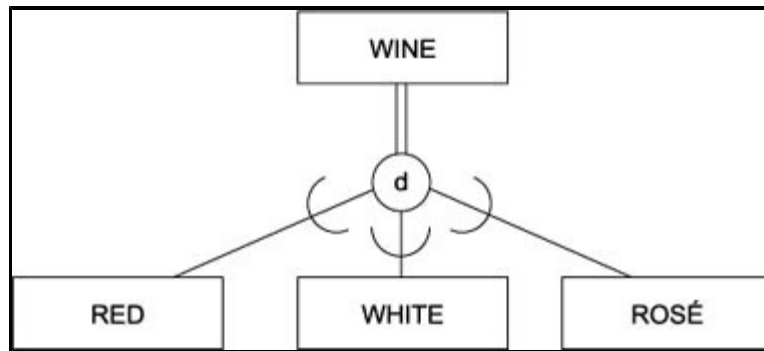
3.4.09. More extended (EER)

- Specialisation lattices
    - and Hierarchies
- Multiple inheritance
- Union of two superclasses (u in circle)
- In addition to basic ER notation

3.4.10. EER diagramatic notation

- Subset symbol to illustrate
- sub/superclass relationship
- direction of relationship
- Circle to link super to subclasses
    - Disjoint
    - Overlapping
    - Union

3.4.11. Disjointness constraint

- Disjointness (d in circle) – single honours
- Overlapping (o in circle) – joint honours/sports
- Membership condition on same attribute
    - attribute-defined specialisation
    - defining attribute
    - implies disjointness
- versus user-defined
   - each entity type specifically defined by user

3.4.12. Completeness constraint

- Total specialisation
    - Every entity in the superclass must be a member of atleast 1 subclass
    - Double line (as ER)

- Partial specialisation
    - Some entites may belong to atleast 1 subclass, or none at all
    - Single line
- Yields 4 possibilities
   - (Total-Dis, Total-Over, Partial-Dis, Partial-Over)

3.4.13. EER Chip example

- Total, overlapping
- A Chip may has to be at least one of FPA Unit, Reg Block, L1 Cache, and may be more than one type
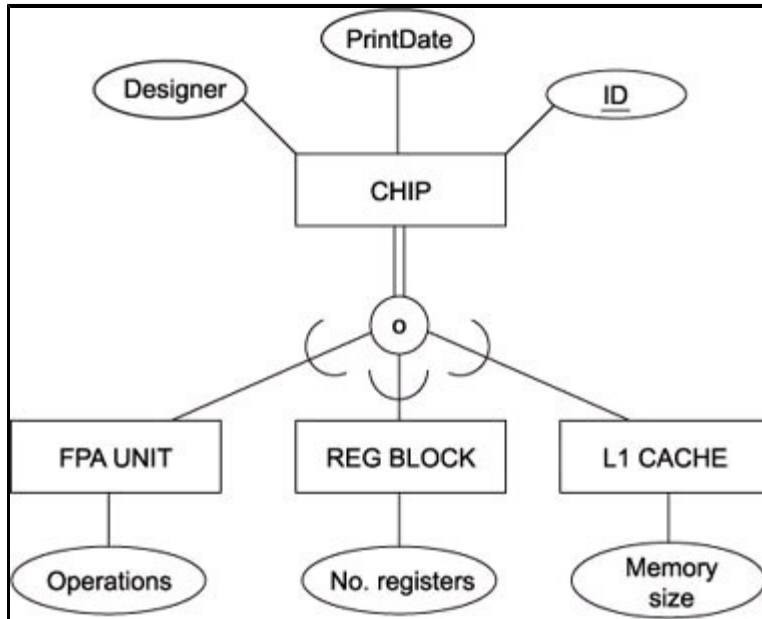
3.4.14. EER Multiple inheritance

- Type hierarchies
- Specialisation lattices
- *Well, sir, the Supreme Court of the United States has determined that the tomato is for legal and commercial purposes both a fruit and a vegetable. So we can legally refer to tomato juice as 'vegetable' juice.*
- Candice, General Foods
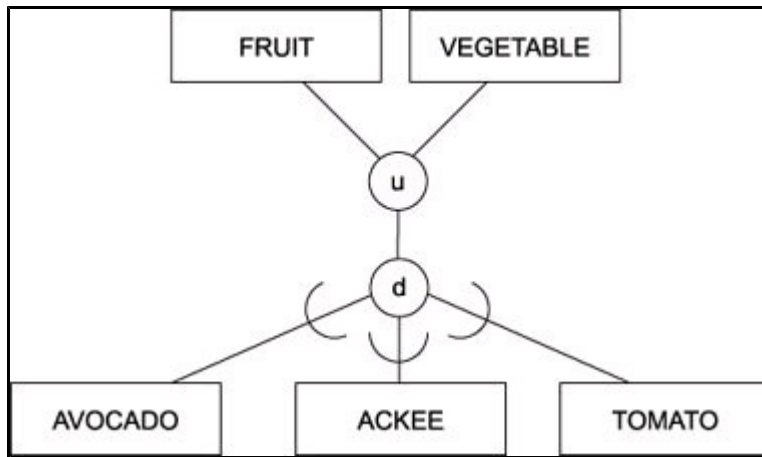
3.4.15. EER to Relational Mapping

- Initially following 7 ER stages
- Stage 8
- 4 different options
  - Optimal solution based on problem
- Let C be superclass, $S_{1..m}$ subclasses

3.4.16. Stage 8

- Create relation for C, and relations for $S_{1..m}$ each with a foreign key to C (primary key)
- Create relations for $S_{1..m}$ each including all attributes of C and its primary key

3.4.17. Stage 8

- Create a single relation including all attributes of $C \cup S_{1..m}$ and a type/discriminating attribute
  - only for disjoint subclasses
- Create a single relation as above, but include a boolean type flag for each subclass
  - works for overlapping, and also disjoint