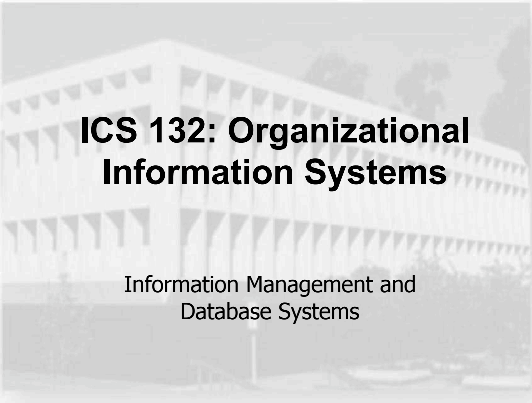


ICS 132: Organizational Information Systems

Information Management and Database Systems

information management

- organisations depend on information
  - about their own processes
  - about what's going on around them
  - the basis of *monitoring* and *planning*
- the dependence is fundamental
  - modern organisational forms and practices are built around the idea that information is available
    - remember the case of the filing cabinet

keys to information mgmt

- scale
  - dealing with information volume
- flexibility
  - need to deal with information in different ways
    - different questions you want to ask
    - different views from different people
- consistency
  - maintaining information quality and integrity
- note the role of the machine metaphor
  - standardization, repeatability, consistency…
  - not concerned with the data but with its *form*

organisational factors

- centralisation and distribution
  - balancing control and autonomy
  - balancing individual and collective control
  - making information more visible
    - and making patterns of access… e.g. Delphion
- standardisation and classification
  - need to come to agreement about what info *means*
  - controlling the form is a very powerful position
  - examples from the ICD

data, database, DBMS

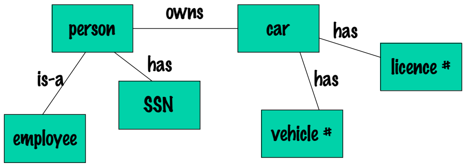
- data, database, DBMS
- DBMS: Data Base Management System
  - set of programs to define, update, control databases
    - this is what we often mean when we say "database"
    - Sybase, Oracle, DB2, MySQL, Postgres…
  - DBMS responsibilities
    - layout out information on the disk, building indexes, getting from one piece of data to another
  - your responsibilities
    - modeling the information
    - describing the relations
    - creating queries

database styles

- DBMS store generic information
  - distinguishing characteristic is the basic data type

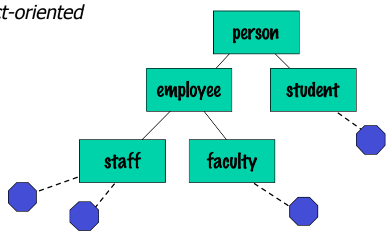
database styles

- DBMS store generic information
  - distinguishing characteristic is the basic data type
  - *network*



database styles

- DBMS store generic information
  - distinguishing characteristic is the basic data type
  - network
  - *object-oriented*



database styles

- DBMS store generic information
  - distinguishing characteristic is the basic data type
  - network
  - object-oriented
  - *relational*

Joe	ICS	132	A+
Bryan	ECON	132	B-
Ann	ICS	132	B+
Haimin	ECE	104	B
Sameer	PolSci	145	D

data modeling

- first step is to model the data
  - looking for generic structure
  - later, encode this as a database format
- modeling
  - modeling languages suit particular forms of encoding
  - ER modeling
    - ER = entity-relationship
    - particularly suited to relational databases
      - based on the relational calculus
      - a systematic procedure for turning models into tables

ER modeling

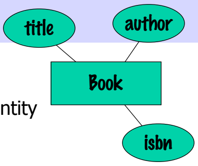
- identifying entities and their relationships
  - not unlike OO modeling, but entirely static
- three (not two) elements
  - entities
    - basic objects of the domain
  - attributes
    - relevant features of those objects
  - relationships
    - (constrained) ways in which objects related to each other

ER modeling

Book

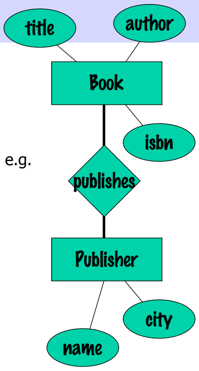
- entities & entity sets
  - entities occur in sets
  - broadly, entity sets in ER are like classes in Java
    - the describe a class of data
      - *concrete*: person, book, computer
      - *abstract*: account, concept, holiday
  - entities are like instances
    - the important thing about entities is that they can be *distinguished from one other*
  - defining entities defines what you can know
    - definitions suited to different purposes
      - e.g. different ways of describing books
        - » for a library, a publisher, or a bookstore

ER modeling



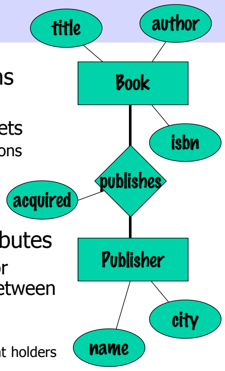
- attributes
  - attributes are properties of an entity
  - attributes have values
    - normally, single-valued (“atomic”)
      - e.g. a person has just one SSN
    - sometimes, multi-valued
      - e.g. a person may have more than one phone number

ER modeling



- relationships define relations between entities
  - relationship sets link entity sets
    - essentially, a typology of relations, e.g.
      - from employee to office
      - from course to instructor
      - from course to student

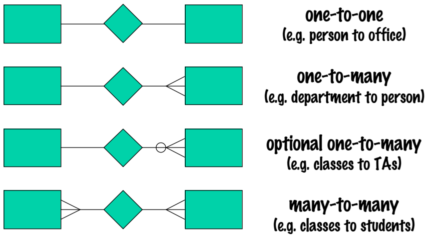
ER modeling



- relationships define relations between entities
  - relationship sets link entity sets
    - essentially, a typology of relations
    - from employee to office
    - from course to instructor
    - from course to student
- relationships can have attributes
  - attributes not of one entity or other, but the relationship between them
    - e.g. last-accessed
      - for bank accounts and account holders

ER modeling

- relationships have *cardinality* (number)



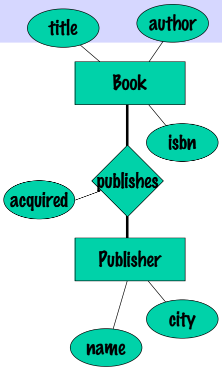
ER modeling: example

the primary key

- identifying instances
  - database needs to be able to tell instances apart
  - all it has to go on is what’s in the ER model
- the primary key
  - one or more attributes that *uniquely identify individual entities*
    - what identifies people?
    - what identifies books?
    - what identifies houses?
    - what identifies cars?
    - what identifies bank accounts?

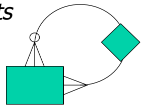
the primary key

- relationships also have primary keys
  - primary key of relationship is set of primary keys of the entity sets involved
  - might add descriptive attributes of relationship



ER modeling

- the simplicity of ER is useful
  - ER is a communication tool – esp. with the participants in a process/setting
- you're dealing with *types*, not *objects*
  - not really entities, but *entity sets*
- *relationship* vs *attribute*?
  - depends on what you want to know
  - structure of data depends on the questions you'll want to ask of it



ER modeling exercise

- draw an ER model for a car rental database
  - identify cardinality
  - identify primary keys

turning models into tables

- step 1
  - for each entity in the ER model
    - create a relation that includes all the atomic attributes
    - choose one or more attributes as the primary key

turning models into tables

- step 2
  - for each one-to-one relationship in the schema
    - identify the two entity sets S and T
    - choose one (say, S)
    - include the primary of T as an attribute of S
    - include the atomic attributes of the relationship as attributes of S

turning models into tables

- step 3
  - for each 1:N relationship
    - identify the relation S at the "N" side of the relationship
    - include the primary key of T as an attribute of S
    - include the atomic attributes of the relationship as attributes of S

turning models into tables

- step 4
  - for each two-way N1:N2 relationship
    - create a new relation S to represent this relationship
    - include primary keys of both relations in S
    - include relationship's atomic attributes in S

turning models into tables

- step 5
  - for each multi-valued attribute
    - create a table to represent this attribute
    - one column for a single value of the attribute
    - add the primary key of the entity (or relationship) of which it is an attribute

turning models into tables

- step 6
  - finally, for each multi-way relationship
    - create new relation S
    - include all the primary keys as attributes of S
    - include atomic attributes of relation as attributes of S

next time

- more databases
  - relational database normalization
  - SQL queries
- read the Bowker paper