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Carnegie Mellon Univ.
Dept. of Computer Science
15-415/615 - DB Applications

Lecture #19 (not in book)

Database Design Methodology handout

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Based on handout:

Adaptable methodology for database design
by N. Roussopoulos and R.T. Yeh, IEEE Computer Vol. 17, no. 5, pp. 64-80. 1984

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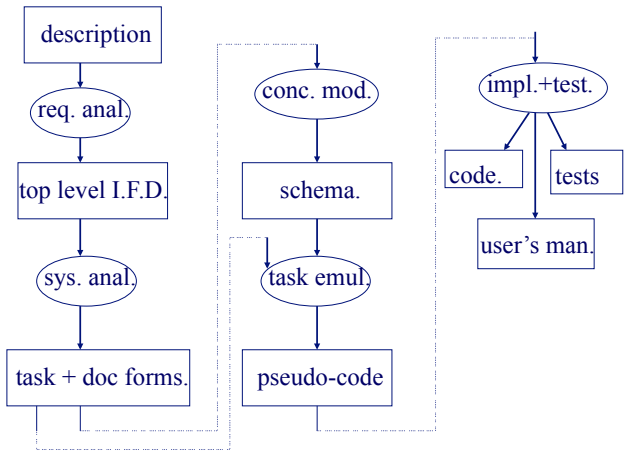
Goal

- Given an English description of an enterprise
- build a system to automate it and
- produce the documentation

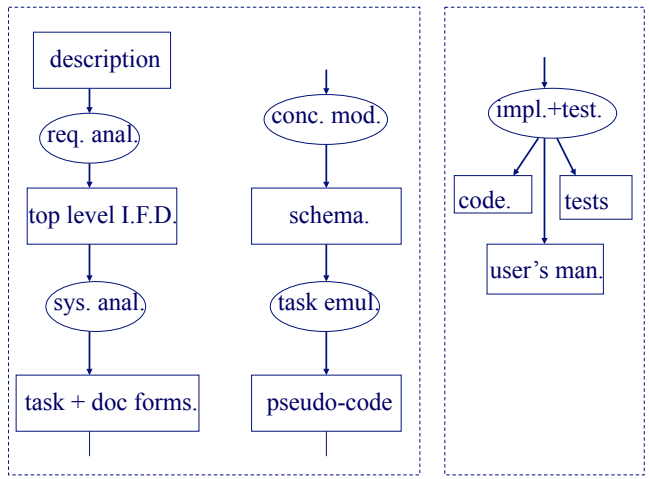
In diagram form

- tasks
- documents

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Running example - 'Mini-U'

- Students register
- Students enroll in courses
- Students ask for transcripts
- Administrator records grades
- Every semester: print class lists

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Requirement analysis

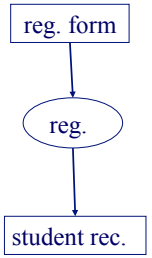
Turn English description in to **top level information flow diagram**, where

- boxes -> documents (~ db tables)
- ovals -> tasks (= db programs)

Important: **system boundary**

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Top level inf. flow diagram

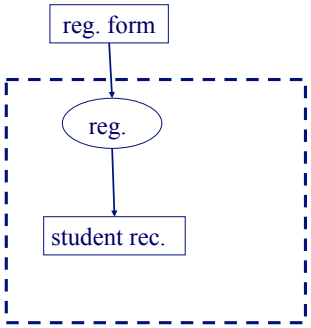


input

output

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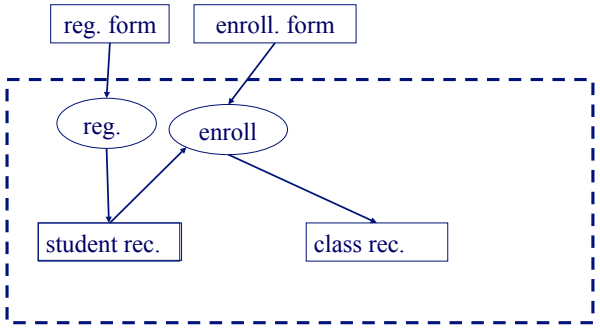
System boundary



- internal documents -> db tables
- tasks -> db programs
- tasks: internal only

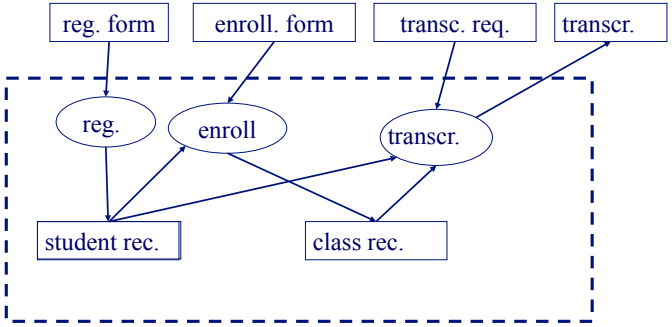
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More on top level diagram



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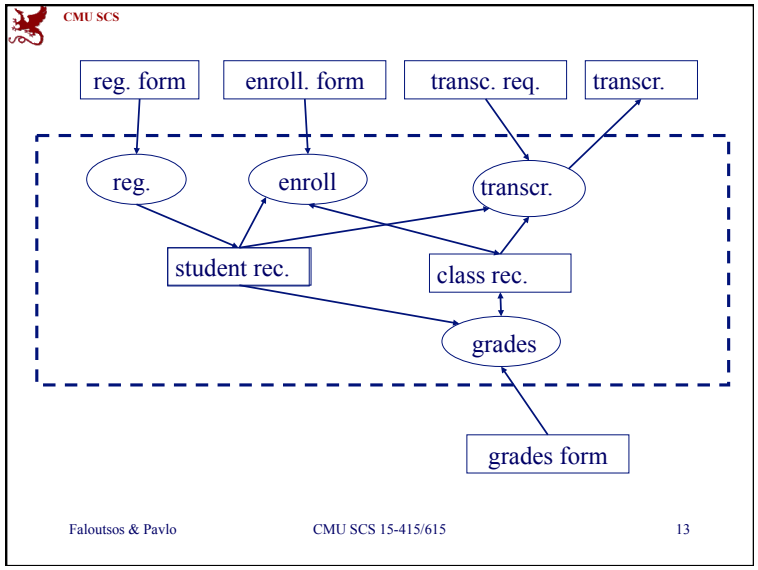
More on top level diagram

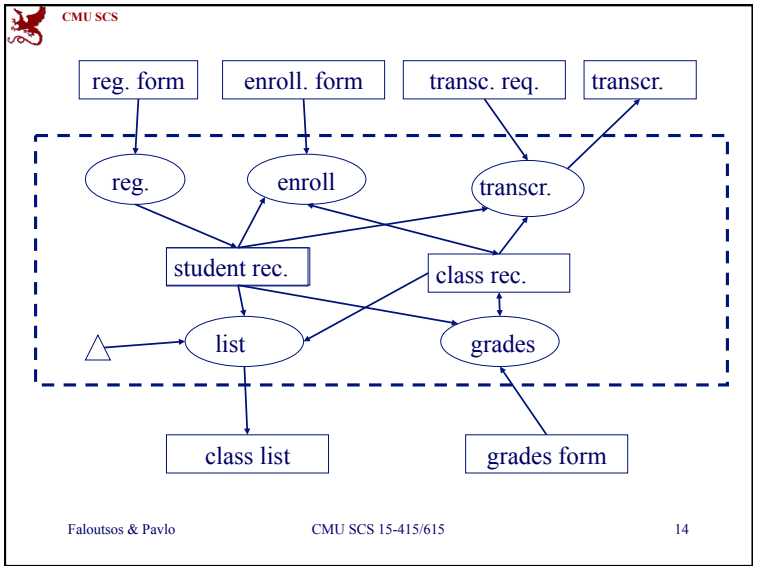


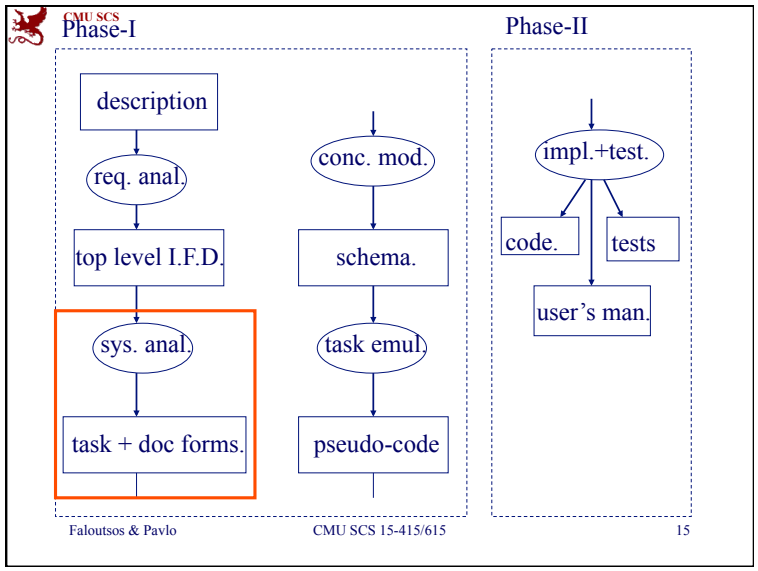
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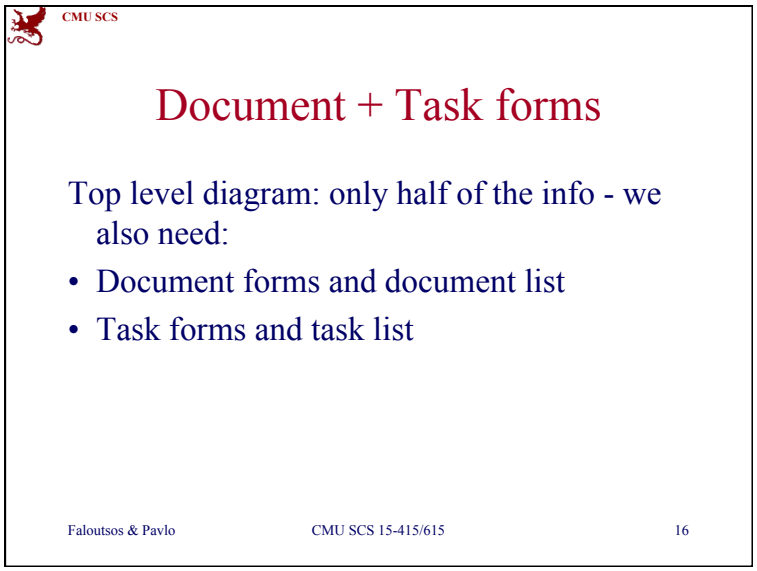
Example - Mini-U

- Students register
- Students enroll in courses
- Students ask for transcripts
- Administrator records grades
- every semester: print class rosters


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reg. form
enroll. form
transc. req.
transcr.
reg.
enroll
transcr.
student rec.
class rec.
grades
grades form
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reg. form
enroll. form
transc. req.
transcr.
reg.
enroll
transcr.
student rec.
class rec.
list
grades
class list
grades form
Faloutsos & Pavlo
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Phase-I
Phase-II
description
req. anal.
top level I.F.D.
sys. anal.
task + doc forms.
conc. mod.
schema.
task emul.
pseudo-code
impl.+test.
code.
tests
user's man.
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Document + Task forms
Top level diagram: only half of the info - we also need:
• Document forms and document list
• Task forms and task list
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Document list

- D1: registration form
- D2: enrollment for
- …
- D7: student record
- D8: class record

} INTERNAL

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Document forms

- D1: registration
  - ssn
  - name
  - address

D2: enrollment
ssn
name
List-of:
course id
course name

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Document forms - cont'd

- D3: transcript request form
  - ssn
  - name

D4: transcript
ssn
name
List-of:
class-id
class name
grade

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Document forms - cont'd

(Internal documents - VERY IMPORTANT)

D7: student record
- ssn
- name
- address

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Document forms - cont'd

D8: class record
- class-id
- class-name
- syllabus
- List-of
  - ssn
  - grade

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Document forms - cont'd

- IMPORTANT POINTS
  - avoid redundancy in internal documents: ie., grades should be stored in ONE place only
  - there are many, different, correct solutions

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Task List

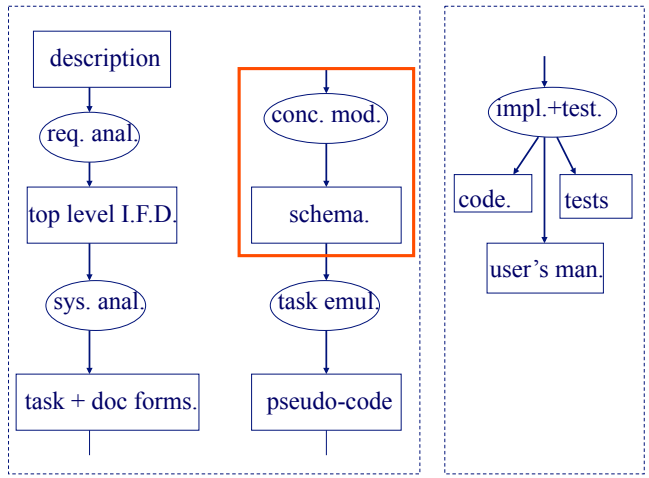
- T1: Registration
- T2: Enrollment
- T3: Transcript
- ...

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Task forms

- As in [R+Y]
- not required for this homework
- sub-tasks: probably there won't be any
  - otherwise: ~3-7 sub-tasks per task

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Database schema - E-R

- from the **internal** documents
- use their forms
  - 'List-of' constructs -> relationships

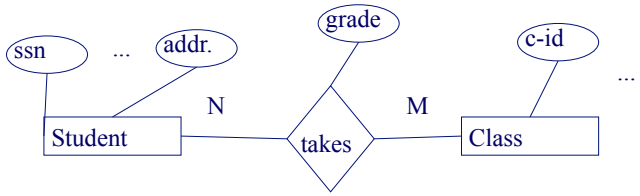
Eg., for 'Mini-U':

D7: Student record (ssn, name, address)

D8: Class record (c-id, …, List-of …)

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E-R diagram for Mini-U



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Relational schema

student(ssn, name, address)

class(c-id, c-name, syllabus)

takes(c-id, ssn, grade)

Make sure that

- Primary keys are underlined;
- tables are in BCNF (or 3NF at worst)

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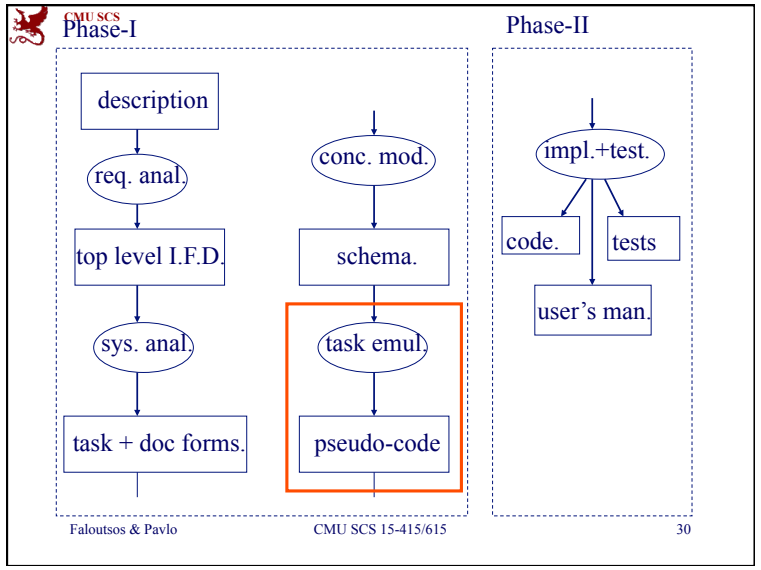
SQL DDL statements

create table student (ssn char(9), …);

create table class (c-id char(5), …);

…

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Task emulation

T1: Registration

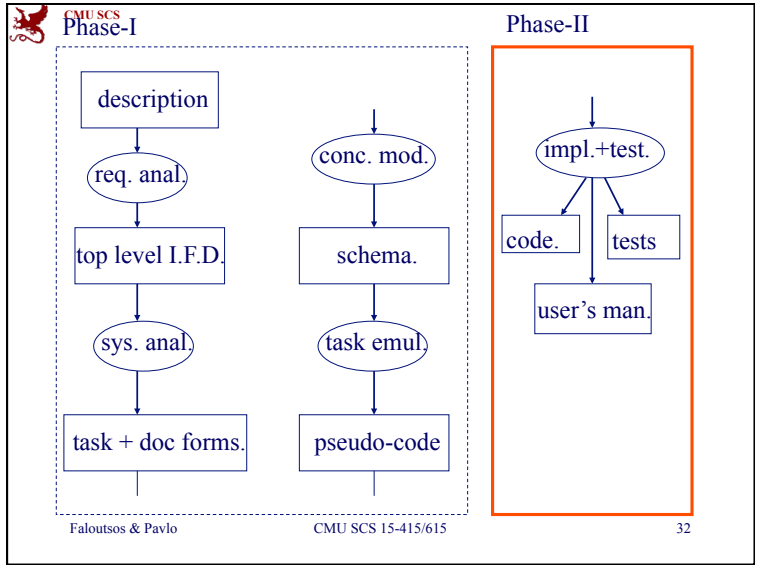
read ssn, name and address

if (ssn does not exist in 'student'){

insert into student values (:ssn, :name, :address);

} else{print "error: duplicate ssn"}

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Testing

- For T1 (registration), we check
  - duplicate ssn
  - ssn with 9 digits
- For T2 (enrollment) we check
  - for valid ssn (9 digits)
  - for registered ssn
  - for valid c-id
  - for duplicate (ssn, c-id) entry

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User's manual

Short (~1 page or less) - eg.,:

- copy myproject.tar
- do 'make'
- follow the menu

<anything else the user should know, like OS, space requirements, etc etc>

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Important points for Phase-I

- No redundancy in the fields of internal documents
- don't forget the system boundary
- make sure the top level diagram agrees with the internal document forms
- explain if/when we deviate from BCNF