

data: known facts that can be recorded and have implicit meaning

database: a collection of related data

mini-world: some part of real world about which data is stored in a database

database management system (DBMS): a software package/system to facilitate the creation and maintenance of a computerized database

database system: the DBMS software together with the data itself. (+ application)

DBMS functionality

- ↳ Define → $\text{និរតាមការពិនិត្យសំគាល់}$, $\text{និង field, និង table}$
- ↳ Construct → $\text{នៅក្នុងការបង្កើត DBMS ទាំងចំណែក}$
- ↳ Manipulating → $\text{នៅក្នុងការបញ្ចូល, modification, accessing}$
- ↳ Processing and sharing → $\text{នៅក្នុងការបញ្ចូលនិងផ្តល់ជាបន្ទីរ DBMS ទៅក្នុង valid state}$
- ↳ protection and security → $\text{នៅក្នុងការបញ្ចូល (sw, hw)}$
- ↳ visualization data
- ↳ maintain

Application Activities Against a Database

- ↳ app នឹង query, transaction → $\text{នៅក្នុងមួយនៃ 1 step} \rightarrow \text{fail} \rightarrow \text{roll back}$
- ↳ សេវា, នឹង report

app នឹងរួមឱ្យ user បញ្ចូន db ឬប្រើប្រាស់

app នឹងដោលឱ្យបញ្ជាក់មិនមែនអ្នកប្រើប្រាស់ user

រឿងនៃការបង្កើត miniworld - relationship នៅក្នុងការរៀបចំការងារក្នុង DB

Main Characteristics of the Database Approach (ມີເນື້ອ)

- ↳ self-describing nature of a database system → ງາມສະແດງ meta-data
- ↳ insulation between program and data → program-data independence
- ↳ data abstraction → encapsulation data
↳ ເປັນແຜນ descrip, ແຫວ່າມີເປັນ
- ↳ support of multiple views of the data → ມົວທີ່ຈະໃຫຍ່ໄດ້ຮັບເຖິງ
- ↳ sharing data between multiple user

Database Users - Actor on the Scene

- ↳ Database administrator → ອຸນາມເຕັກຝັກ, ອຸນັດບ
- ↳ Database designer → ອາການັດບອັນ business logic

When not to use a DBMS

- ↳ Main cost of using DBMS:
 - ↳ ຕ້ອງລືກທຸກໃໝ່ scw, hw, security, concurrency control, backup, integrity function
- ↳ When a DBMS may be unnecessary
 - ↳ ຖີ່ໄດ້ຄາສະຕິທີ່ຈຳລັກຂຶ້າຂະໜາດເພື່ອສະໜັບສະໜູນ
 - ↳ ຖີ່ໄດ້ກາງຈຳກົງໃໝ່ໂດຍມີເຫຼືອກຳທີ່ຈຳລັກສະໜັບສະໜູນ
- ↳ When a DBMS may be infeasible
 - ↳ embed system → run × dbms ຍຸດ

→ user-defined → ລາຍລາວ
→ basic → ດັ່ງນີ້ (insert, delete, update ·
→ retrievals, update

Data Models

- ↳ set of concept to describe the structure of a database { operation, constraints }
- ↳ Construct → ອີເຈົ້າ db structure , Constraints
- ↳ elements and their data types
↳ ພົບມີມານີ້ແລ້ວ ຕັດສະພາ ທີ່ສະເໜີ ທີ່ສະເໜີ
- ↳ groups of elements
- ↳ relationship among such groups

↳ Categories of Data Model

↳ hierarchical, network, relation model

↳ Conceptual (high-level, semantic) data model: ពេលវិជ្ជាបន្ទាន់សម្រាប់បណ្តុះបណ្តាល

↳ Physical (low-level, internal) data model: បច្ចុប្បន្ន, តាមរយៈបច្ចុប្បន្ន

Schemas

↳ description of the database, "schema diagram"

STUDENT
Name Student_number Class Major
COURSE
Course_name Course_number Credit_hours Department
PREREQUISITE
Course_number Prerequisite_number
SECTION
Section_identifier Course_number Semester Year Instructor
GRADE_REPORT
Student_number Section_identifier Grade

Figure 2.1
Schema diagram for the database in Figure 1.2.

Database State

- ↳ ឯកសារណាយការណាស់ដែលអាចបញ្ចប់
- ↳ valid state → no violation

database schemas → ឯកសារណាយការ
state → ការរក្សាសម្រាប់ update

Database System Utilities (ឧបនគរ)

- ↳ function → load data និងការបង្កើត
backup
reorganize file
- ↳ monitoring utilities
- ↳ report generation

DBMS server

- ↳ provide query & transaction service
- ↳ provide API (ការបន្ថែមឱ្យប្រើប្រាស់បណ្តុះបណ្តាល)

weak entity → មាន key attr ដែលអាចរាយការណាស់

→ properties used to describe an entity → type → simple

Entities and Attributes

- ↳ specific thing represented in the database
- ↳ entity type = name + attrs

Employee
Name, Age, Salary

set ⇒ ក្រួចលាង
 e_1
(Sed, 18, 12000)

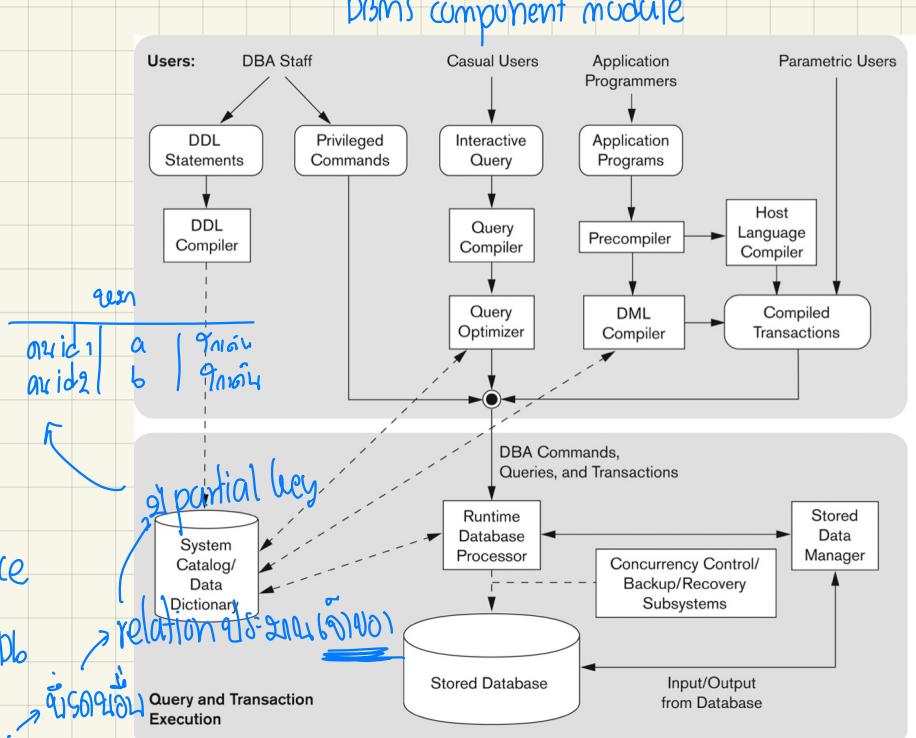
→ current state នៃក្រួចលាង

attr value: null value

composite → មានបច្ចុប្បន្ន attr

multi-valued → មានលាង attr

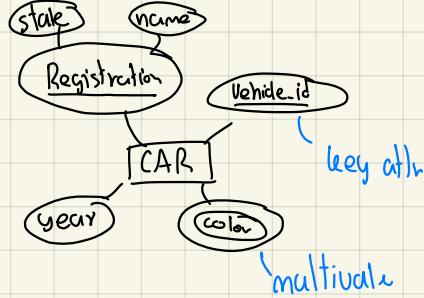
derived → attr ដែលត្រូវការគ្រប់គ្រង



key attribute type

↳ unique \rightarrow 9₁ entity ^{type} ດີວຍເຫັນ 1 key alt.

↳ ପ୍ରମାଣିତ



Registration(state, name), Vechicle_id, year, {color}

9. $\forall ER \rightarrow entity \Rightarrow \square$

attr \Rightarrow 

weak entity

relationship

identifying relationship

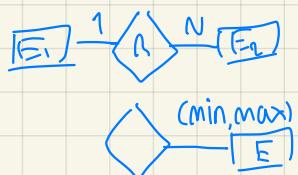
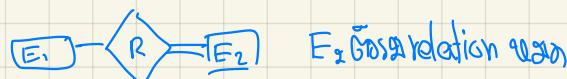
attr

(key attr) — name

multicell culture

composite attr

Derived attr - age

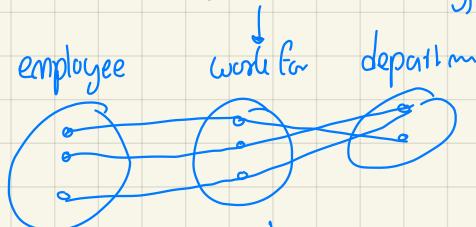


→ gl attr 

relationship type → relation នៃទីតាំងនៃការងារនេះជាន់ទីតាំងនៃការងារនេះជាន់ relationship type

↳ degree of relation type

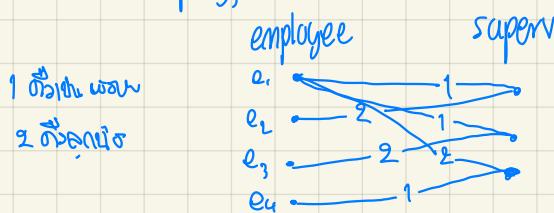
↳ the number of participating entities, time



$g \rightarrow$ "binary")

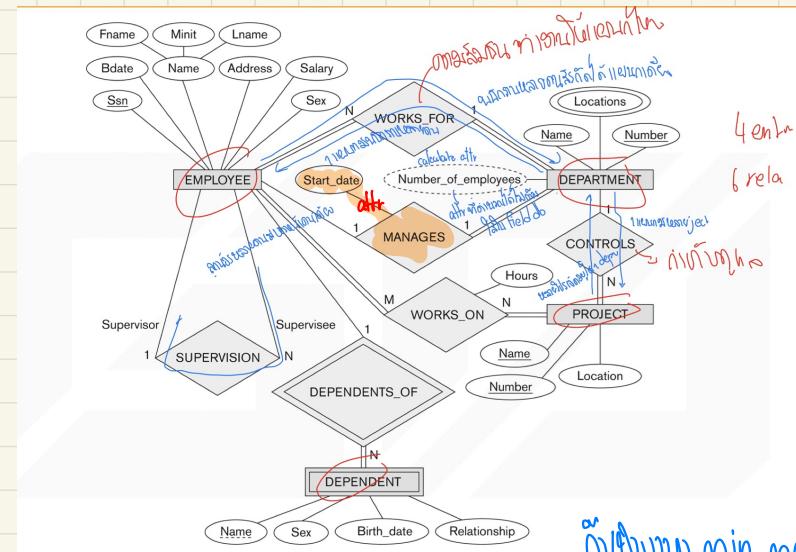
$\exists \rightarrow$ "temporary"

↳ recursive relationship type → self ref → 18.14.9.2.2.2.2



గుర్తించాలి?

କେବେଳା କିମ୍ବା ?



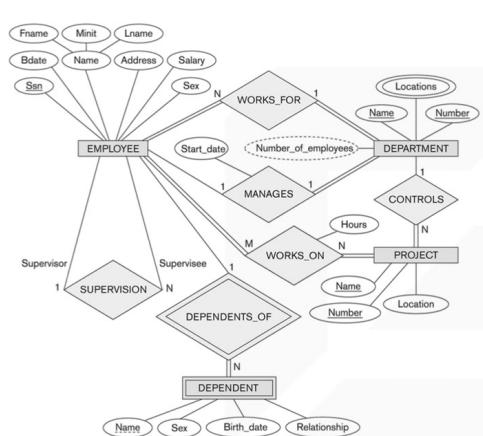
minimum min, max

4 ent
6 rela

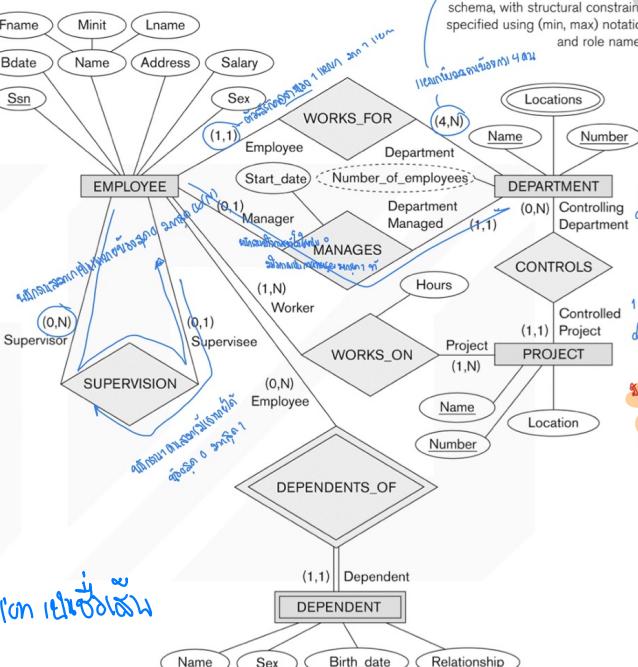
X , 1:1 1:m m:N



Figure 3.15
ER diagrams for the company schema, with structural constraints specified using (min, max) notation and role names.



for format



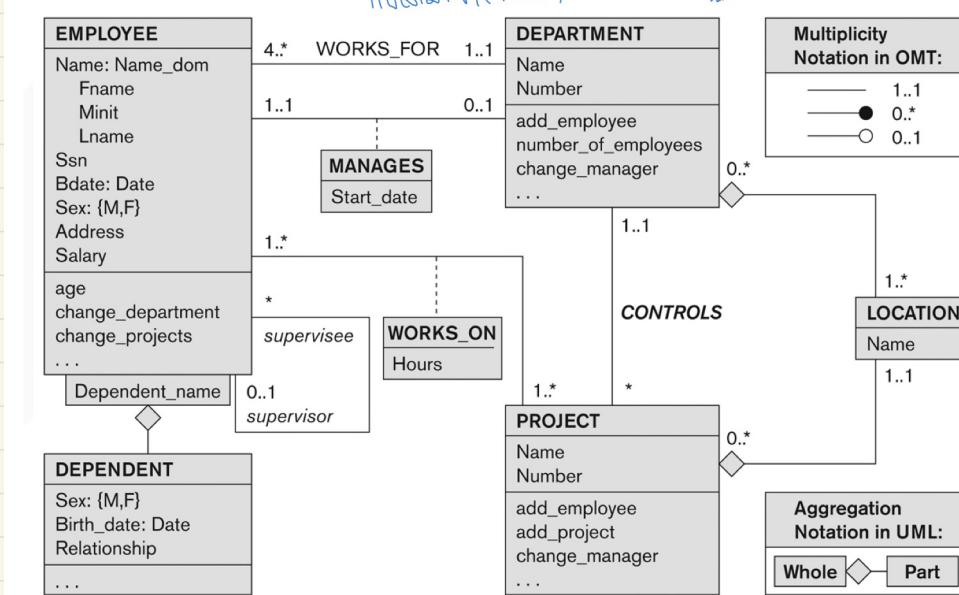
depend 1:N
1:N min, max
ukan to project
1 project constraint -> department count, max count
dependent -> department count, max count

1:N 1:N, min, max
ukan -> department count, max count

UML 1:1, 1:N, min, max relation

ema

minimum min, max



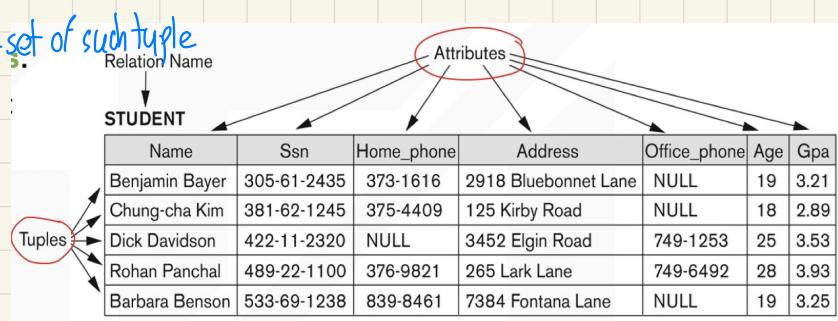


table definition → schema of relation
populated table → state of relation

Schemas = ~~Transactions~~ tuple $\Rightarrow R(A_1, A_2, A_3 \dots A_n)$ ogni attr si domaina in $\{1, \dots, n\}$

tuple = set of values in $\{ \text{str}, \text{int}, \text{float} \}$ $\Rightarrow \langle v_1, v_2, v_3, \dots, v_n \rangle$

$r(R) \subset \text{domain}(A_1) \times \text{domain}(A_2) \times \dots \times \text{domain}(A_n) \rightarrow \text{relation state}$

$$r(R) = \{t_1, t_2, \dots, t_n\}$$

$$t_j = \langle v_1, v_2, \dots, v_n \rangle$$

$t_i = \langle \text{key}: \text{value} \rangle, \dots \rangle$

{ access by $t[A_j]$ also $t.A_j$

\hookrightarrow set of atomic value

↳ ແບ່ນກາງຕຳມືລີ

Constraint

- ↳ Inherent or implicit constraint → แก้ไขดูตัว model ตัวเองแล้วก็ → atomic value } domain rule
 - ↳ Schema-based or explicit constraint → กำหนดรูปแบบ
 - ↳ Application-based or semantic constraint → รับรู้ความหมาย

Relation Integrity Constraint

- ↳ primary key គឺជាកូនតិចបែកចំណេះដឹងទាំងអស់
 - ↳ $t_1[plk] \neq NULL \rightarrow t_1[plk] = t_2[Lfk]$
 - ↳ 3 explicit constraint \rightarrow key, entity integrity, referential integrity, domain.
 - ↳ superkey
 - ↳ attributes-ក្នុងកូនតិច និង unique
 - ↳ key
 - ↳ ត្រូវត្រួតពី superkey
 - ↳ candidate key
 - ↳ ក្នុងកូនតិចដែលមិនត្រូវត្រួតពី superkey \rightarrow ត្រូវការពិនិត្យ \rightarrow រួម primary key

↳ ចាប់ពីការណែនាំ

Figure 6.2
Referential integrity constraints displayed on the COMPANY relational database

```

    graph TD
        subgraph COMPANY_RELATIONAL_DATABASE [COMPANY RELATIONAL DATABASE]
            EMPLOYEE[EMPLOYEE: Employee | Minit | Lname | Ssn | Bdate | Address | Sex]
            DEPARTMENT[DEPARTMENT: Dname | Dnumber | Mgr_ssn | Mgr_start_date]
            DEPT_LOCATIONS[DEPT LOCATIONS: Dname | Location]
            PROJECT[PROJECT: Pname | Pnumber | Plocation | Dirum]
            WORKS_ON[WORKS ON: Essn | Proj | Hours]
            DEPENDENT[DEPENDENT: Essn | Dependent_name | Sex | Bdate | Relationship]

            EMPLOYEE --> DEPARTMENT
            DEPARTMENT --> DEPT_LOCATIONS
            PROJECT --> WORKS_ON
            DEPENDENT --> WORKS_ON
        end
    
```

Figure 5.7
Referential integrity constraints displayed on the COMPANY relational database schema.

```

    graph TD
        EMPLOYEE[EMPLOYEE] --> DEPARTMENT[DEPARTMENT]
        EMPLOYEE --> DEPT_LOCATIONS[DEPT LOCATIONS]
        EMPLOYEE --> PROJECT[PROJECT]
        EMPLOYEE --> WORKS_ON[WORKS ON]
        DEPARTMENT --> DEPT_LOCATIONS
        DEPARTMENT --> PROJECT
        DEPT_LOCATIONS --> WORKS_ON
        PROJECT --> WORKS_ON
    
```

EMPLOYEE

Fname	Minit	Lname	SSN	Bdate	Address	Sex	Salary	Supervisor_ssn	Dno
-------	-------	-------	-----	-------	---------	-----	--------	----------------	-----

DEPARTMENT

Dname	Dnumber	Mgr_ssn	Mgr_start_date
-------	---------	---------	----------------

DEPT_LOCATIONS

Dnumber	Locations
---------	-----------

PROJECT

Pname	Prerequisite	Location	Duration
-------	--------------	----------	----------

WORKS_ON

Employee_id	Project_id	Hours
-------------	------------	-------

DEPENDENT

Essn	Dependent_name	Sex	Bdate	Relationship
------	----------------	-----	-------	--------------

Relational Database Schema's

- $$\hookrightarrow S = \overbrace{\quad}^{\Rightarrow} \{R_1, R_2, \dots, R_n\}$$

Barrel

goals

Relational Database State → ດາວໂຫຼດຂອງມານີ

Populated Database State → ຜົນຂະໜາງ → ແລະກຳມະ ເຊື່ອ, ລົບ, ແກ້ໄງ

Other constraint

↳ Semantic Integrity Constraint → ເພິ່ນໄປແກ່ມາຮັດ

↳ SQL check trigger, assertion → ອີ່ຕາມຄວາມ semantic constraint

↳ ຈົດກາ → ຍາກຳໃບ, ອີ່ຕາມຈຸດສູງ, trigger ສ້າງຕົວເລີນໃນ update ດາວໂຫຼດ, stored procedure ທີ່

Update operation on Relation → ອີ່ຕາມຄວາມ integrity constraint

ດີດັ່ງສ່ວນ

↳ Insert tuple → domain, key, ref integrity, entity integrity ← ດັກເປົ້າມີຄວາມ

↳ Update tuple → update rule (read-only, read insert), update rule (read-only), update rule (domain constraint)

↳ delete tuple → ຂໍ້ມູນຕົວ tuple ທີ່ → SET NULL, CASCADE, RESTRICT

↳ inhomogeneous design

SETNULL

CASCADE

RESTRICT

Summary

- Presented Relational Model Concepts
 - Definitions
 - Characteristics of relations
- Discussed Relational Model Constraints and Relational Database Schemas
 - Domain constraints
 - Key constraints
 - Entity integrity
 - Referential integrity
- Described the Relational Update Operations and Dealing with Constraint Violations