



Objective

To be familiar with Entity Relationship Model Design.

Entity Relationship (ER) Model

ER model is a graphical notation describes data as entities, relationships, and attributes.

Example 1: COMPANY

The COMPANY database keeps track of a company's employees, departments, and projects.

Suppose that after the requirements collection and analysis phase, the database designers provide the following description of the miniworld—the part of the company that will be represented in the database.

- The company is organized into departments. Each department has a unique name, a unique number, and a particular employee who manages the department. We keep track of the start date when that employee began managing the department. A department may have several locations.
- A department controls a number of projects, each of which has a unique name, a unique number, and a single location.
- We store each employee's name, Social Security number, address, salary, sex (gender), and birth date. An employee is assigned to one department, but may work on several projects, which are not necessarily controlled by the same department. We keep track of the current number of hours per week that an employee works on each project. We also keep track of the direct supervisor of each employee (who is another employee).
- We want to keep track of the dependents of each employee for insurance purposes. We keep each dependent's first name, sex, birth date, and relationship to the employee.

COMPANY ER

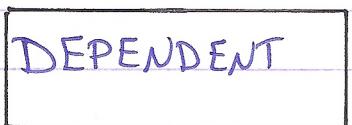
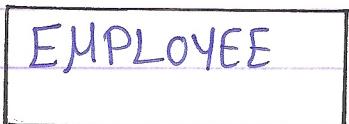
* لرسم ER يجب اتباع الخطوات التالية :-

System will have Sub-Systems like Entity Types ١- ٤ entity types.

- 4-Entity Types are the following in COMPANY :-

- 1- EMPLOYEE
- 2- DEPARTMENT
- 3- PROJECT
- 4- DEPENDENT.

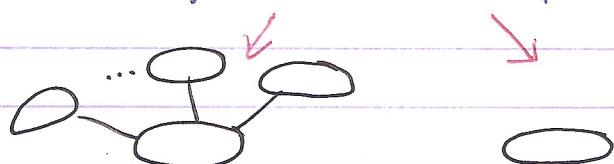
- كل إنتي تايب في الشكل ER في المربعات -



att. ومن ثم اختيار نوع كل Entity-Type ذو attributes المحدد -
• لغة SQL يسمى هذا نوع attibutes باسم

* Attributes Types:-

1- Composite versus Simple



(1)

2- Single-Valued vs. Multi-Valued.



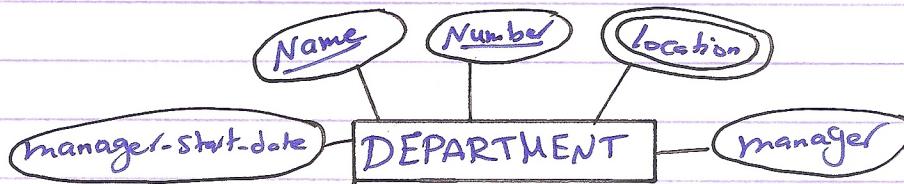
3- Stored vs. Derived.



مُسْتَوْدَعٌ مُعْلَمٌ مُنْسَقِّيٌّ key attribute مُسْتَوْدَعٌ مُعْلَمٌ مُنْسَقِّيٌّ

* Department Entity Types:-

It has 4 single-valued & simple Attr. : name, number, manager
1 multi-valued Attr. : location.
manager-start-date



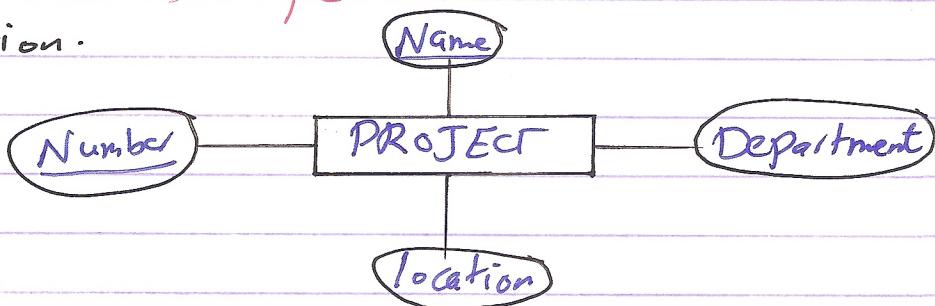
Note:- Name, Number are specified as unique.

* PROJECT.

It has the following Simple & Single-valued Attrs:-

1- Department

- 2- Name → Unique
- 3- Number → Unique.
- 4- location.



* EMPLOYEE

It has the following Attr:-

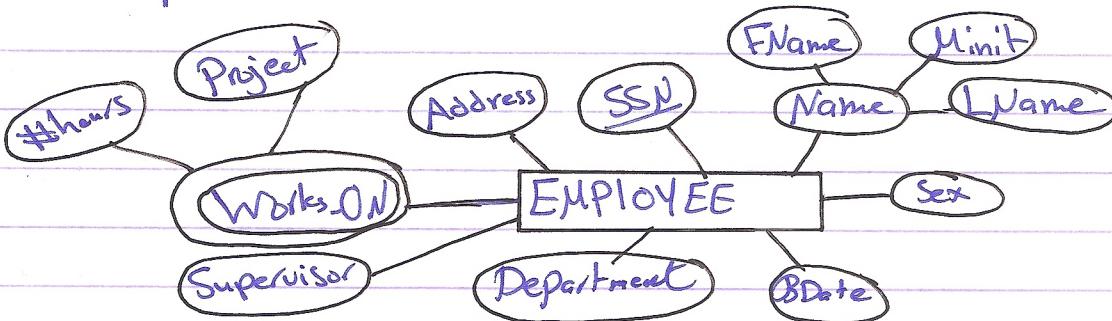
- 1- Name:- It can be Simple or Composite of FName, Minit, LName.
- 2- SSN:- Simple & Single-valued → Unique.
- 3- Address:- Can be simple or Composite.
- 4- Salary:- Simple & Single-valued
- 5- Sex :- " "
- 6- BDate:- " "
- 7- Department:- " "

من وحدة Employee التي يحدُّها من حيث القيمة
- project الذي ينسب إلى Employee على مسارات

من هنا الوحدة تنتهي في
#hours. < project في عبارات Works-on مثل

8- Works-ON : multi-Valued & Composite.

9- Supervisor.



* Dependent

It has the following Simple & Single-Valued Attrs:-

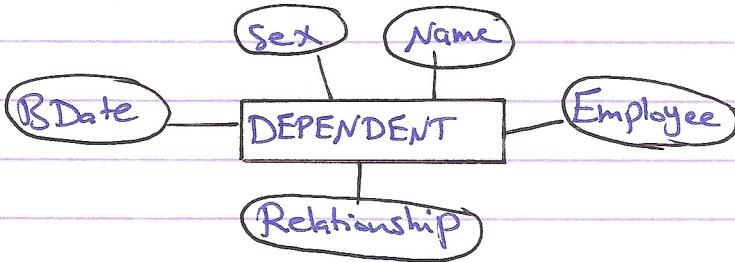
1- Employee

2- Name

3- Sex

4- BDate

5- Relationship.

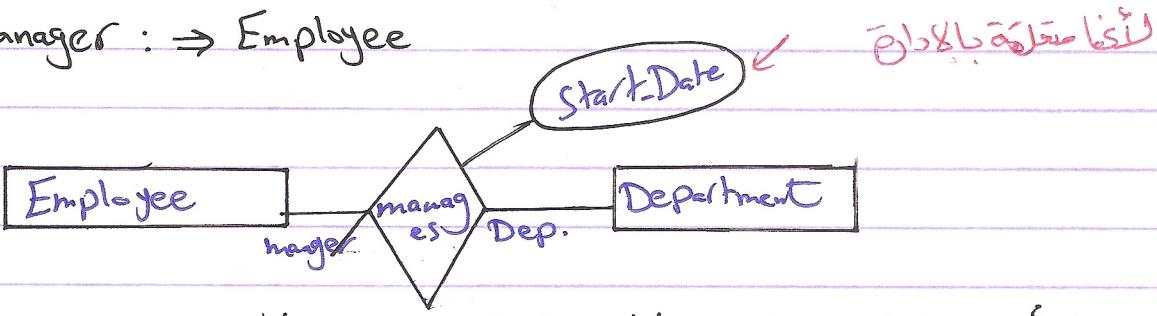


4- Relationships between Entity Types -

(نحو) Entity-Type عن عباره عن Att. (نحو) Entity-Type او *
وينجزها بعلاقة مع Att او ما كان
جداً، Entity-Type من خلفها من relationship \Rightarrow relationship Attrs او
Relationship \Rightarrow Att.

* Department

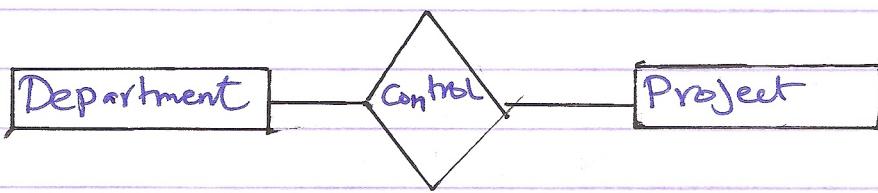
- Manager : \Rightarrow Employee



* غالباً يكون اسم هو فعل يسمى حاكماً.
* تكون تسمى Role \leftarrow Entity-Type التي دور في العلاقة -
* Relationship Entity هي على الخط العاصل بي

* PROJECT :-

- Department

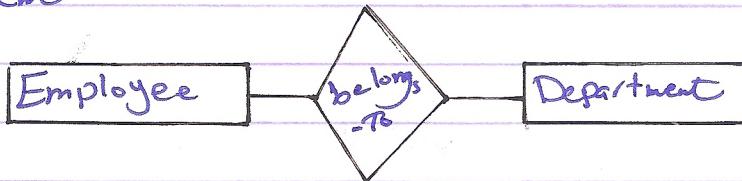


→ مراجعة

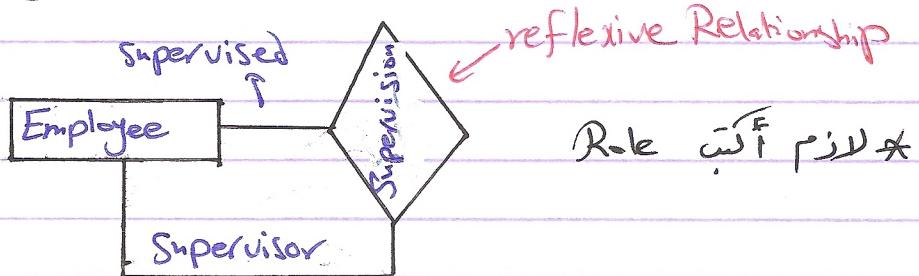
is part of the project is Reflexive in Relationship is لازم
• Roles is

* Employee.

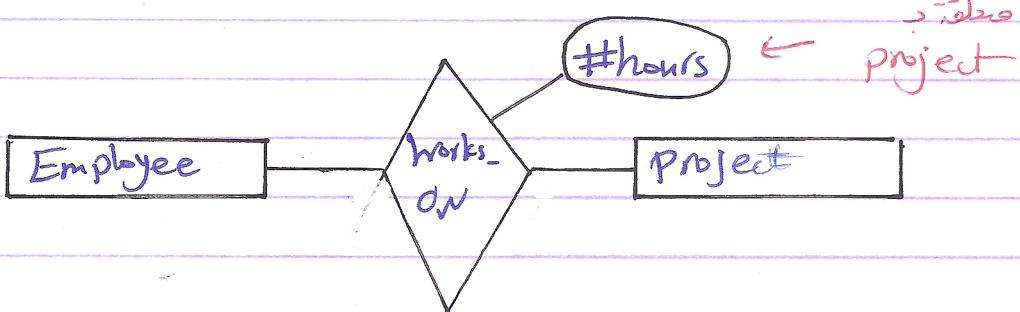
- Department



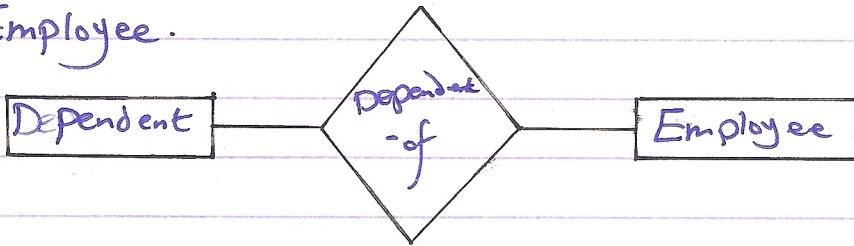
- Supervisor \Rightarrow Employee.



- Project



* Dependent
- Employee.

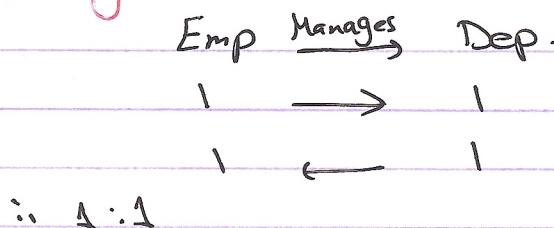


5- Constraints on Relationship types..

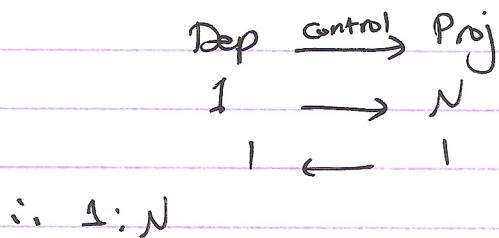
1- Cardinality Ratio .

For binary Relationship , it is 1:1 , 1:N, N:1 or M:N.

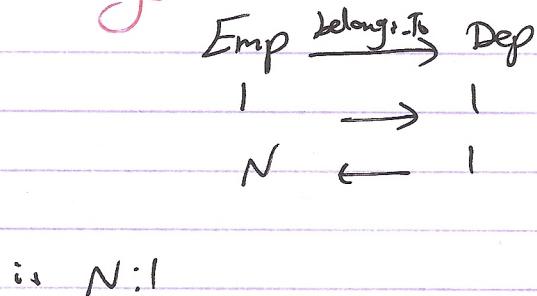
* Manages:-



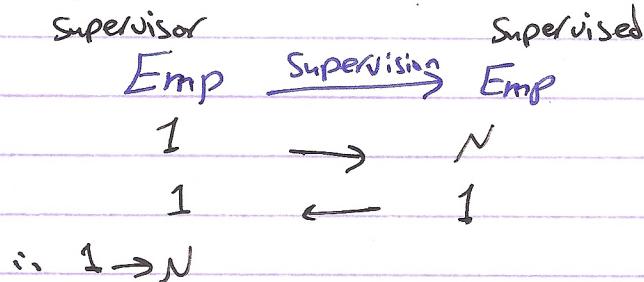
* Control



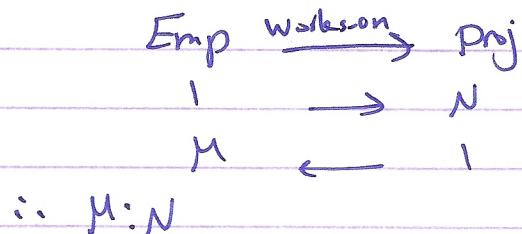
* Belongs-To



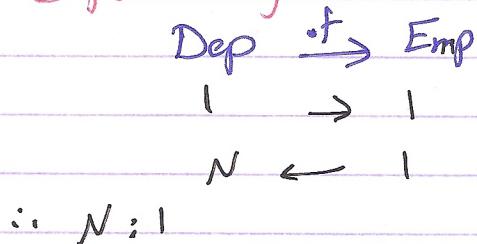
* . Supervision



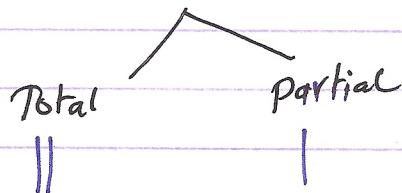
* Works on



* Dependent - of



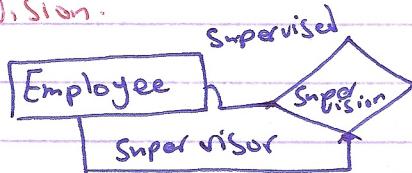
2- Participation Constraint



* Manages:-



* Supervision



- partial \leftarrow No \leftarrow ?? Supervised يجب أن يكونوا Emp كل دل -
 - Partial \leftarrow Mb \leftarrow SS Supervisor يجب أن يكونوا Emp كل دل -

Relationships

6- Weak Entity Types

Weak attributes من الأسماء التي هي قوياً entity-type *

وَقْتِ مُسَرَّحَا

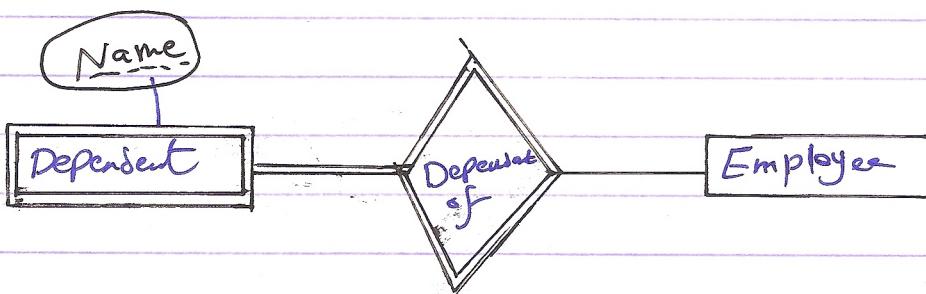
* دل دل owner w ple لابرمن و هو owner En. اجنبى تكون weak من att. weak w ple ارجع اى weak من att. ارجع اى weak من att. weak من att. weak من att. weak من att. *

* العلاقة التي تربط بين owner و weak . حيث تشيرها دالة weak من tota

* Dependent :-

- weak entity : Swi j pk Bal *
- Employee is owner *

لَا يَكُون (SSN, Name) دِلْيُو Name \Rightarrow Partial key



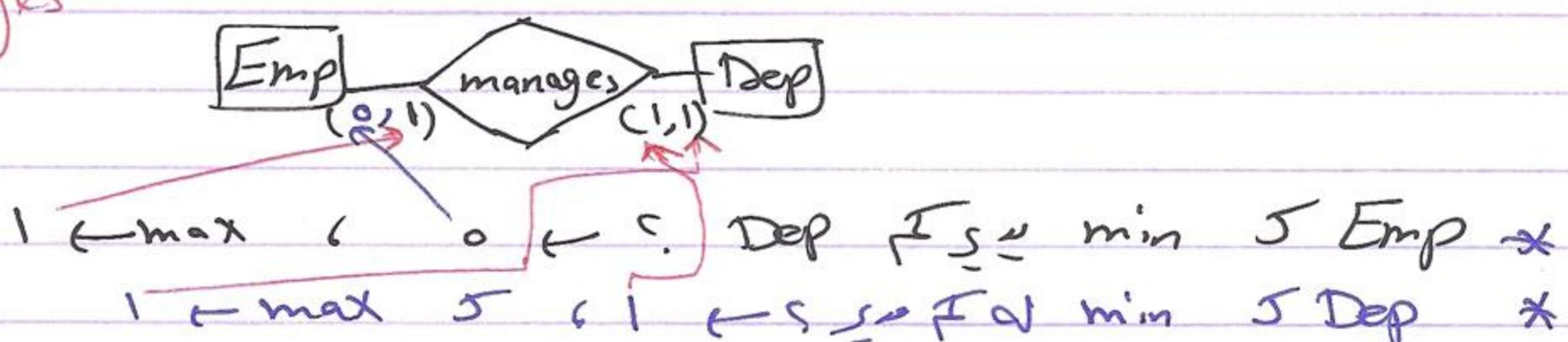
(min, max) Notation:-

نحویہ (min, max)

Relationship Constr. جائزہ تھیک *

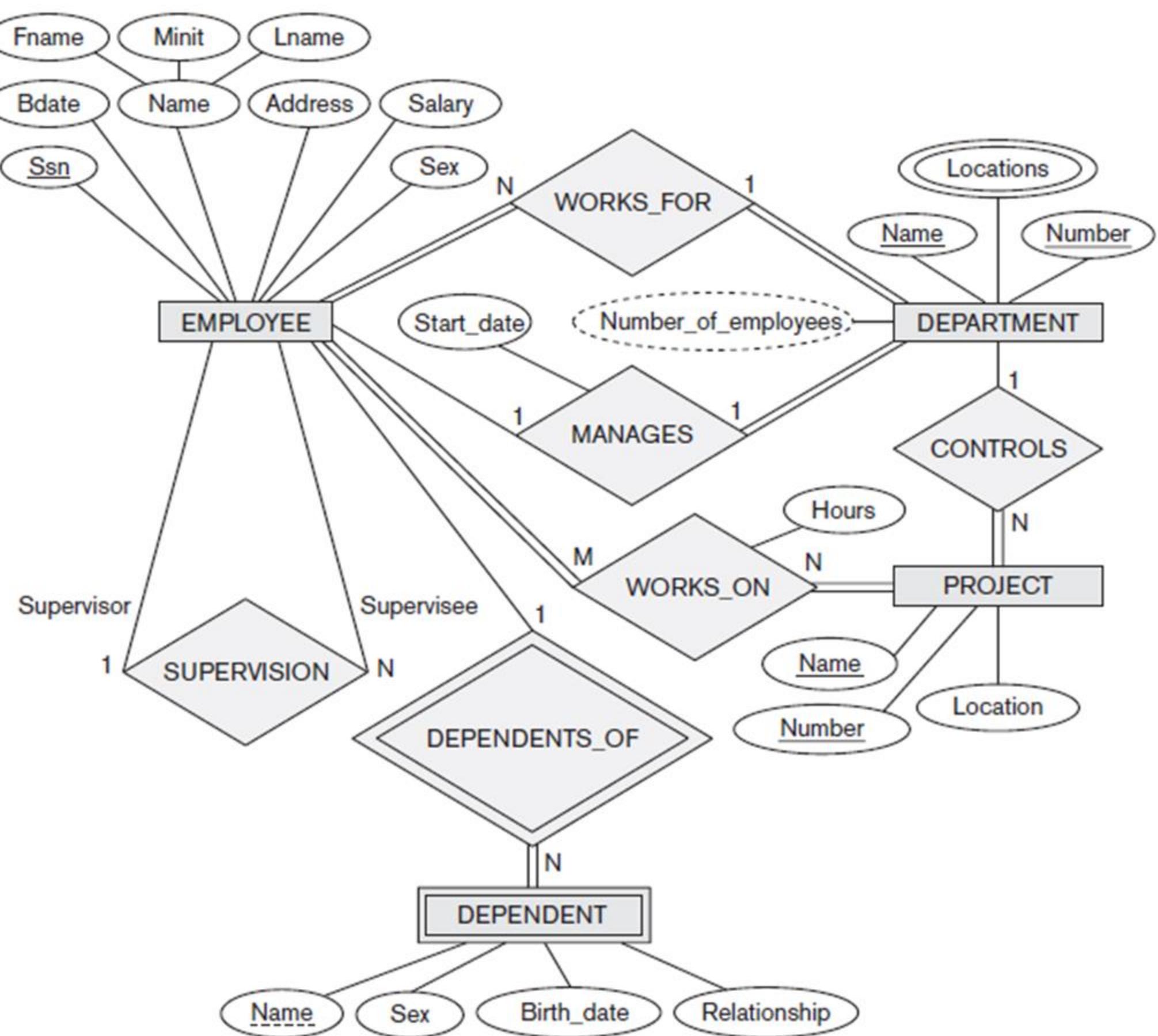
:- گزینے کے لئے ممکن

*manages



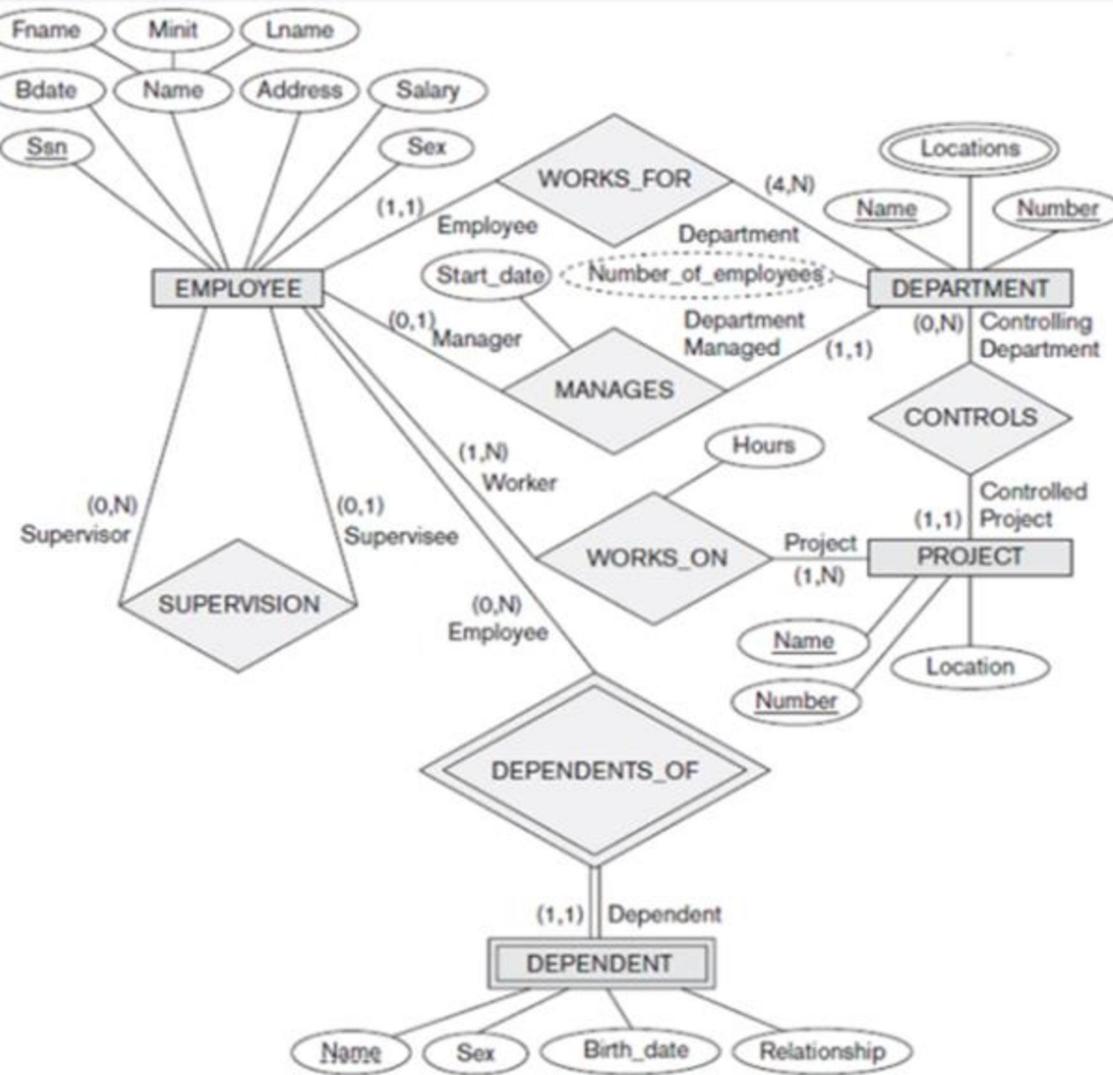
ن-ن Relationships گزینے لیے، ن-ن

Final ER Diagram.





ER Using (Min, Max) Notation





Example 2: UNIVERSITY

Consider the following set of requirements for a **UNIVERSITY** database that is used to keep track of students' transcripts.

- a) The university keeps track of each student's name, student number, Social Security number, current address and phone number, permanent address and phone number, birth date, sex, class (freshman, sophomore, ..., graduate), major department, minor department (if any), and degree program (B.A., B.S., ..., Ph.D.). Some user applications need to refer to the city, state, and ZIP Code of the student's permanent address and to the student's last name. Both Social Security number and student number have unique values for each student.
- b) Each department is described by a name, department code, office number, office phone number, and college. Both name and code have unique values for each department.
- c) Each course has a course name, description, course number, number of semester hours, level, and offering department. The value of the course number is unique for each course.
- d) Each section has an instructor, semester, year, course, and section number. The section number distinguishes sections of the same course that are taught during the same semester/year; its values are 1, 2, 3, ..., up to the number of sections taught during each semester.
- e) A grade report has a student, section, letter grade, and numeric grade (0, 1, 2, 3, or 4).



Example 3: MAIL_ORDER

Consider a **MAIL_ORDER** database in which employees take orders for parts from customers. The data requirements are summarized as follows:

- a) The mail order company has employees, each identified by a unique employee number, first and last name, and Zip Code.
- b) Each customer of the company is identified by a unique customer number, first and last name, and Zip Code.
- c) Each part sold by the company is identified by a unique part number, a part name, price, and quantity in stock.
- d) Each order placed by a customer is taken by an employee and is given a unique order number. Each order contains specified quantities of one or more parts. Each order has a date of receipt as well as an expected ship date. The actual ship date is also recorded.