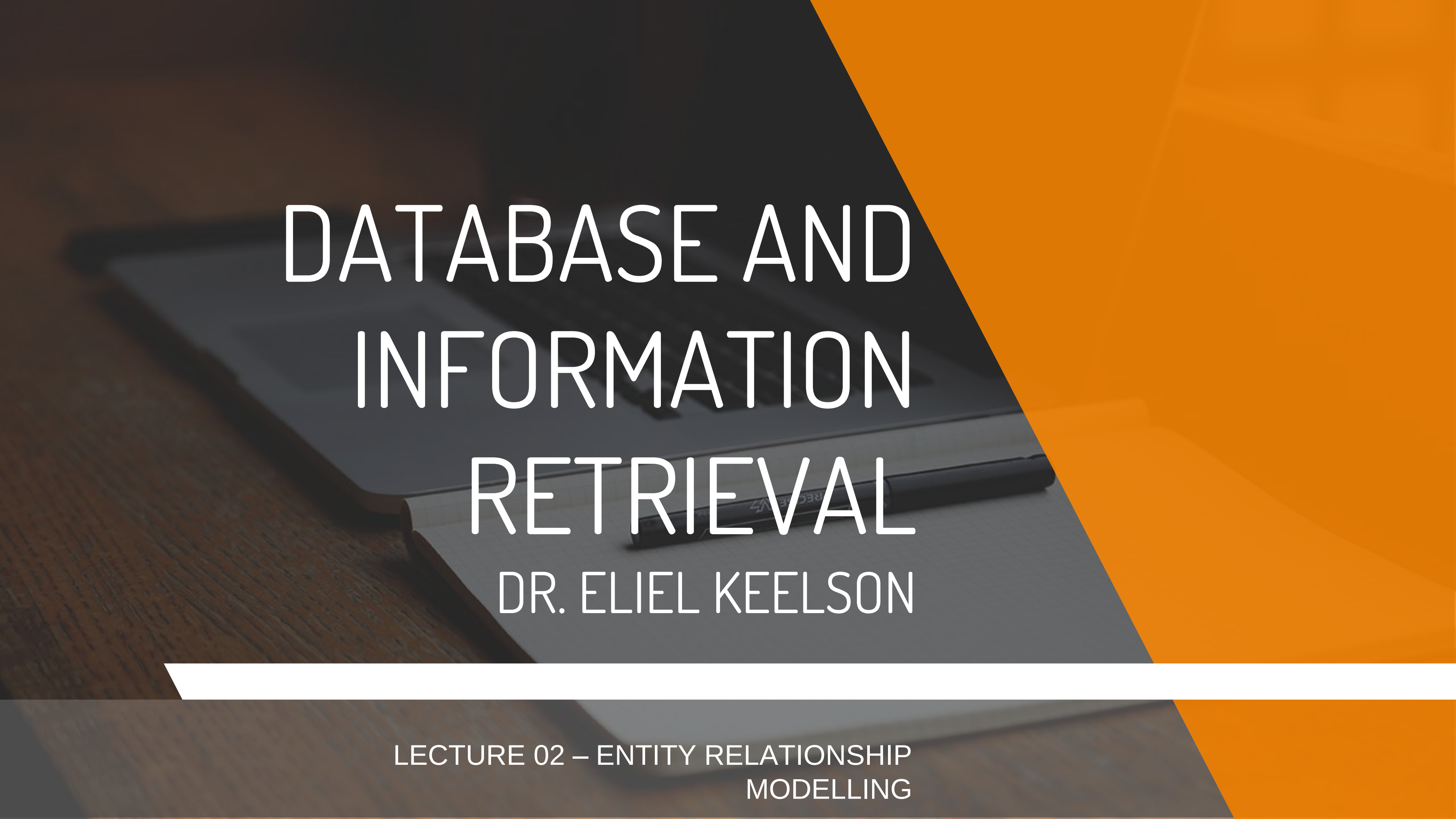


DATABASE AND INFORMATION RETRIEVAL

DR. ELIEL KEELSON

LECTURE 02 – ENTITY RELATIONSHIP MODELLING

BASIC CONCEPTS

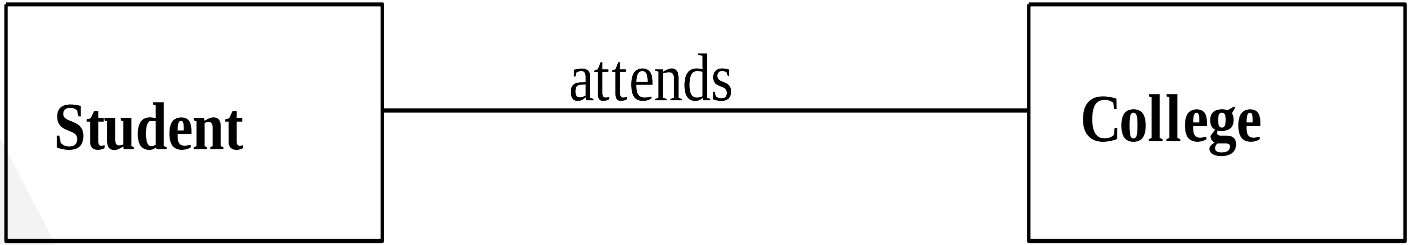
Basic Concepts

- Entity Relational (ER) modelling is a diagrammatic technique used to assist in the design of relational databases.

- An application domain is viewed as consisting of a number of 'entities' which have relationships between each other.

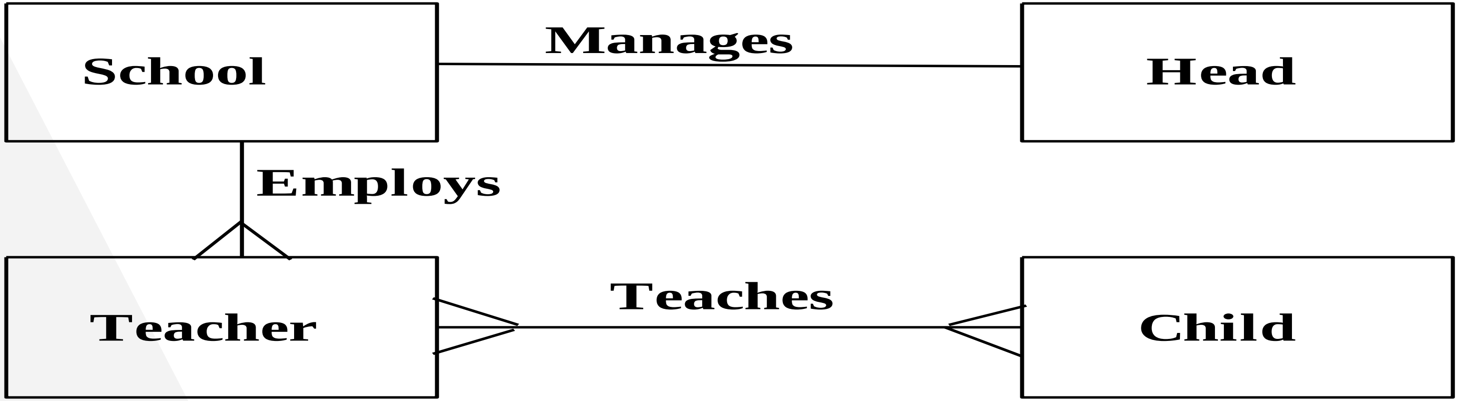
- An entity set (e.g. Students) is represented by a rectangle and a relationship by lines connecting the rectangles.

Basic Concepts



- We can read this diagram as 'student attends college' or its inverse sense 'college is attended by student'.

Basic Concepts



Basic Concepts

- The cardinality specifies, for one member of the first entity set, the possible number of members it can be related to in a second entity set.

- There are three flavours of cardinality:
  - **1:1** **One to one** - e.g. Head manages school
  - **1:n** **One to many** - e.g. School employs teacher
  - **m:n** **Many to Many** - e.g. Teacher teaches child

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ER DIAGRAMS

Reading An ER Diagram

- Interpret the relationship from the point of view of one entity – ‘***one* teacher teaches many children**’

- For this reason, entities are usually named in singular: teacher, child.

- The interpretation of Figure is:
  - One head manages only one school and each school has only one head.
  - One school employs many teachers but one teacher is only employed by one school.
  - One teacher teaches many children and each child is taught by many teachers.

Reading An ER Diagram

- Interpret each relationship from the point of view of *one* instance of the entity.

- Even for the many-many relationship, we refer to ‘*one* teacher teaches many children’.

Reading An ER Diagram

- To interpret a relationship for instance, *school employs teacher*, start at one end and move towards the other end, interpreting the relationship and the terminal crowsfoot, if any:

- starting at the school end we say –
one school employs (*crowsfoot*) **many** teachers.

- starting at the teacher end we say -
one teacher is employed by (no *crowsfoot*) **one** school.

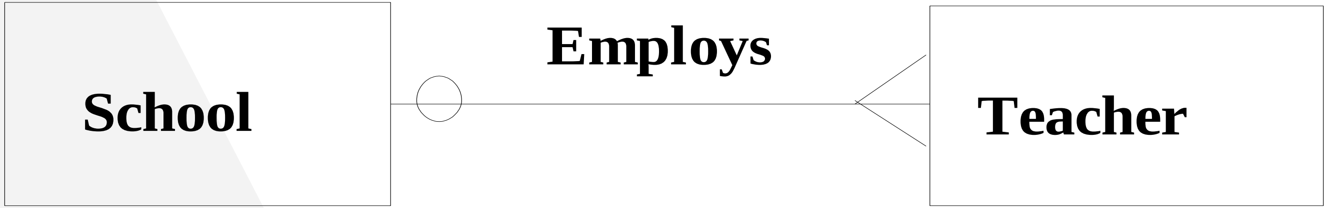
ER DIAGRAMS

OPTIONALITY

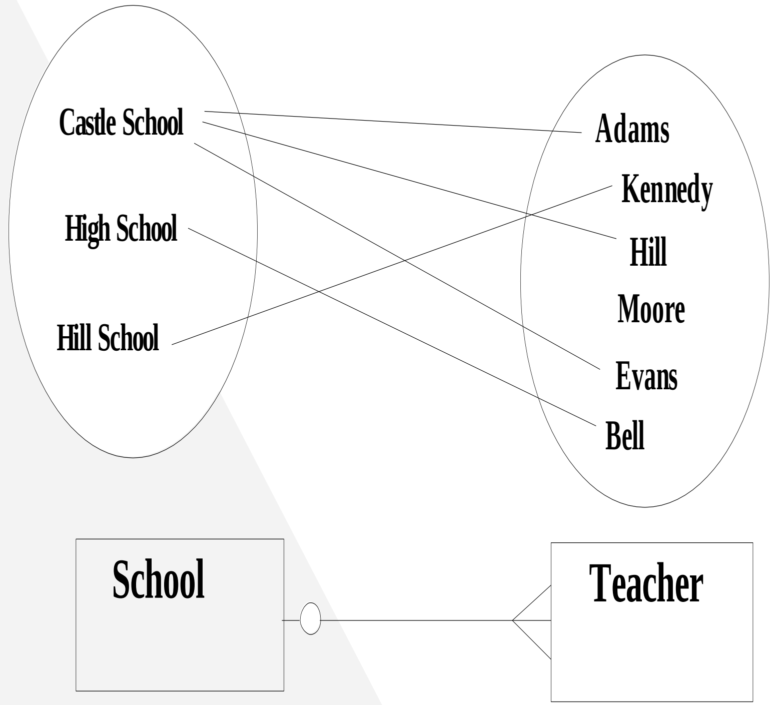
ER Diagram: Optionality

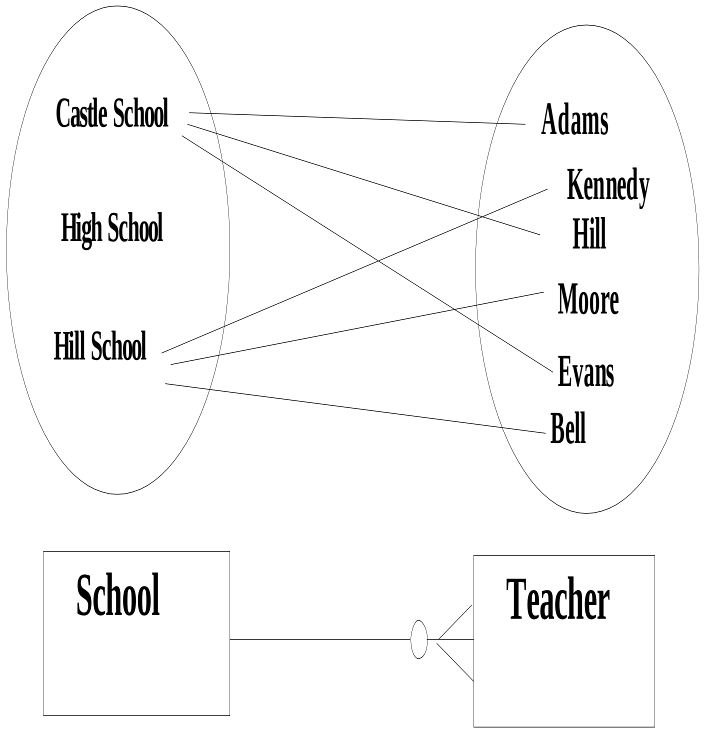
- We may need to express the possibility that some teachers are not employed by any school.

- This requires an additional diagram convention, using a zero.



Visualization of Relationships





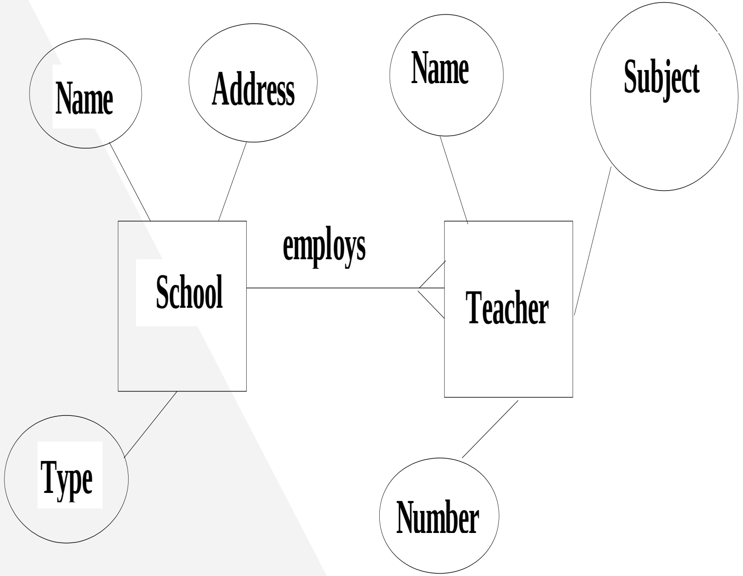
ER DIAGRAMS

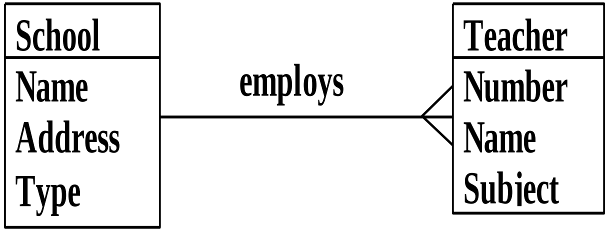
ATTRIBUTES

ER Diagram: Attributes

- The next step is to identify the properties or attributes of the entities and include them in the diagrams.
- It is important to identify attributes at this stage as it helps to clarify what we mean by each entity.
- There are two conventions for this:

ER Diagram: Attributes



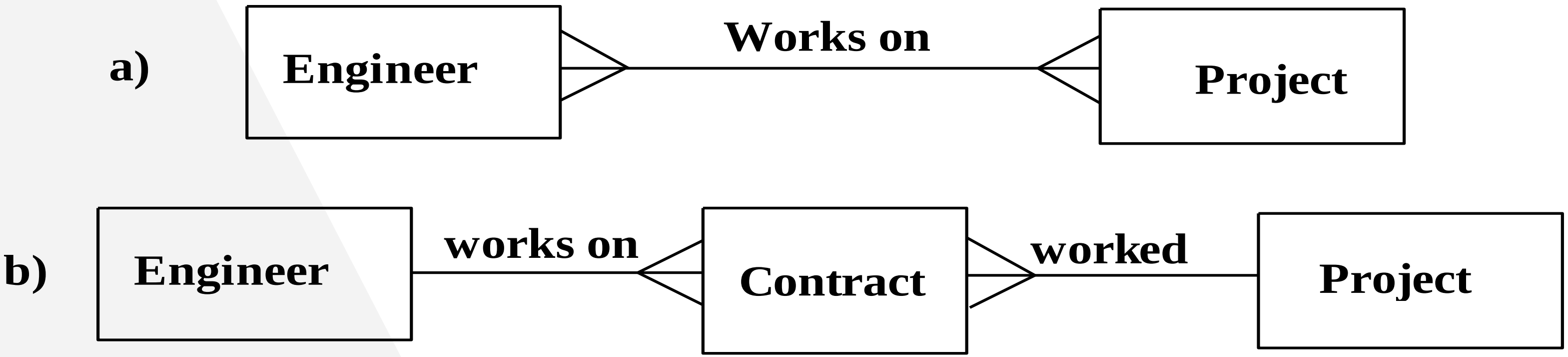


ER DIAGRAMS

MANY TO MANY RELATIONSHIPS

ER Diagram: Many to Many Relationships

- The relationship between some pairs of entities is many to many.
- When we come to the construction of relational tables we find that we cannot directly represent many to many relationships in tables.
- A many to many relationship can be converted to two one to many



ER DIAGRAMS

DESIGN PROCESS

ER Diagram: Many to Many Relationships

ER design is an iterative process that requires successive passes through the design. The elements of this iterative process can be defined as shown below:

- Obtain a thorough understanding of the system including the customer's requirements and expectations, business rules that govern the working of the required application and limits and quantities involved.

- Identify from the above a set of entities and relationships.

ER Diagram: Many to Many Relationships

- Construct an initial ER diagram, adopting suitable primary and foreign keys.
- Review the ER design, look for potential problems and simplifications.
- Seek approval of the design from the future users of the system. One benefit of the ER method is that the design can be understood by non-computing staff.
- Revise the ER design in the light of the above reviews.
- Repeat the above as necessary.

Conversion of ER to relational model

Summary of the design process:

- Entity tables: Create a table to represent each entity in the ER model.

- Relationships: Represent relationships according to their cardinality and optionality. Some relationships will generate another table while some can be represented within the entity tables,

- Primary and foreign keys: Linkages between the tables must be established by the selection of suitable primary and foreign keys. This process actually occurs in parallel with the other two.

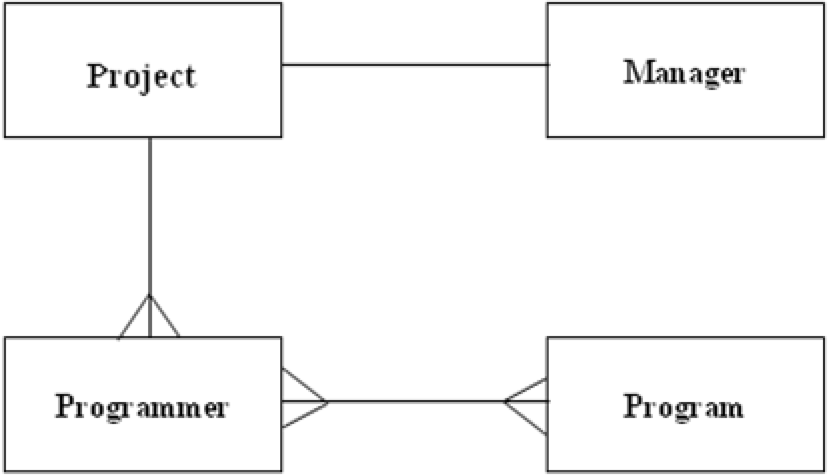
Conversion of ER to relational model

A software company employs a number of programmers who are assigned to work on specific projects.
Each project is controlled by one manager.
Each programmer works on only one project but contributes to the writing of several programs.
Each program may be written by one or more programmers.

Construct an ER diagram to represent this scenario and hence construct suitable relational tables. Assume that the entities shown have (at least) the following attributes:

Manager:	Employee Number, Name
Project:	Project Code, Start Date, Planned Finish Date
Programmer:	Employee Number, Name, Programming Language, Years Experience in language.
Program:	Program Number, Title, Language

Conversion of ER to relational model

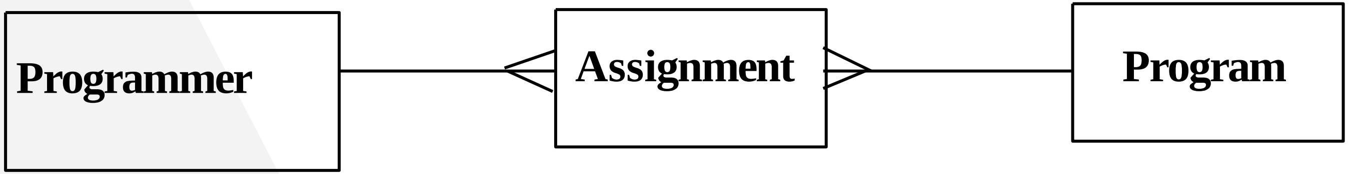


Project

Manager

Programmer

Program



Programmer

Assignment

Program

Conversion of ER to relational model

Manager

Employee Number	Name
432	Morrison
512	Kennedy

Project

Project Code	**Project Name**	**Start Date**	**Finish Date**	**Manager Number**
P001	Website	12/02/06	30/09/06	512
P002	Sales	5/04/07	20/11/08	432

Programmer

Employee Number	**Name**	**Language**	**Years Exper**	**Project Code**
127	Jones	Oracle	4	P001
258	Green	Oracle	8	P001
361	Allen	Java	2	P002
677	Orr	Java	10	P001
780	Grant	Oracle	4	P002

Conversion of ER to relational model

Program

Program Number	Title	Language
A001	Home pages	HTML
A002	Forms input	Java
A003	Database interface	Java
S101	Enter New Sales	Oracle
S102	Invoicing	Oracle
S103	Sales Enquiry	Oracle

Assignment

Programmer Emp Number	Program Number
127	S102
258	S101
361	A002
677	A003
780	S103

THANKS!

Any questions?

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