

# Databases 1 - Organisation and Creation

Lecture 18 - COMPSCI1111/111G SS 2016

## Today's lecture

- ▶ What is a database?
- ▶ Understanding how data is organised in a database
- ▶ Creating a database in Microsoft Access

## What is a database?

- ▶ A (typically large) collection of data about a particular topic, organized systematically
- ▶ Examples:
  - ▶ Catalogue of library books
  - ▶ Patients' files in a clinic
  - ▶ Entries in an address book
  - ▶ Students in a class
- ▶ Computers allow us to store and manage databases that contain very large amounts of information

## Aspects of a database

- ▶ Before we can create our database, we need to decide how to:
  1. Organize data in our database
  2. Enter data in our database
  3. Retrieve data from our database
  4. Present the retrieved data to the user

# 1. Organising data - models

- ▶ A model defines how data is organized and structured within the database
  - ▶ We're going to look at the relational model in this course
- ▶ When deciding what data to store in a database, we need to think about:
  - ▶ **Entities:** things about which we store information
    - ▶ Eg. students in uni, courses in uni
  - ▶ **Relationships:** specific connections among entities
    - ▶ Eg. *students* enrolled in *CompSci111/111G*

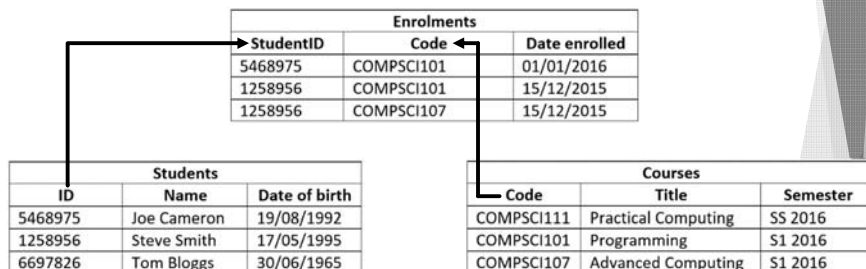
# 1. Organising data - tables

- ▶ The **relational model** was developed by Edgar Codd in 1970
- ▶ Data is stored and organized in tables
  - ▶ A table's columns are called **fields**; an entity's attributes
  - ▶ A table's rows are called **records**; one instance of an entity
- ▶ A collection of tables form a **database**

	Field			
Record	StudentId	Name	Address	Phone
	12345	C. Brown	12 Apple St.	555-1234
	67890	L. Van Pelt	34 Pear Ave.	555-5678
	22222	P. Patty	56 Grape Blvd.	555-9999

# 1. Organising data

- ▶ Tables are connected together using **relationships**, thereby creating connections between different entities



# 1. Organising data

- ▶ There are two parts to a relationship; **primary key** and **foreign key**
- ▶ 1. Primary key:
  - ▶ Generally, all tables must have a primary key field
  - ▶ All records must have a value in the primary key field
  - ▶ The primary key's value must be unique

Primary key →

Field Name	Data Type
ID	AutoNumber
First Name	Text
E-mail Address	Text
Level	Text
Room	Text
Date of Birth	Date/Time

# 1. Organising data

## ▶ 2. Foreign key

- ▶ A field in one table that is related to a primary key field in another table
- ▶ Creates a connection between the two fields
- ▶ Can take blank values and/or repeated value depending on the relationship

Enrolments		
StudentID	Code	Date enrolled
5468975	COMPSCI101	01/01/2016
1258956	COMPSCI101	15/12/2015
1258956	COMPSCI107	15/12/2015

Students		
ID	Name	Date of birth
5468975	Joe Cameron	19/08/1992
1258956	Steve Smith	17/05/1995
6697826	Tom Bloggs	30/06/1965

# Referential integrity

- ▶ An important concept underlying relationships between tables
- ▶ Referential integrity requires all values of a foreign key field to be:
  - ▶ Present in the related primary key field, OR
  - ▶ Null (ie. blank)

# Referential integrity

Students		
ID	Name	Date of birth
5468975	Joe Cameron	19/08/1992
1258956	Steve Smith	17/05/1995
6697826	Tom Bloggs	30/06/1965

Enrolments		
StudentID	Code	Date enrolled
5468975	COMPSCI101	01/01/2016
1258956	COMPSCI101	15/12/2015
1258956	COMPSCI107	15/12/2015

`Insert 9998881, COMPSCI111, 22/12/2015 into Enrolments` ✘

`Insert 6697826, COMPSCI105, 16/12/2015 into Enrolments` ✔

`Insert , COMPSCI101, 01/12/2015 into Enrolments` ✔

# Types of relationships

- ▶ There are three kinds of relationship that can exist between tables
- ▶ **One to one:** one record in PK related to one record in FK
  - ▶ Eg. student can only have one transcript
- ▶ **One to many:** one record in PK related to multiple records in FK
  - ▶ Eg. student can have multiple emergency contacts
- ▶ **Many to many:** multiple records in PK related to multiple records in FK
  - ▶ Eg. many students can be enrolled in many papers

# Aspects of a database

- ▶ Before we can create our database, we need to decide how to:
  1. Organize data in our database
    - ▶ Models, tables, relationships
  2. Enter data in our database
  3. Retrieve data from our database
  4. Present the retrieved data to the user

# Database Management System (DBMS)

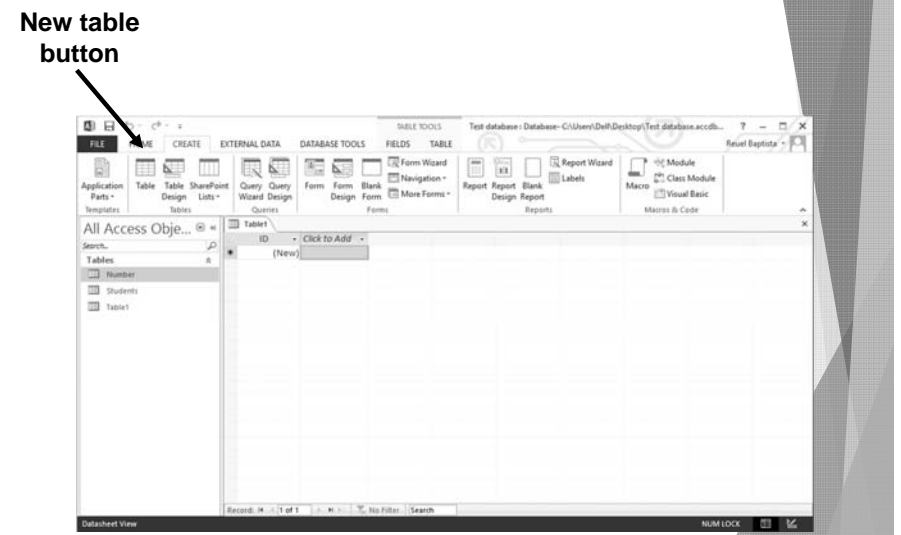
- ▶ Application software that is used to manage databases.
- ▶ Four main functions:
  - ▶ Definition
  - ▶ Update
  - ▶ Querying
  - ▶ Administration
- ▶ Examples:
  - ▶ Microsoft Access
  - ▶ Microsoft SQL Server



# Creating a database

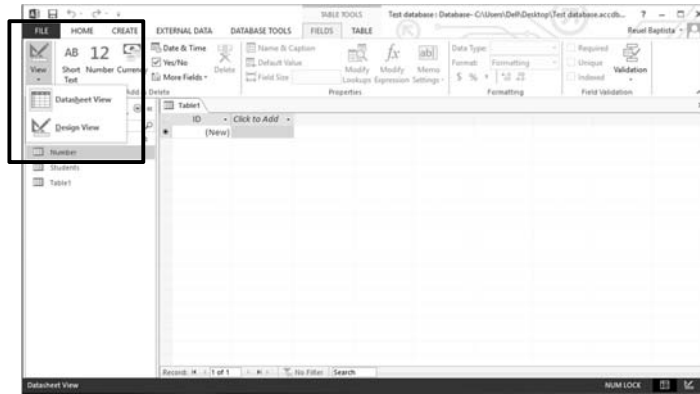


# Creating a table

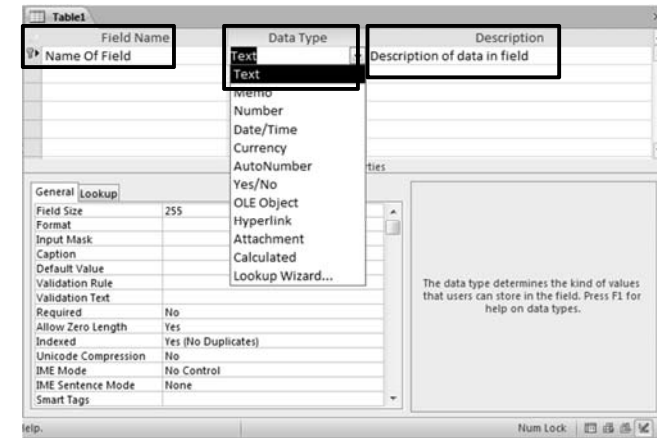


# Creating a table

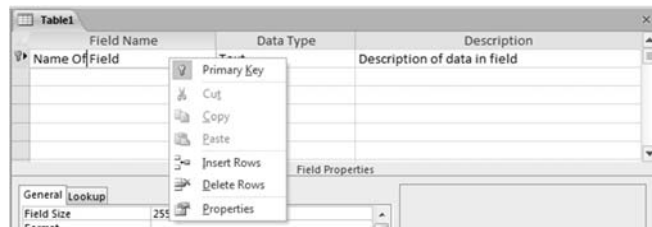
- ▶ Design view: create/view the fields in the table
- ▶ Datasheet view: create/view data in the table



# Design view



# Design view



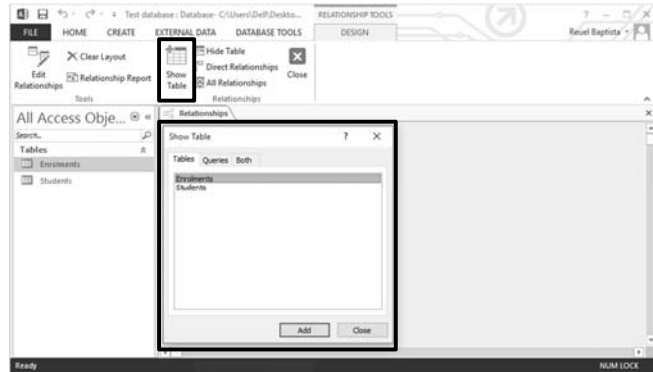
# Datasheet view

- ▶ Allows us to enter data into our table
- ▶ Need to ensure that we enter the correct type of data in each field (eg. no text in a number field)

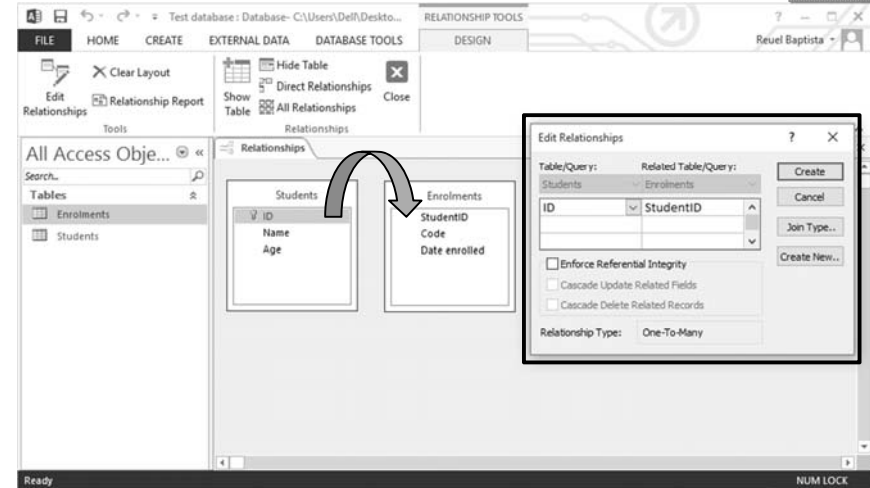


# Creating relationships

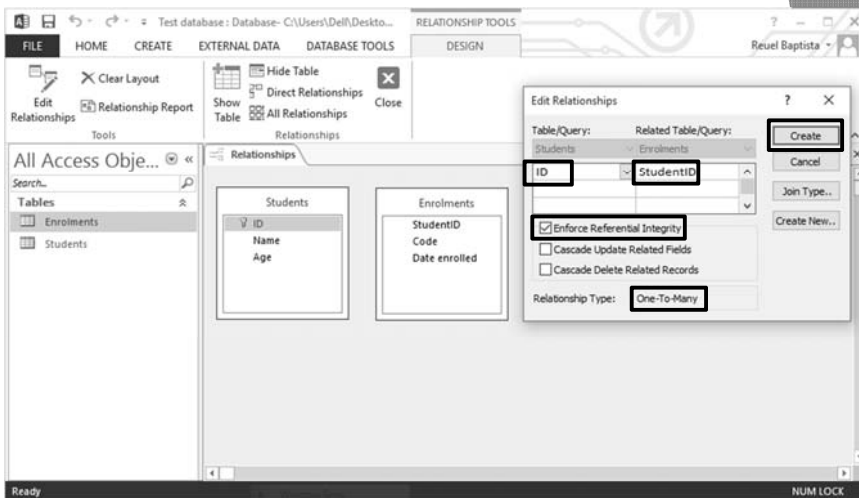
- ▶ Relationships view allows us to create relationships between fields in different tables
- ▶ Database Tools tab → Relationships button



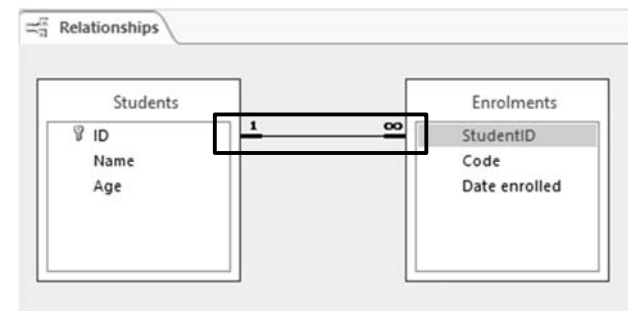
# Creating relationships



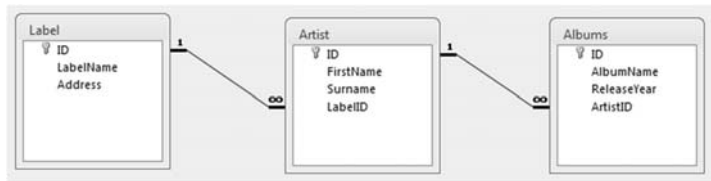
# Creating relationships



# Creating relationships

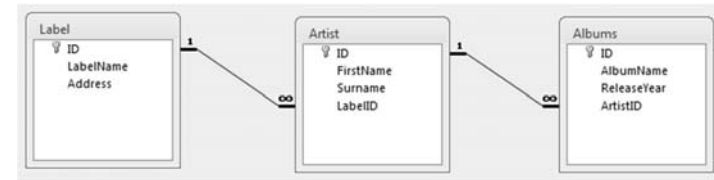


# Exercises



1. What is the primary key and the foreign key (if one exists) for the *Label* table?
2. What is the primary key and the foreign key (if one exists) for the *Artist* table?
3. What is the primary key and the foreign key (if one exists) of the *Albums* table?

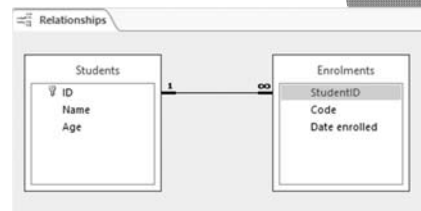
# Answers



- ▶ Label
  - ▶ PK: ID
  - ▶ FK: none
- ▶ Artist
  - ▶ PK: ID
  - ▶ FK: LabelID
- ▶ Albums
  - ▶ PK: ID
  - ▶ FK ArtistID

# Inserting data

ID	Name	Age
1	Bob	23
2	Jane	24
3	John	19



StudentID	Code	Date enrolled
1	COMPSCI111	08-Dec-15
1	COMPSCI105	29-Nov-15
2	COMPSCI105	03-Dec-15
5	COMPSCI280	05-Jan-16
0		

- ▶ Can we insert this record in the Enrolments table?

# Inserting data

- ▶ This won't work; StudentID's value ('5') doesn't exist in the primary key ID

# Summary

- ▶ A database is used to store information in a systematic and orderly manner
- ▶ The relational model uses tables to store information about entities and relationships to connect tables together
- ▶ Relationships require tables, primary keys, foreign keys. Referential integrity is an important concept
- ▶ Microsoft Access is a popular DBMS that we can use to insert and manage data in our database

