

Database Fundamentals – CS990

Database and Web Systems Development - CS952

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Database Fundamentals CS990

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CS990 Database Fundamentals

- Module Content:
 - Introduction – basics and administration
 - The relational model
 - Database design
 - SQL
 - Normalisation
- Practical: Lab Sessions

Introduction

- Motivation
- Opportunities
- Module Organisation

22 Jan 2025

The screenshot shows the Indeed job search interface. At the top, the Indeed logo is on the left, and navigation links for 'Home', 'Company reviews', and 'Salary guide' are in the center. A 'Sign in' link is on the right. Below the navigation bar is a search bar with 'sql' entered, a location field with a placeholder 'City or postcode', and a blue 'Find jobs' button. Under the search bar are several filter buttons: 'Remote', 'Date posted', 'Pay', 'Job type', 'Company', 'Posted By', 'Location', 'Programming language', 'Education level', 'Industry', and 'Encouraged to apply'. The main content area is divided into two columns. The left column has a header 'Post your CV and find your next job on Indeed!' and a sub-header 'sql jobs'. It shows 'Sort by: relevance - date' and '6,000+ jobs'. Two job listings are visible: 'Project Manager - Software Development' (marked 'New') and 'Programming Analyst - AI Trainer' (marked 'Hiring multiple candidates'). The right column shows a detailed view of the 'Project Manager - Software Development' job. It includes a 'Media Plan' link, the location 'Weybridge KT13 ORH', 'Hybrid work', and the salary range '£50,000 - £80,000 a year - Full-time'. There are buttons for 'Apply now', a bookmark icon, and a share icon. Below this, the 'Job details' section shows 'Pay' as '£50,000 - £80,000 a year' and 'Job type' as 'Full-time'. A 'Shift and schedule' section is partially visible at the bottom.

indeed Home Company reviews Salary guide Sign in

sql City or postcode Find jobs

Remote Date posted Pay Job type Company Posted By Location Programming language Education level Industry Encouraged to apply

Post your CV and find your next job on Indeed!

sql jobs

Sort by: relevance - date 6,000+ jobs ?

New

Project Manager - Software Development

Media Plan

Hybrid work in Weybridge KT13 ORH

£50,000 - £80,000 a year Full-time Monday to Friday

Easily apply

Hiring multiple candidates

Programming Analyst - AI Trainer

DataAnnotation 4.0 ★

Remote

Project Manager - Software Development

Media Plan

Weybridge KT13 ORH • Hybrid work

£50,000 - £80,000 a year - Full-time

Apply now

Job details

Here's how the job details align with your profile.

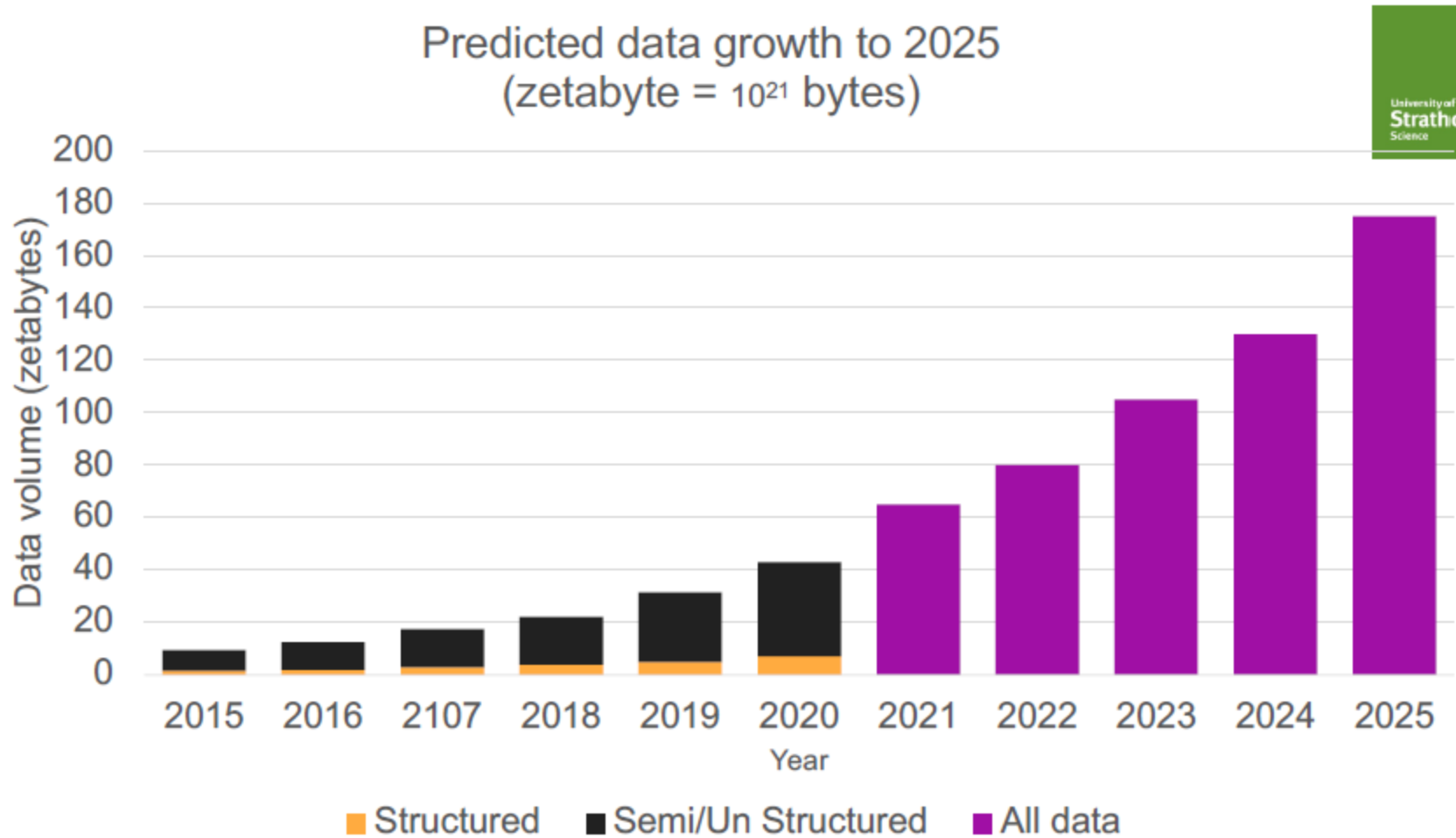
Pay

£50,000 - £80,000 a year

Job type

Full-time

Shift and schedule



Source: Data Age 2025: <https://www.i-scoop.eu/big-data-action-value-context/data-age-2025-datasphere/> and other

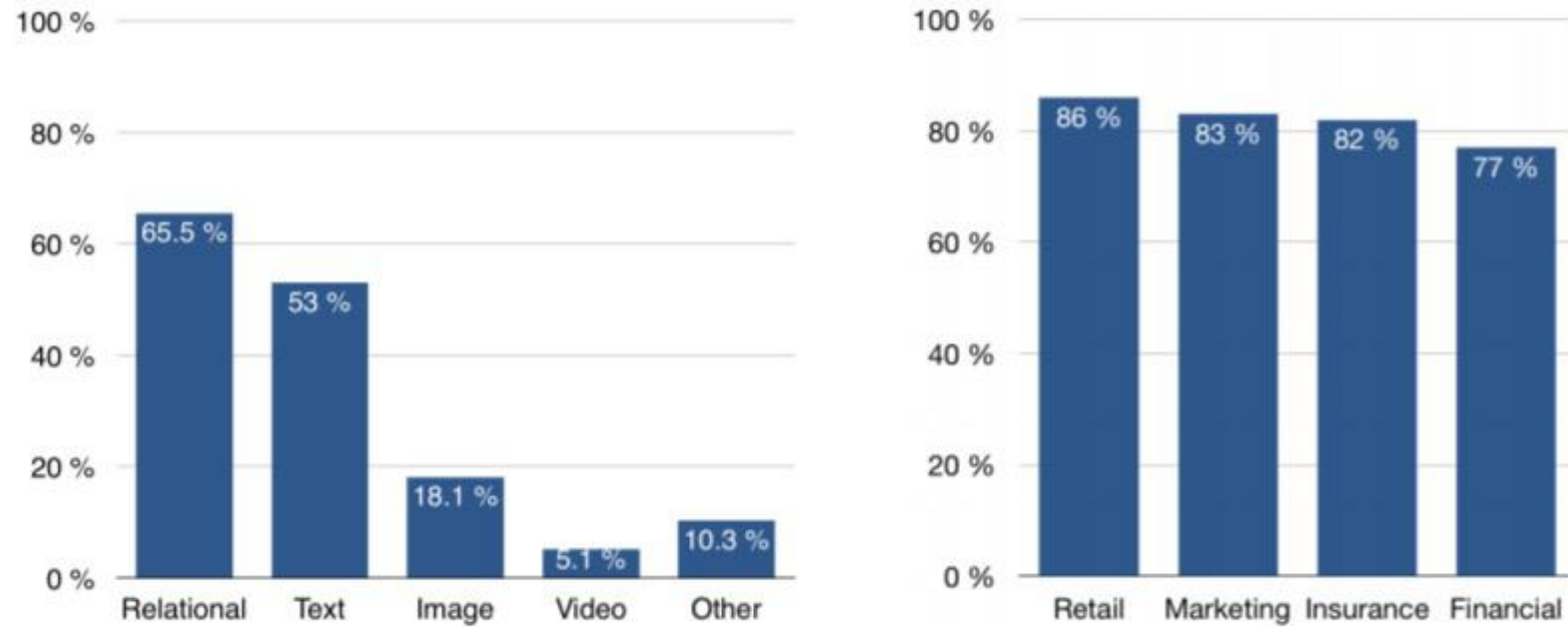


Figure 1: Kaggle survey of 16,000 practitioners on the state of data science and machine learning: Use of relational data: overall (left), by industry (right).

Dan Olteanu. The Relational Data Borg is Learning. PVLDB, 13(12): 3502-3515, 2020. DOI: <https://doi.org/10.14778/3415478.3415572>

Roles in the Database Environment

- Data Administrator (DA)
- Database Administrator (DBA)
- Database Designers (Logical and Physical)
- Application Programmers
- End Users (naive and sophisticated)

itjobswatch.co.uk/

Results 1 - 24 of 24							
Description	Rank 6 Months to 17 Jan 2024	Rank YoY Change	Median Salary	Median Salary YoY Change	Historical Absolute & Relative Jobs Vacancies		Live Jobs
SQL	10	▼ -4	£59,028	-1.62%	8,786	14.13%	3,985

Module content

CS952	CS990	Lectures:	Introduction – basics and administration
			The relational model
			Database design
			SQL
			Normalisation
		Tutorials:	Database design & normalisation
		Practicals:	Oracle
		Lectures:	PHP/CSS/HTML/Javascript
			Security
			Accessibility
		Practicals:	PHP/CSS/HTML/Javascript

Assessments – CS990

Classwork 1: Entity Relationship Modelling – A self-assessed formative exercise.	0%
Class Tests (3) - MCQs - Online on MyPlace	30%
Exam 1 hour	70%
Resit: Examination	100%

Assessments – CS952

Classwork 1: Entity Relationship Modelling – A self-assessed formative exercise.	0%
Class tests (3) - MCQs - Online on MyPlace	15%
Classwork 2 - Database & Web Systems Project	35%
Exam – 2 Hour – Paper based	50%
Resit: Examination – Paper based	100%

Resources - MyPlace

▶ Open all ▼ Close all

Instructions: Clicking on the section name will show / hide the section.

- ▶ **Week 1 (20/01/2025 - 26/01/2025): Introduction to Relational Databases - Toggle** Topic 1
- ▶ **Week 2 (27/01/2025 - 02/01/2025): Data Modelling - Toggle** Topic 2
Hidden from students
- ▶ **Week 3 (03/02/2025 - 09/02/2025): Database Design and SQL - Toggle** Topic 3
Hidden from students
- ▶ **Week 4 (10/02/2025 - 16/02/2025): Further SQL - Toggle** Topic 4
Hidden from students
- ▶ **Week 5 (17/02/2025 - 23/02/2025): Normalisation - Toggle** Topic 5

Additional resources

→ ↻ w3schools.com/sql/trysql.asp?filename=trysql_select_all

SQL Statement:

```
SELECT * FROM Customers;
```

Edit the SQL Statement, and click "Run SQL" to see the result.

[Run SQL »](#)

Result:

Number of Records: 91

CustomerID	CustomerName	ContactName	Address	City	PostalCode	Country
1	Alfreds Futterkiste	Maria Anders	Obere Str. 57	Berlin	12209	Germany
2	Ana Trujillo Emparedados y helados	Ana Trujillo	Avda. de la Constitución 2222	México D.F.	05021	Mexico
3	Antonio Moreno Taquería	Antonio Moreno	Mataderos 2312	México D.F.	05023	Mexico
4	Around the Horn	Thomas Hardy	120 Hanover Sq.	London	WA1 1DP	UK
5	Berglunds snabbköp	Christina Berglund	Berguvsvägen 8	Luleå	S-958 22	Sweden
6	Blauer See Delikatessen	Hanna Moos	Forsterstr. 57	Mannheim	68306	Germany

Recommended Text/Reading

Internet & World Wide Web How to Program (4th Edition). *Deitel, H. and Deitel, P.* Prentice Hall, 2007. ISBN-13: 978-0136035428 | [Stocked at Amazon](#) (Other retailers are available)

Database Systems: A Practical Approach to Design, Implementation and Management (6th Edition). *Connolly, T.M. and Begg, C.E.* Pearson, 2014. | [Stocked at Amazon](#) (Other retailers are available)

Database Principles and Design (3rd Edition). *Ritchie, C.* Cengage, 2008. ISBN-13: 978-1844805402 | [Stocked at Amazon](#) (Other retailers are available)

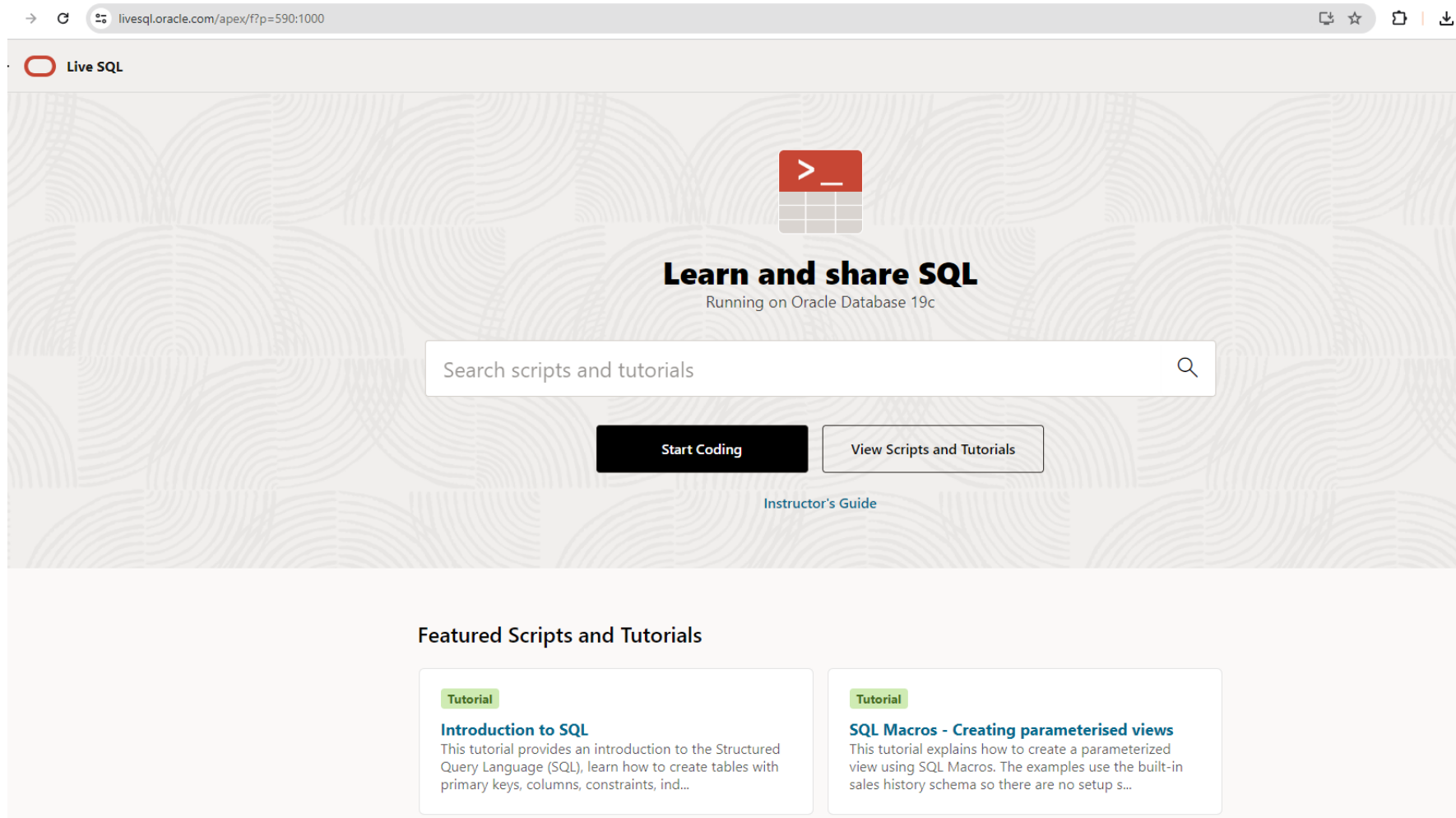
Practical - organisation

Practical Session	Programme
Tuesday 15:00 – 17:00	MSc Software Development
Thursday 12:00 – 14:00	MSc Information Management - MSc Data Analytics
Friday 12:00 – 14:00	MSc Data Science for Politics and Policy Making MSc Digital Health Systems

Oracle live: Web based Database learning platform.

<https://livesql.oracle.com>

Oracle Live



The screenshot shows the Oracle Live SQL web application. The browser address bar displays `livesql.oracle.com/apex/f?p=590:1000`. The page header includes the "Live SQL" logo. The main content area features a large red button with a SQL prompt symbol (>_) and the text "Learn and share SQL" and "Running on Oracle Database 19c". Below this is a search bar with the placeholder text "Search scripts and tutorials". Two buttons are present: "Start Coding" (black) and "View Scripts and Tutorials" (white). A link for "Instructor's Guide" is also visible. The "Featured Scripts and Tutorials" section contains two items:

- Tutorial**
Introduction to SQL
This tutorial provides an introduction to the Structured Query Language (SQL), learn how to create tables with primary keys, columns, constraints, ind...
- Tutorial**
SQL Macros - Creating parameterised views
This tutorial explains how to create a parameterized view using SQL Macros. The examples use the built-in sales history schema so there are no setup s...

Getting started with Database

Database


- A shared collection of logically-related data (along with its description) intended to meet the information needs of an organisation.
- Data - facts: bill. Information – organised data: Name-bill.
- Logically related data that represents the entities, attributes, and relationships of an organisation's information.
- The description is provided in a system catalogue – the metadata.

Flat Files (1968)

The Evolution :

1968 File-Based: predecessor of database, Data was maintained in a flat file.

Flat Files: Earlier, punched cards technology was used to store data – later, files. But the files have no as such advantage, rather have several limitations.

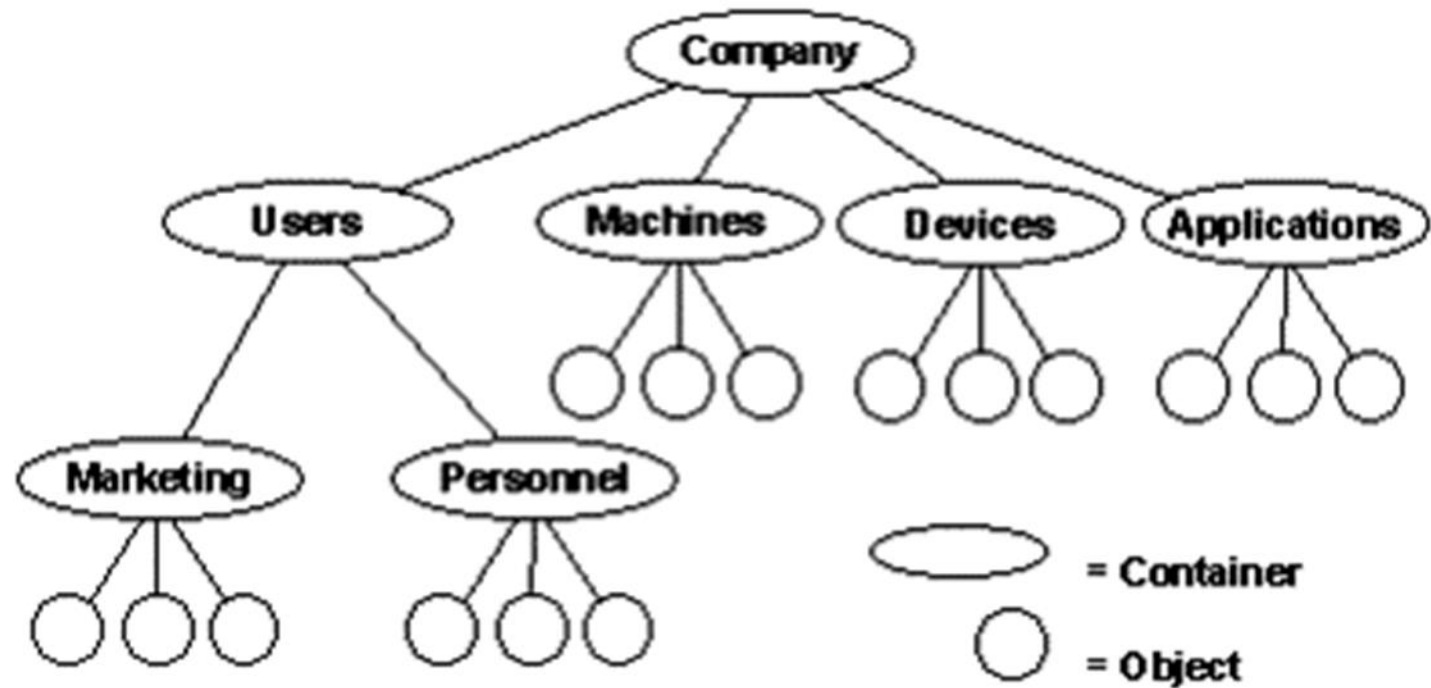


CustomerID	CompanyName	ContactName	ContactTitle
ALFKI	Alfreds Futterkiste	Maria Anders	Sales Representative
ANATR	Ana Trujillo Emparedados y helados	Ana Trujillo	Owner
ANTON	Antonio Moreno Taquería	Antonio Moreno	Owner
AROUT	Around the Horn	Thomas Hardy	Sales Representative
BERGS	Berglunds snabbköp	Christina Berglund	Order Administrator
BLAUS	Blauer See Delikatessen	Hanna Moos	Sales Representative
BLONP	Blondesddsl père et fils	Frédérique Citeaux	Marketing Manager
BOLID	Bólido Comidas preparadas	Martin Sommer	Owner
BONAP	Bon app'	Laurence Lebihan	Owner
BOTTM	Bottom-Dollar Markets	Elizabeth Lincoln	Accounting Manager
BSBEV	B's Beverages	Victoria Ashworth	Sales Representative
CACTU	Cactus Comidas para llevar	Patricio Simpson	Sales Agent
CENTC	Centro comercial Moctezuma	Francisco Chang	Marketing Manager
CHOPS	Chop-suey Chinese	Yang Wang	Owner
COMMI	Comércio Mineiro	Pedro Afonso	Sales Associate
CONSH	Consolidated Holdings	Elizabeth Brown	Sales Representative
DRACD	Drachenblut Delikatessen	Sven Ottlieb	Order Administrator
DUMON	Du monde entier	Janine Labrune	Owner
EASTC	Eastern Connection	Ann Devon	Sales Agent
ERNSH	Ernst Handel	Roland Mendel	Sales Manager
FAMIA	Familia Arquibaldo	Aria Cruz	Marketing Assistant
FISSA	FISSA Fabrica Inter. salchichas S.A.	Diego Roel	Accounting Manager

<https://mhaadi.wordpress.com/2010/10/18/the-evolution-of-database/>

Hierarchical Data Model (1968-1980)

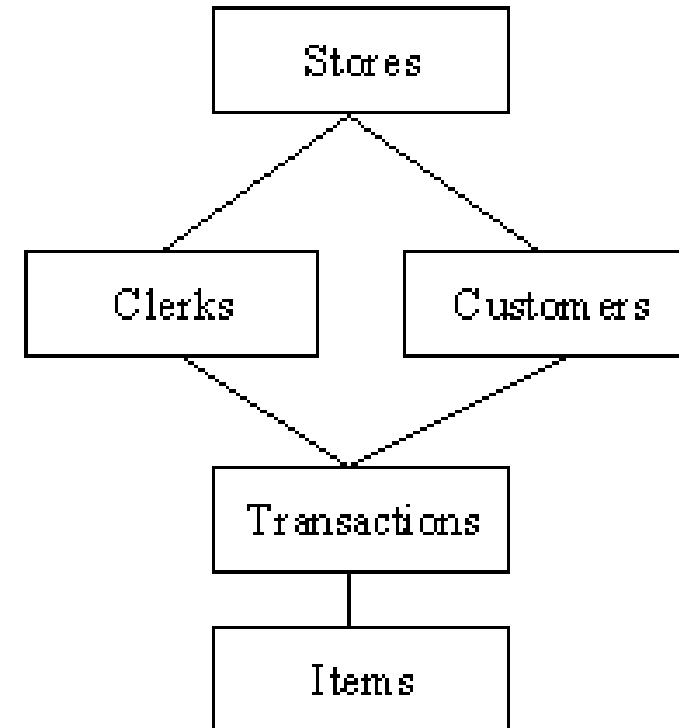
Files are related in a parent/child manner, with each child file having at most one parent file.



<https://mhaadi.wordpress.com/2010/10/18/the-evolution-of-database/>

Network Data Model (1960-1971)

- Files are related as owners and members, similar to the common network model except that each member file can have more than one owner.

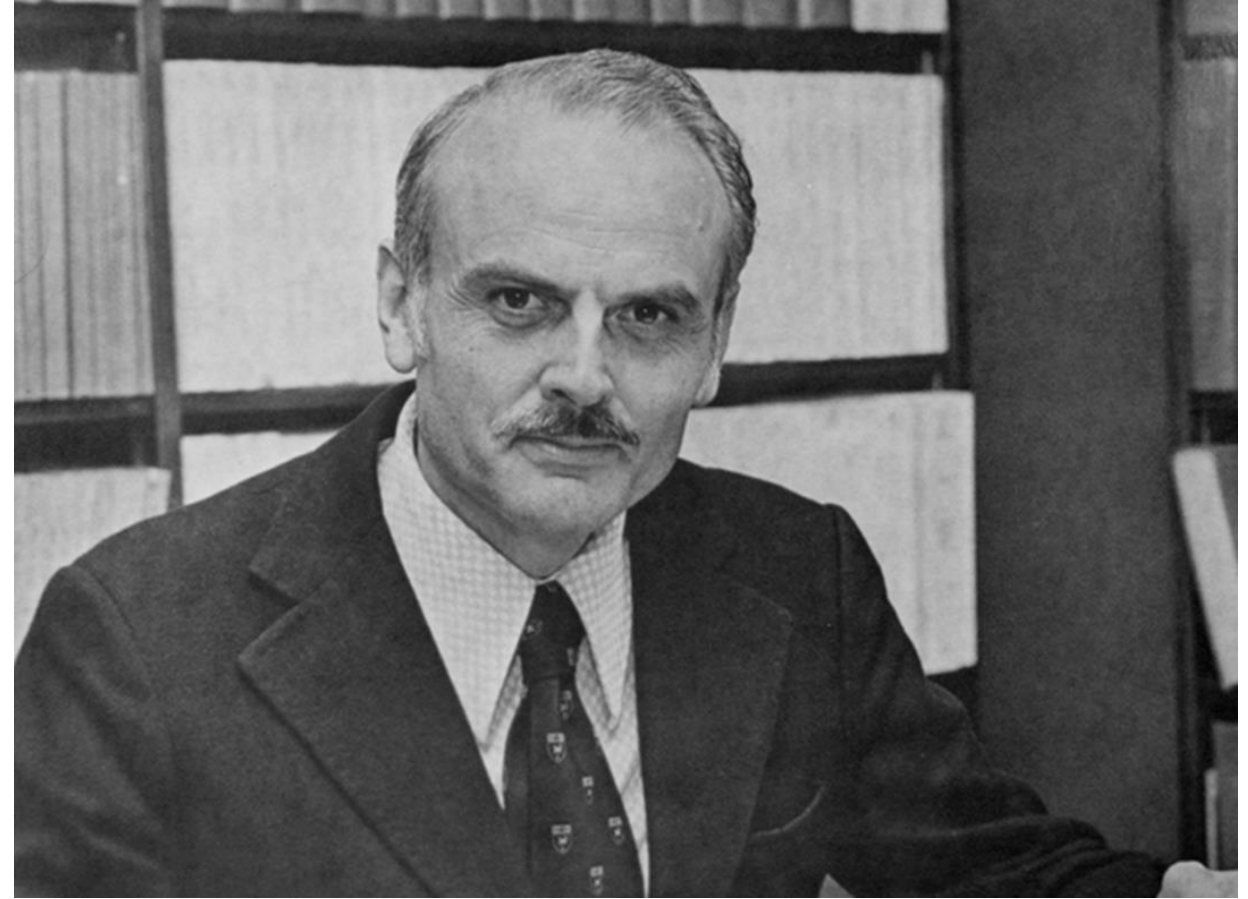


Relational Model: Ted Codd

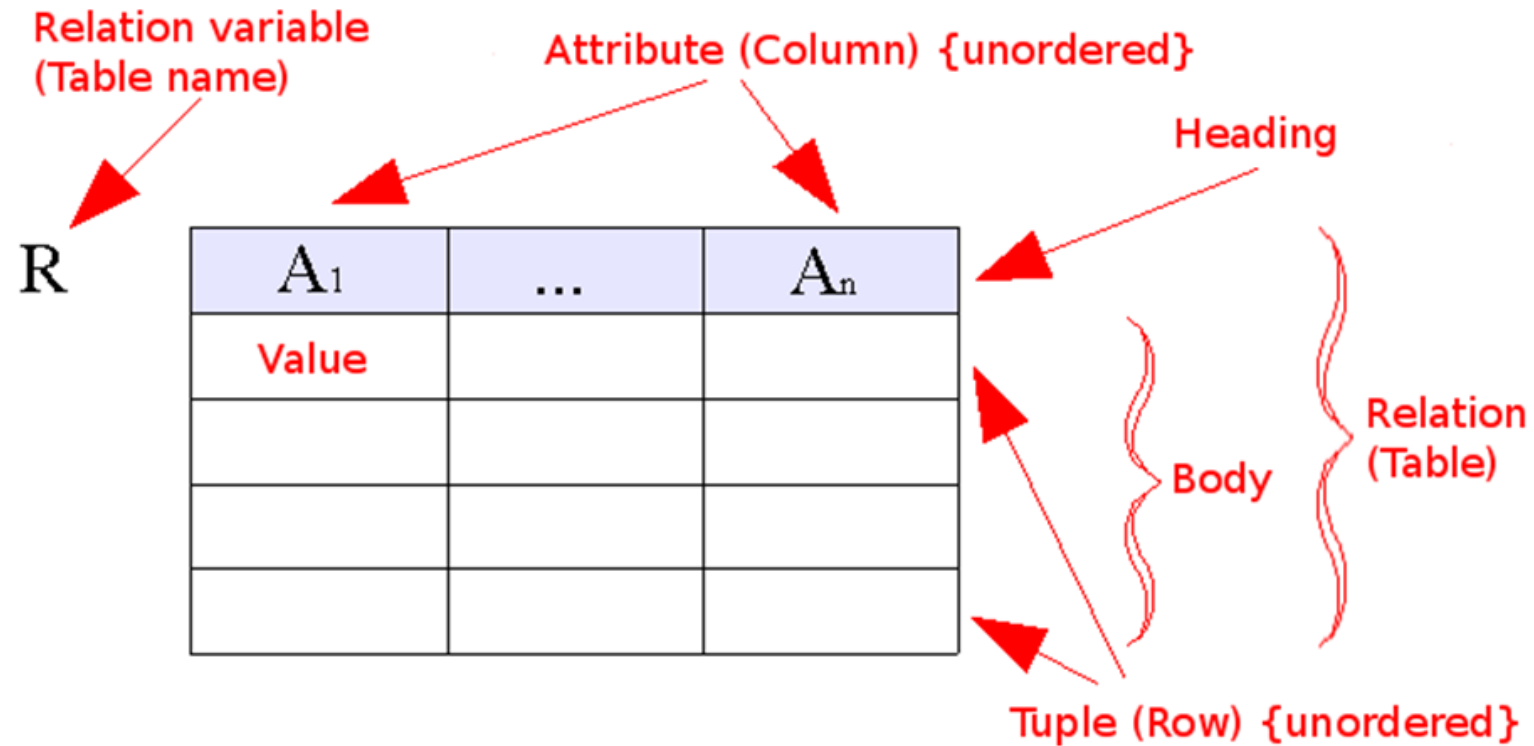
Two terminologies:

- Instance – a table with rows or columns.
- Schema – specifies the structure (name of relation, name and type of each column)

*The model is based on branches of mathematics called **set theory** and **predicate logic**.*



Relational Model (*1970-present*)



https://en.wikipedia.org/wiki/Relational_model#/media/File:Relational_model_concepts.png

ER Notation: Peter Chen



ER Notation: Peter Chen

Dr. Peter Chen

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Welcome to the home page of Dr. Peter Chen (陳品山) at [Louisiana State University](#) (LSU) where he worked from 1983 to 2011. Currently, he is Adjunct Professor at in the Computer Science Department and Emeritus.

Prof. Peter Chen received his Ph.D. from Harvard University and has held regular and visiting faculty positions. He is the creator of the **Relationship Model (ER Model)**, which serves as the foundation of many systems analysis and design repository systems including IBM's Repository Manager/MVS and DEC's CDD/Plus. After years of developing relationship concepts, now "Entity-Relationship Model (ER Model)," "Entity-Relationship Diagram (ERD)," "online" dictionaries, books, articles, web pages, course syllabi, and commercial product brochures.

His work started a new field of research and practice: **Conceptual Modeling**. Since 1978, an annual International Conference on Conceptual Modeling has been held in various countries. To recognize his pioneering contributions, the [Peter P. Chen Award](#) was established in 2001.

Dr. Peter Chen's original paper on the Entity-Relationship model (ER model) is **one of the most cited papers** in the computer science literature according to a survey of 1,000 computer science college professors ([Table Publishing, 1996](#)). It was selected for inclusion as one of the important publications in the "[Science Pearls](#)" project of Wiley ([cited article in Computer Science](#)). It is the **4th most downloaded paper** from the ACM Digital Library in January 2005 (4 years ago).

The ER model was adopted as the meta model for the **ANSI Standard in Information Resource Directory System (IRDS)** design and **one of the top methodologies in systems development** by several surveys of **FORTUNE 500 companies**.

Dr. Chen's work is a cornerstone of software engineering, in particular **Computer-Aided Software Engineering (CASE)** (**AD/Cycle**) framework and **DB2 repository (RM/MVS)** were based on the ER model. Other vendors' repository systems made significant impact on the CASE industry by his research work and by his lecturing around the world on structured systems analysis. **Computer Associates' ERWIN**, **Oracle's Designer/2000**, and **Sybase's PowerDesigner** (and even a general drawing tool [ADO.NET Entity Framework](#) (a software development framework) is also based on the ER model.

<https://www.csc.lsu.edu/~chen/>

ER Notation



Entity



Attribute



Relationship



**Weak
Entity**

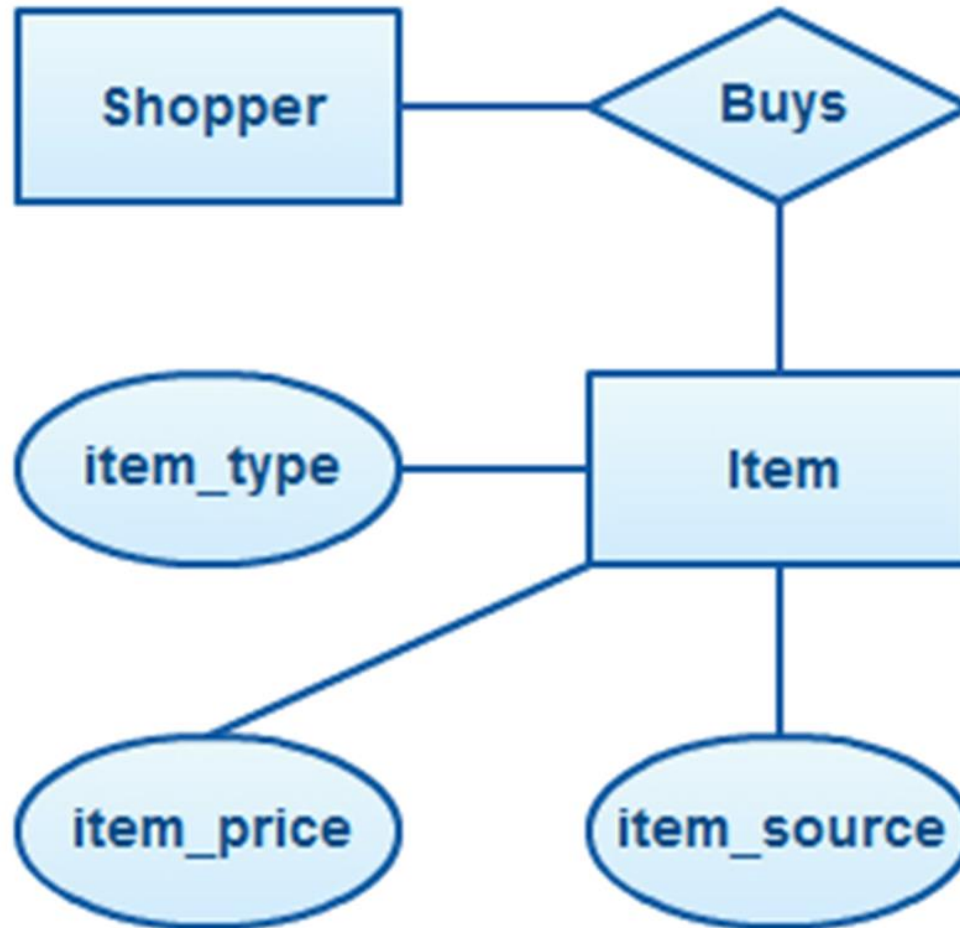


**Multivalued
Attribute**



**Weak
Relationship**

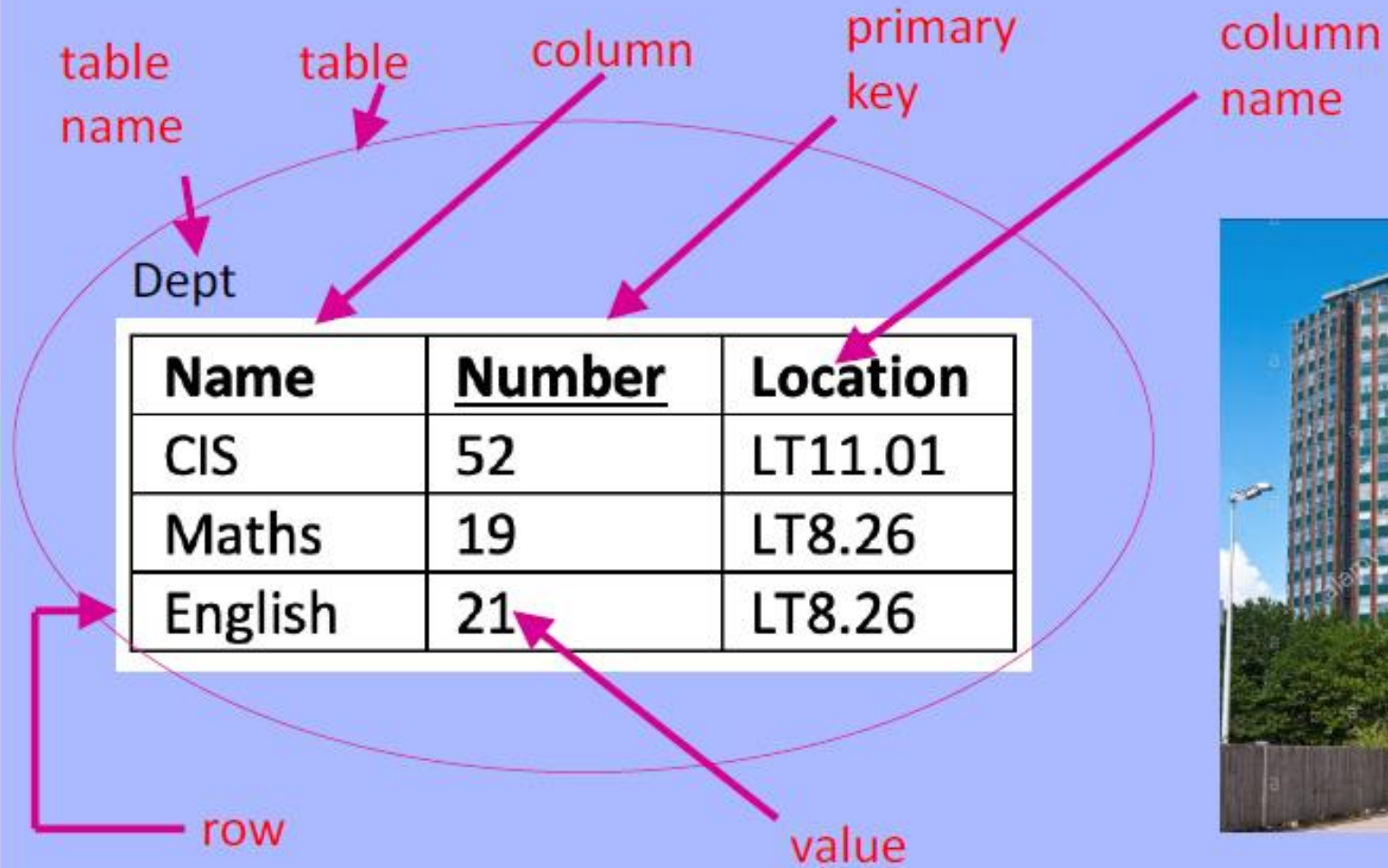
Really Simple



Examples of Database Applications

- Purchases from the supermarket
- Facebook/Twitter (FB 5 petabytes/day)
- Booking a holiday
- Checking your phone
- Taking out insurance
- Using the Internet
- Studying at university

Basics 1



Basics 2

Dept

Name	<u>Number</u>	Location
CIS	52	LT11.01
Maths	19	LT8.26
English	21	LT8.26

SQL “select” is used to retrieve data from databases.

select Name, Number, Location
from Dept
where Number > 20;

SQL keywords

column names

table name

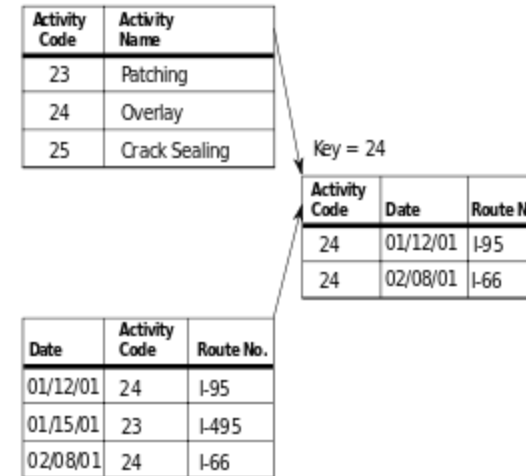
condition

Name	<u>Number</u>	Location
CIS	52	LT11.01
English	21	LT8.26

Next lecture

- The Relational Model

Relational Model



https://simple.wikipedia.org/wiki/Relational_model

Course Content

1. Introduction to Relational Databases (*Introduction + Relational Model*)
2. Data Modelling - (*Entity Relationship Modelling + The Enhanced Entity Relationship Model*)
3. Database Design and SQL - (*Logical modelling + Introduction to SQL*)
4. Further SQL - (*Advanced SQL queries + Creating tables with SQL*)
5. Normalisation - (*Normalisation to second normal form + Third normal form*)



thank
you

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University of **Strathclyde** Glasgow