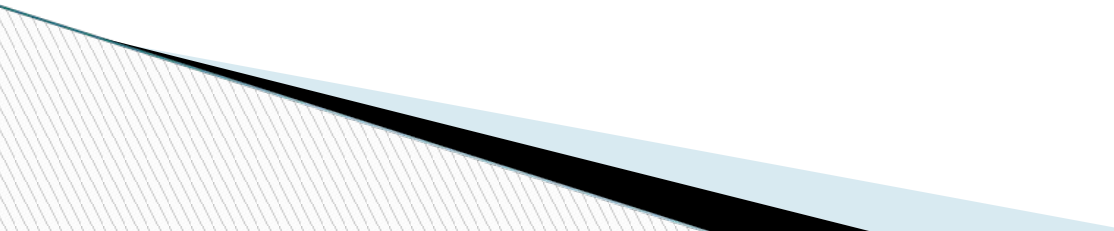


# Lecture 2

- Data Model
  - hierarchical
  - network
  - relational
  - post-relational
  - multidimensional
  - object-oriented

# Data Model

- The data model is a description of the organization of data in the database.
  - The data model also describes the relationship between the data and restrictions applicable to the data.
  - Data models can be divided into two categories:
    - Object - a logical model - focuses on the description of data, data relationships, and limiting.
    - Logical model based on the entries - focuses on the description of the data structures and access methods in the database management system.
- 

# Data Models

## **Classic models:**

- hierarchical
- Network
- Relational

## **Current models:**

- post-relational
- multidimensional
- object-oriented

## **Other data models that extend the known models**

object-relational  
deductive object-oriented,  
semantic,  
conceptual,  
and others.

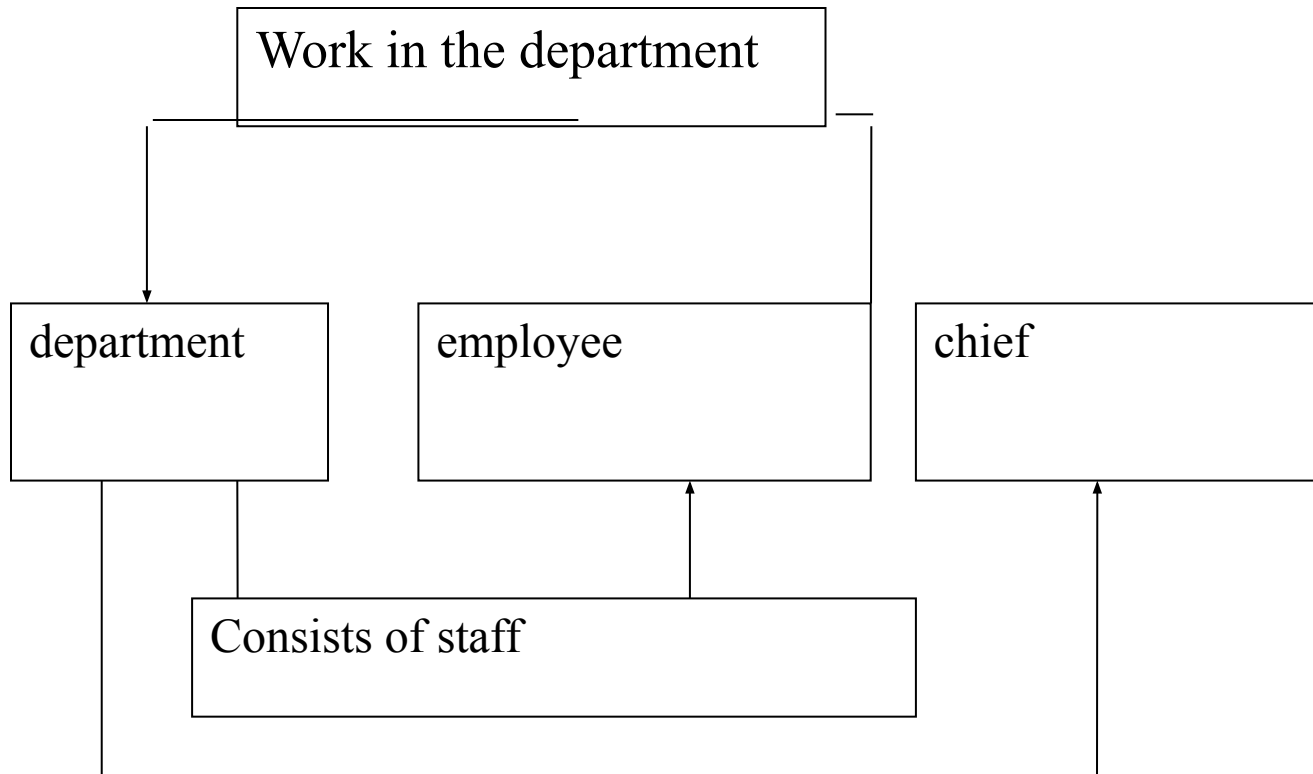
# hierarchical model

- ADVANTAGES hierarchical model
  - Effective use of computer memory
  - Good performance of time to perform basic operations
  - Model is convenient to work with hierarchically structured information
- DISADVANTAGES hierarchical model
  - Cumbersome to process information with a fairly complex logical relationships
  - Complexity of understanding for the average user
- Examples of database hierarchical model
  - IMS, PC / Focus, Team-Up and Data Edge,  
(from Russian): *Ока, ИИЭС и МИРИС*

# network Model

- ADVANTAGES network model:  
The possibility of effective implementation in terms of memory consumption and speed  
(Compared to the hierarchical) great opportunities in terms of the admissibility of arbitrary relationships education
- DISADVANTAGES network model  
High complexity and rigidity of the database schema  
The difficulty for the understanding and implementation of information processing in the database as a regular user
- *Known network database:*
  - *IDMS, db\_VistaIII,*
  - *СЕТЬ, СЕТОР и КОМПАС*

# Example of a network model



# relational Model

- ADVANTAGES relational model  
Simplicity, ease the physical implementation on a computer  
Processing efficiency
  
- DISADVANTAGES relational model  
Lack of standard means of identification of individual records  
Complexity of the description of hierarchical and network links
  
- Examples of relational database model:
  - *dBaseIIIPlus* и *dBaseIV* ( фирма *Ashton-Tate*), *DB2*(*IBM*), *R: BASE* (*Microrim*), *FoxPro* ранних версий и *FoxBase* (*Fox Software*), *Paradox* и *dBASE for Windows* (*Borland*), *FoxPro* б.поздних версий, *Visual FoxPro* и *Access* (*Microsoft*), *Clarion* (*Clarion Software*), *Ingres* (*ASK Computer Systems*)и *Oracle* (*Oracle*)
  - (from Russian): *ПАЛЬМА* (*ИК АН УССР*), *HyTech* (*МИФИ*)
  - Object-relational: *Oracle 8.x*

# post-relational model

- ADVANTAGES post-relational model  
The possibility of representing the aggregate related relational tables with a single post-relational table, so - clear presentation of information and increase the effectiveness of its treatment
- DISADVANTAGES post-relational model  
The difficulty in solving the problem of ensuring the integrity and consistency of data stored
- *Examples of post-relational database model:*
  - *uniVers, Bubba u Dasdb*



# Example of relational Model

INVOICES (накладные)

INVNO	CUSTNO
0373	8723
8374	8232
7364	8723

INVOICE.ITEMS (накладные-товары)

INVNO	GOODS	QTY
0373	cheese	3
0373	fish	2
8374	lemonade	1
8374	juice	6
8374	cookies	2
7364	yogurt	1

# Example of post-relational model

## 6) INVOICES

a) SELECT INVOICES.INVNO,  
CUSTNO, GOODS, QTY  
FROM INVOICES, INVOICE.ITEMS  
WHERE  
INVOICES.INVNO=INVOICE.ITEMS.  
INVNO;

b) SELECT \* FROM INVOICES;

INVNO	CUSTNO	GOODS	QTY
0373	8723	cheese	3
		fish	2
8374	8232	lemonade	1
		juice	6
		cookies	2
7364	8723	yogurt	1

# multivariate Model

- ADVANTAGES multivariate model  
Convenience and efficiency analysis of large amounts of data related to the time (in rel.m. - nonlinear increase complexity of operations)
  
- DISADVANTAGES multivariate model  
Cumbersome for the simplest of tasks common operational processing
  
- EXAMPLES database multidimensional model
  - *Essbase (Arbor Software), Media Multi-matrix (Speedware), Oracle Express Server (Oracle) u Cache (InterSystems)*
  - Relational-dimensional model: *Media/MR (Speedware)*
  - Multidimensional object-relational model: *Cache*

# An example of a relational view of car sales

<b>model</b>	<b>month</b>	<b>volume</b>
BMW	June	12
BMW	July	24
BMW	August	5
Audi	June	2
Audi	July	18
Mazda	July	19

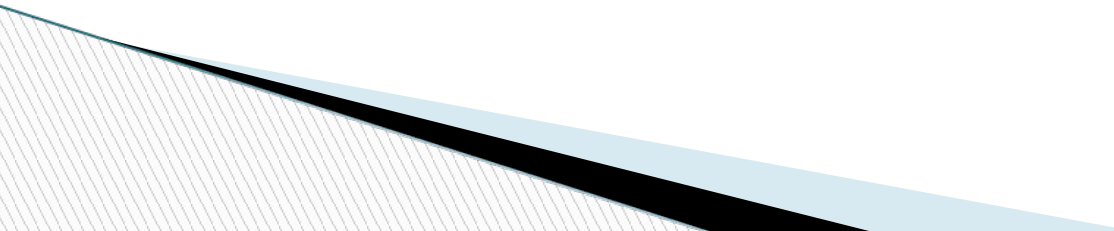
## multi-dimensional view

<b>model</b>	<b>June</b>	<b>July</b>	<b>August</b>
<b>BMW</b>	12	24	5
<b>Audi</b>	2	18	NULL
<b>Mazda</b>	NULL	19	NULL

# Object-oriented model

- ADVANTAGES OOM (versus relational)  
The ability to display information about the complex relationships of objects  
OOM can identify individual records database and the responsibilities of their treatment
  
- DISADVANTAGES OOM  
High conceptual complexity  
The disadvantage of the data and the low speed of queries
  
- EXAMPLES database OOM
  - *POET (POET Software), Jasmine (Computer Associates), Versant (Versant Technologies), O2 (Ardent Software), ODB-Jupiter (науч.произв. центр «ИнтеллектПлюс»), Iris, Orion и Postgres.*


# Model "Entity-Relationship"

- There are a variety of object-oriented models. The most widely used model is the "entity - relationship" (ER model).
  
  - Model "entity - relationship" is based on a realistic view which encompasses a set of objects or entities and their relationships.
  
  - Schema components of ER are:
    - entity ;
    - connection;
    - attributes.
- 

# entity

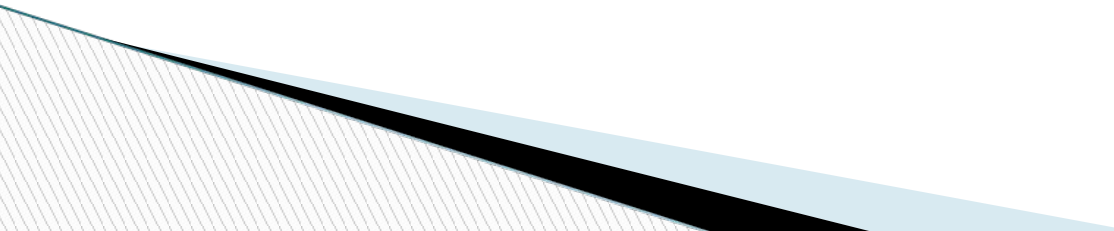
- The entity is any object, place, person, or action, details of which are recorded.
- Entities are represented as rectangles, on which are written the names assigned to them.
- There are two types of entities:
  - dependent;
  - independent.
- Affiliated entities are also referred to as weak entities, and independent - regular entities.
- Weak entity represented by a rectangle outlined by the double line.

# connection

- Combining entities are called connection.
  - Relationship is depicted in the form of diamond with the name of the link.
  - can attach an entity to itself.
  - Between the same entities may also be multiple connections.
  - Connections are of three types:
    - one-to-one;
    - one-to-many;
    - many-to-many.
- 



# attributes

- Attribute called property of this entity.
  - Attributes are represented as ellipses, equipped name properties. Key attributes are underlined.
  - Connection can also have attributes.
- 

# review

- Data Model, examples of models:
  - hierarchical
  - network
  - relational
  - post-relational model
  - multi-dimensional
  - object-oriented