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**Kampus
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INDONESIA JAYA

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DATA SCIENCE DARMAJAYA
“YOUR BEST FUTURE IN DATA”

MEETING: [3 & 4]

THE RELATIONAL MODEL

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The Relational Model

1. Brief History of Relational Model.
2. Terminology (Relational Data Structure, Database Relation, Properties of Relation, Relational Keys, Representing Relational Database Schema)
3. Integrity Constraint (Null, Entity Integrity, Referential Integrity, General Constraint)



Learning Objectives

- The origins of the relational model.
- The terminology of the relational model.
- How tables are used to represent data.
- Properties of database relations.
- How to identify candidate, primary, alternate, and foreign keys.
- The meaning of entity integrity and referential integrity.
- The purpose and advantages of views in relational systems.
- Practical in Lab.



Brief History of Relational Model

The relational model was first proposed by E. F. Codd in his seminal paper “A relational model of data for large shared data banks” (Codd, 1970). This paper is now generally accepted as a landmark in database systems, although a set-oriented model had been proposed previously (Childs, 1968). The relational model’s objectives were specified as follows:

1. To allow a high degree of data independence.
2. To provide substantial grounds for dealing with data semantics, consistency, and redundancy problems. Normalized Relation.
3. To enable the expansion of set-oriented data manipulation languages.



Terminology (Relational Data Structure)

Relation → A relation is a table with columns and rows.

Attribute → An attribute is a named column of a relation.

Domain → A domain is the set of allowable values for one or more attributes.

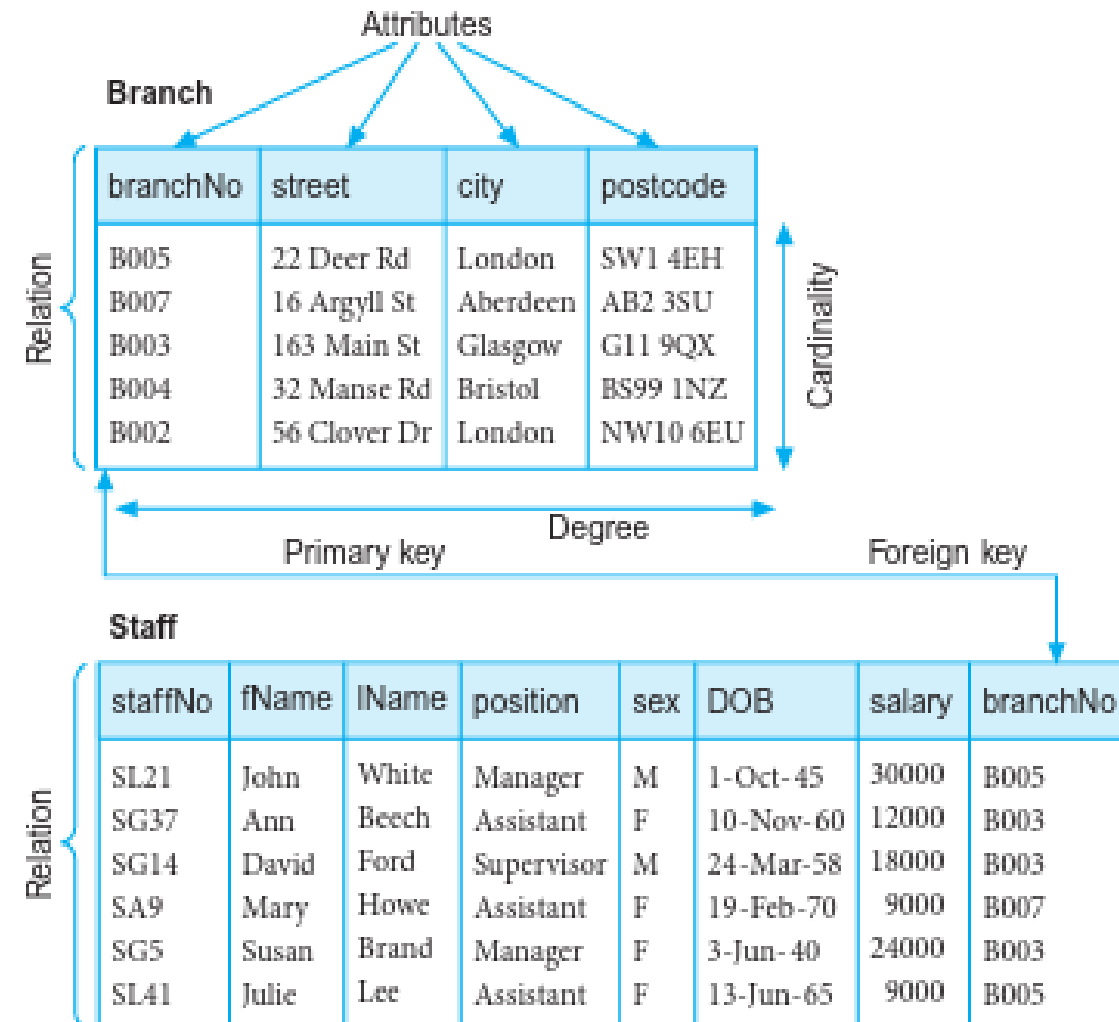
Tuple → A tuple is a row of a relation.

Degree → The degree of a relation is the number of attributes it contains.

Cardinality → The cardinality of a relation is the number of tuples it contains.

Relational database → A collection of normalized relations with distinct relation names.

Terminology (Alternative)



Attribute	Domain Name	Meaning	Domain Definition
branchNo	BranchNumbers	The set of all possible branch numbers	character: size 4, range B001-B999
street	StreetNames	The set of all street names in Britain	character: size 25
city	CityNames	The set of all city names in Britain	character: size 15
postcode	Postcodes	The set of all postcodes in Britain	character: size 8
sex	Sex	The sex of a person	character: size 1, value M or F
DOB	DatesOfBirth	Possible values of staff birth dates	date, range from 1-Jan-20, format dd-mmm-yy
salary	Salaries	Possible values of staff salaries	monetary: 7 digits, range 6000.00-40000.00



Terminology (Alternative)

Formal Term	Alternative 1	Alternative 2
Relation	Table	File
Tuple	Row	Record
Attribute	Column	Field



Terminology (Database Relation)

Relation schema \rightarrow A named relation defined by a set of attribute and domain name pairs. How table or relation in database will be made, include attributes and so on.

Relational database \rightarrow schema A set of relation schemas, each with a distinct name.



Terminology (Properties of Relation)

A relation has the following properties:

- the relation has a name that is distinct from all other relation names in the relational schema;
- each cell of the relation contains exactly one atomic (single) value;
- each attribute has a distinct name;
- the values of an attribute are all from the same domain;
- each tuple is distinct; there are no duplicate tuples;
- the order of attributes has no significance;
- the order of tuples has no significance, theoretically. (However, in practice, the order may affect the efficiency of accessing tuples.)



Terminology (Relational Keys)

- Superkey → An attribute, or set of attributes, that uniquely identifies a tuple within a relation.
- Candidate key → A superkey such that no proper subset is a superkey within the relation.
- Primary key → The candidate key that is selected to identify tuples uniquely within the relation.
- Foreign key → An attribute, or set of attributes, within one relation that matches the candidate key of some (possibly the same) relation.

Terminology (Representing Relational Database Schema)

Branch	(<u>branchNo</u> , street, city, postcode)
Staff	(<u>staffNo</u> , fName, lName, position, sex, DOB, salary, branchNo)
PropertyForRent	(<u>propertyNo</u> , street, city, postcode, type, rooms, rent, ownerNo, staffNo, branchNo)
Client	(<u>clientNo</u> , fName, lName, telNo, prefType, maxRent, eMail)
PrivateOwner	(<u>ownerNo</u> , fName, lName, address, telNo, eMail, password)
Viewing	(<u>clientNo</u> , <u>propertyNo</u> , viewDate, comment)
Registration	(<u>clientNo</u> , <u>branchNo</u> , staffNo, dateJoined)

Terminology (Representing Relational Database Schema)

Branch

branchNo	street	city	postcode
B005	22 Deer Rd	London	SW1 4EH
B007	16 Argyll St	Aberdeen	AB2 3SU
B003	163 Main St	Glasgow	G11 9QX
B004	32 Manse Rd	Bristol	BS99 1NZ
B002	56 Clover Dr	London	NW10 6EU

Staff

staffNo	fName	lName	position	sex	DOB	salary	branchNo
SL21	John	White	Manager	M	1-Oct-45	30000	B005
SG37	Ann	Beech	Assistant	F	10-Nov-60	12000	B003
SG14	David	Ford	Supervisor	M	24-Mar-58	18000	B003
SA9	Mary	Howe	Assistant	F	19-Feb-70	9000	B007
SG5	Susan	Brand	Manager	F	3-Jun-40	24000	B003
SL41	Julie	Lee	Assistant	F	13-Jun-65	9000	B005

PropertyForRent

propertyNo	street	city	postcode	type	rooms	rent	ownerNo	staffNo	branchNo
PA14	16 Holhead	Aberdeen	AB7 5SU	House	6	650	CO46	SA9	B007
PL94	6 Argyll St	London	NW2	Flat	4	400	CO87	SL41	B005
PG4	6 Lawrence St	Glasgow	G11 9QX	Flat	3	350	CO40		B003
PG36	2 Manor Rd	Glasgow	G32 4QX	Flat	3	375	CO93	SG37	B003
PG21	18 Dale Rd	Glasgow	G12	House	5	600	CO87	SG37	B003
PG16	5 Novar Dr	Glasgow	G12 9AX	Flat	4	450	CO93	SG14	B003

Client

clientNo	fName	lName	telNo	prefType	maxRent	eMail
CR76	John	Kay	0207-774-5632	Flat	425	john.kay@gmail.com
CR56	Aline	Stewart	0141-848-1825	Flat	350	astewart@hotmail.com
CR74	Mike	Ritchie	01475-392178	House	750	mritchie01@yahoo.co.uk
CR62	Mary	Tregear	01224-196720	Flat	600	maryt@hotmail.co.uk

PrivateOwner

ownerNo	fName	lName	address	telNo	eMail	password
CO46	Joe	Keogh	2 Fergus Dr, Aberdeen AB2 7SX	01224-861212	jkeogh@lhh.com	*****
CO87	Carol	Farrel	6 Achray St, Glasgow G32 9DX	0141-357-7419	cfarrel@gmail.com	*****
CO40	Tina	Murphy	63 Well St, Glasgow G42	0141-943-1728	tinam@hotmail.com	*****
CO93	Tony	Shaw	12 Park Pl, Glasgow G4 0QR	0141-225-7025	tony.shaw@ark.com	*****

Viewing

clientNo	propertyNo	viewDate	comment
CR56	PA14	24-May-13	too small
CR76	PG4	20-Apr-13	too remote
CR56	PG4	26-May-13	
CR62	PA14	14-May-13	no dining room
CR56	PG36	28-Apr-13	

Registration

clientNo	branchNo	staffNo	dateJoined
CR76	B005	SL41	2-Jan-13
CR56	B003	SG37	11-Apr-12
CR74	B003	SG37	16-Nov-11
CR62	B007	SA9	7-Mar-12



Terminology (Integrity Constraint)

An integrity constraint is a set of rules or conditions that are applied to the data in order to ensure its accuracy and consistency. These constraints are used to maintain the integrity of the data, ensuring that it is reliable and accurate. Integrity constraints help enforce data quality and prevent the entry of incorrect or inconsistent data into the database.

- Null → Represents a value for an attribute that is currently unknown or is not applicable for this tuple.
- Entity integrity → In a base relation, no attribute of a primary key can be null.
- Referential integrity → If a foreign key exists in a relation, either the foreign key value must match a candidate key value of some tuple in its home relation or the foreign key value must be wholly null.
- General constraints → Additional rules specified by the users or database administrators of a database that define or constraint some aspect of the enterprise.



CONCLUSION

- Relations are physically represented as tables, with the rows corresponding to individual tuples and the columns to attributes.
- The structure of the relation, with domain specifications and other constraints, is part of the intension of the database; the relation with all its tuples written out represents an instance or extension of the database.
- Properties of database relations are: each cell contains exactly one atomic value, attribute names are distinct, attribute values come from the same domain, attribute order is immaterial, tuple order is immaterial, and there are no duplicate tuples.
- The degree of a relation is the number of attributes, and the cardinality is the number of tuples. A unary relation has one attribute, a binary relation has two, a ternary relation has three, and an n-ary relation has n attributes.



CONCLUSION

- A superkey is an attribute, or set of attributes, that identifies tuples of a relation uniquely, and a candidate key is a minimal superkey. A primary key is the candidate key chosen for use in identification of tuples. A relation must always have a primary key. A foreign key is an attribute, or set of attributes, within one relation that is the candidate key of another relation.
- A null represents a value for an attribute that is unknown at the present time or is not applicable for this tuple.
- entity integrity is a constraint that states that in a base relation no attribute of a primary key can be null. Referential integrity states that foreign key values must match a candidate key value of some tuple in the home relation or be wholly null. Apart from relational integrity, integrity constraints include required data, domain, and multiplicity constraints; other integrity constraints are called general constraints.



REFERENCES

1. Connolly. T., Begg. Carolyn. 2015. Database System: A Pratical Approach to Design, Implementation, and Management. Sixth Edition. Global Edition. Pearson.



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