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Data. DB. DBMS

DB Basics

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What is Data?

Minsk, Ivan, 7, Kuprevicha, 80221234567, 220022, Ivanov

01100111010011111100011001111101011100 11

5401 0610 0570 0150

What is Information?

Data

Data is a set of facts in a “raw”, non-processed state. Data requires processing to become useful for people.

Minsk, Ivan, 7, Kuprevicha, 80221234567, 220022, Ivanov

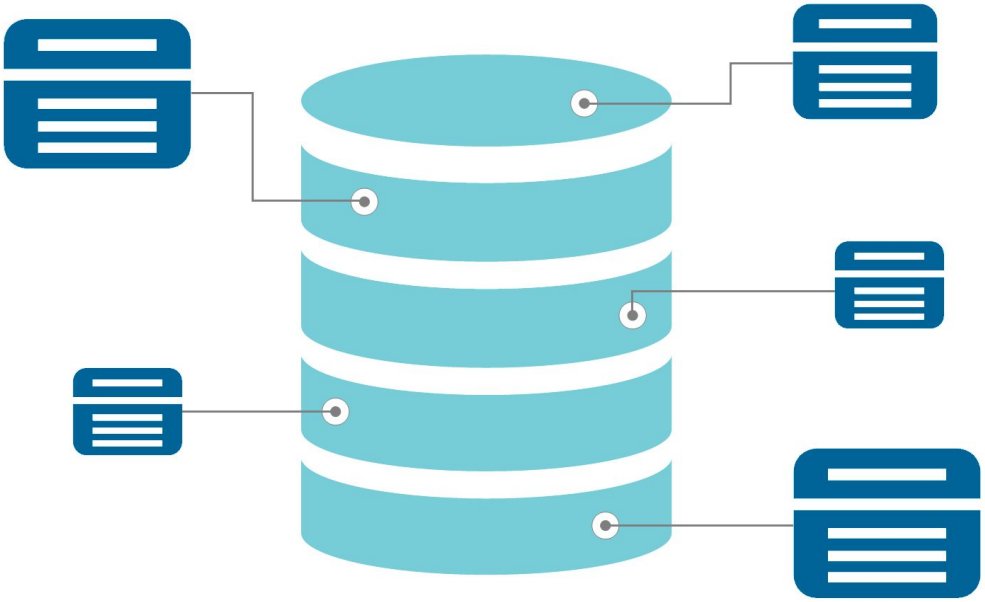
processing

Information

When data is processed, organized, structured and can be used by a human or a PC to gain value / profit.

Ivan Ivanov
Kuprevicha, 7
Minsk, 220022
8-(022)-1234567

What is DataBase (DB)?

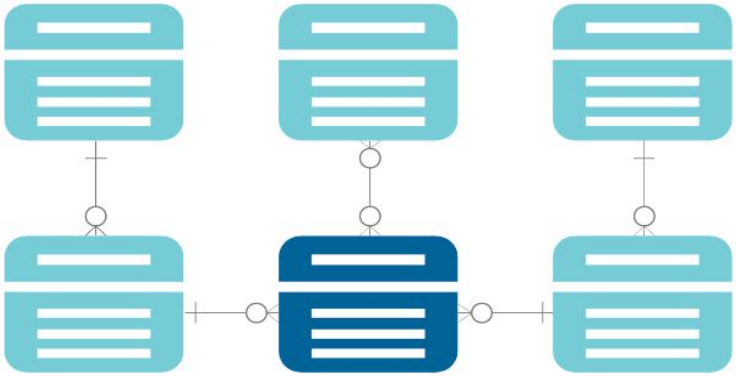


Real life examples:

- Booking tickets
- Weather prediction
- Supermarket purchases
- Financial analytics
- Instagram
- Training courses

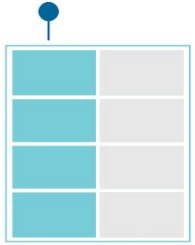
Common DataBase Types

Relational DB

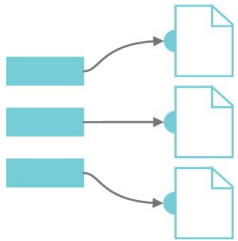


Relational Database Management Systems (RDBMS)

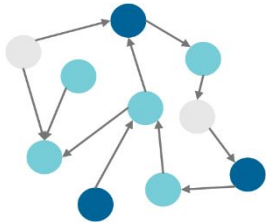
Non-Relational DB



Key-Value



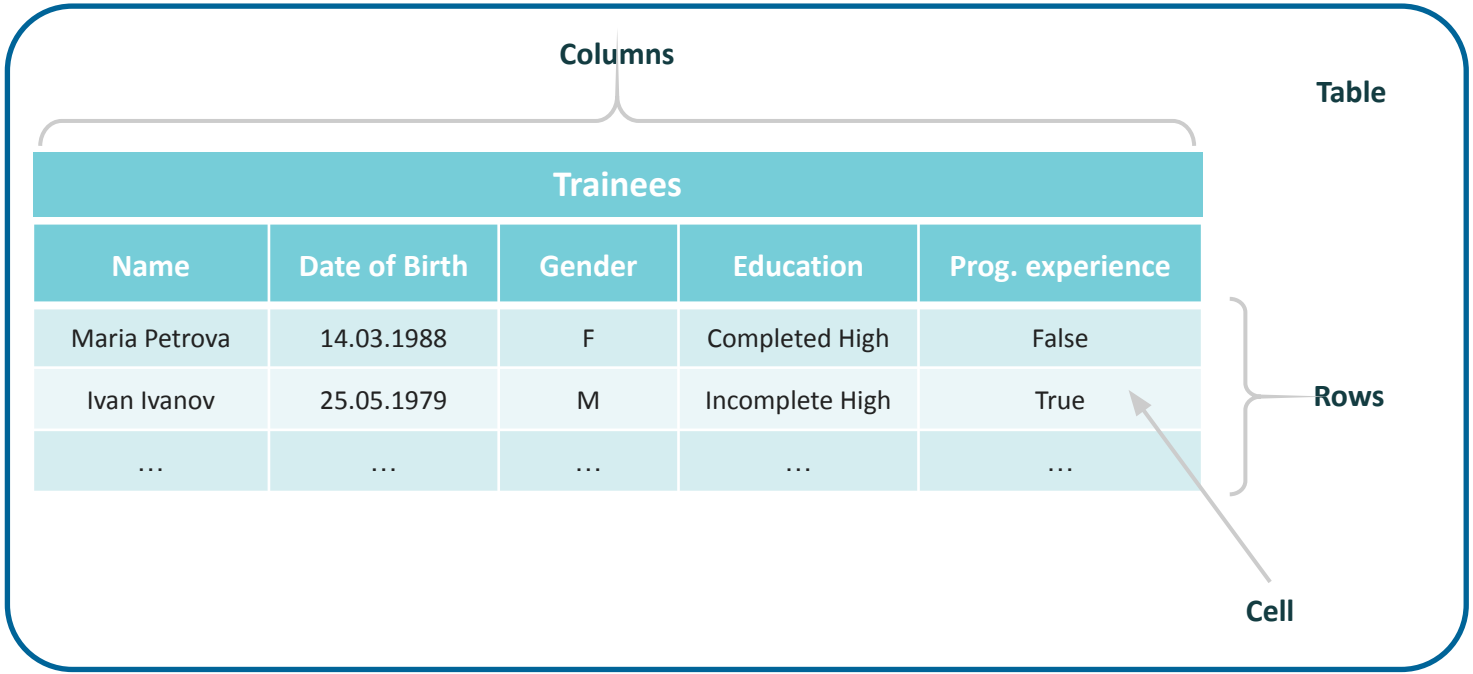
Document



Graph

Common DataBase Types

Trainees
Name
Date of Birth
Gender
Education
Prog. experience

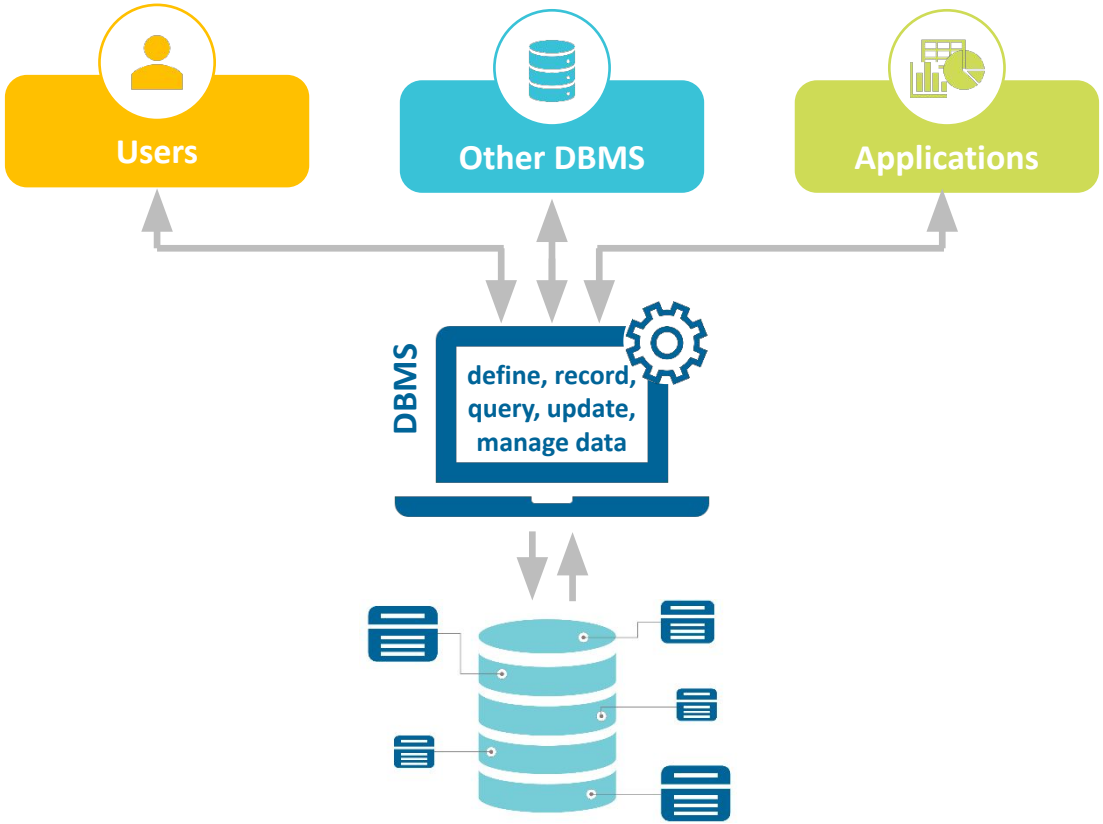


Common DataBase Types

Relational database	Key-value database
Table	**Collection**
Table row	**Element of collection**
Table column	**Key of an element**
Table cell	**Value by element's key**

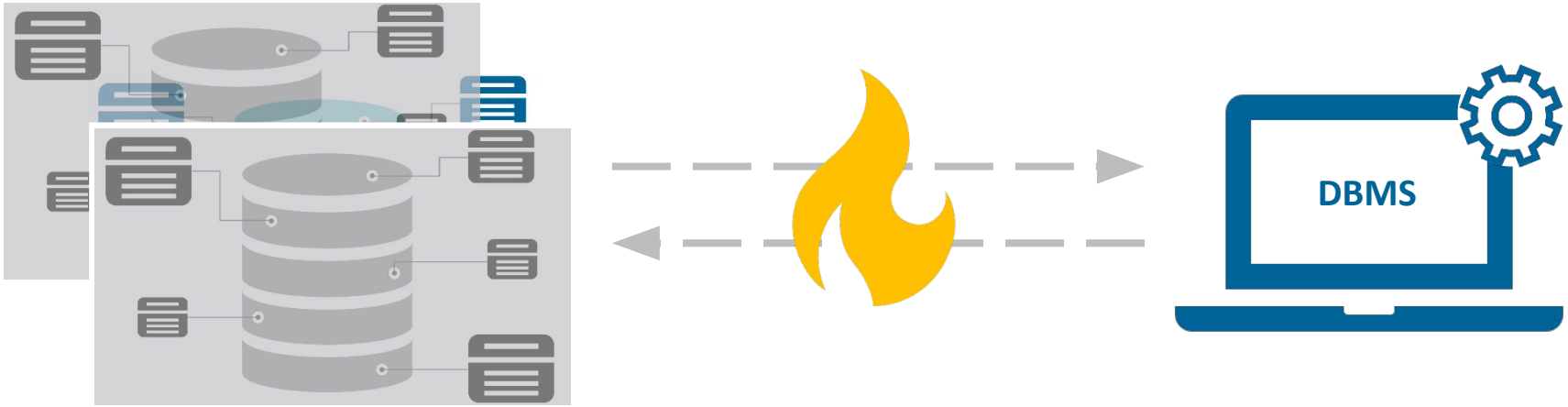
```
"Trainees": [{
      "Name":           "Maria Petrova",
      "Date of Birth":  "14.03.1988",
      "Gender":         "F",
      "Education":      "Completed High",
      "Prog. experience" "False"
   }, {
      "Name":           "Ivan Ivanov",
      "Date of Birth":  "25.05.1979",
      "Gender":         "M",
      "Education":      "Incomplete High",
      "Prog. experience": "True"
   }
]
```

What is DataBase Management System (DBMS)



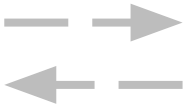
What RDBMS is for?

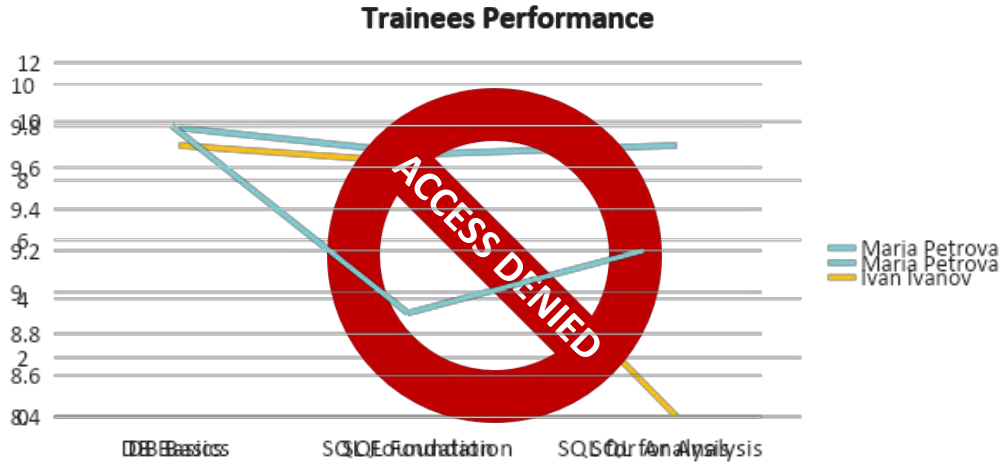
Manage database backup and recovery processes



What RDBMS is for?

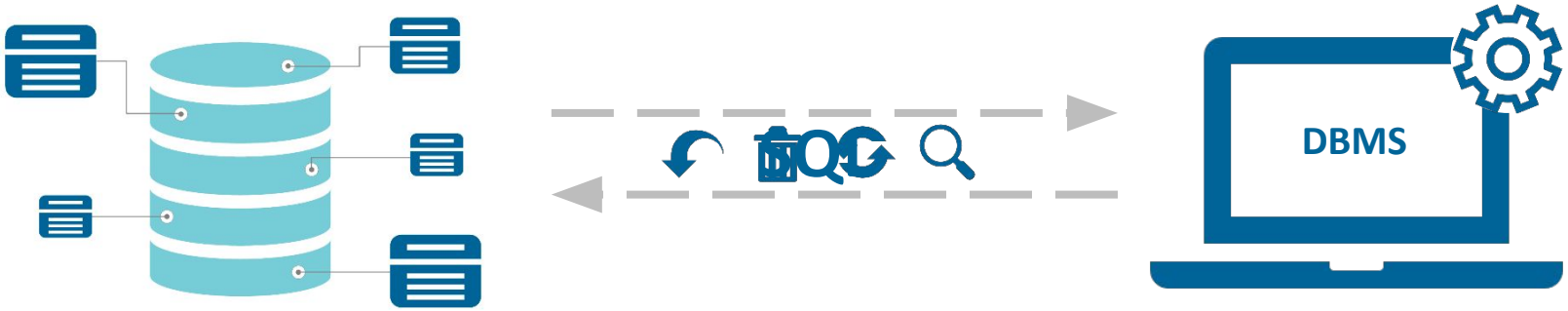
Restrict data access according to predefined rules





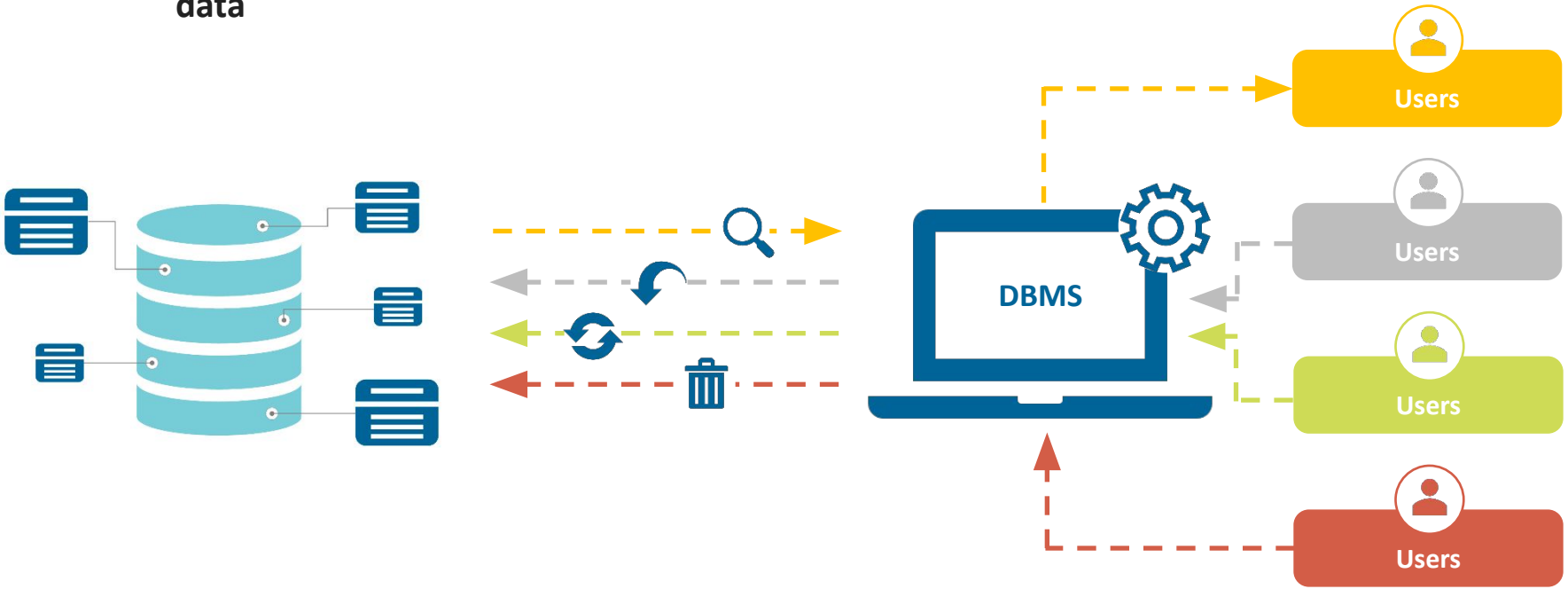
What RDBMS is for?

Allow database access via one of predefined interfaces (most common is SQL query)



What RDBMS is for?

Support data consistency when multiple users work with same pieces of data



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DB Components

DB Basics

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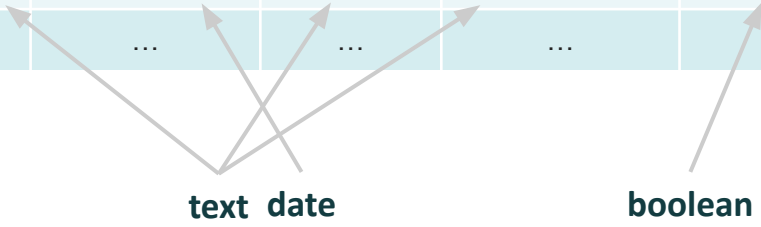
Relational DataBase Components: Table

Name	Date of Birth	Gender	Education	Prog. experience	Hair Color	Favorite Brand
Maria Petrova	14.03.1988	F	Completed High	False	Light brown	Nike
Ivan Ivanov	25.05.1979	M	Incomplete High	True	Blonde	Gant
…	…	…	…	…	…	…

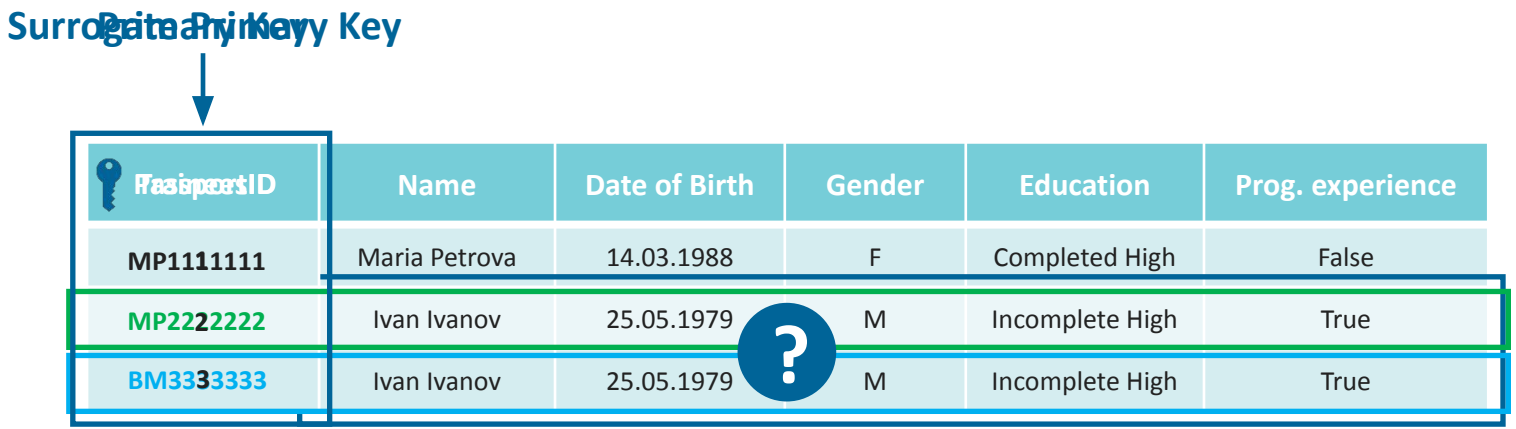


Relational DataBase Components: Constraint

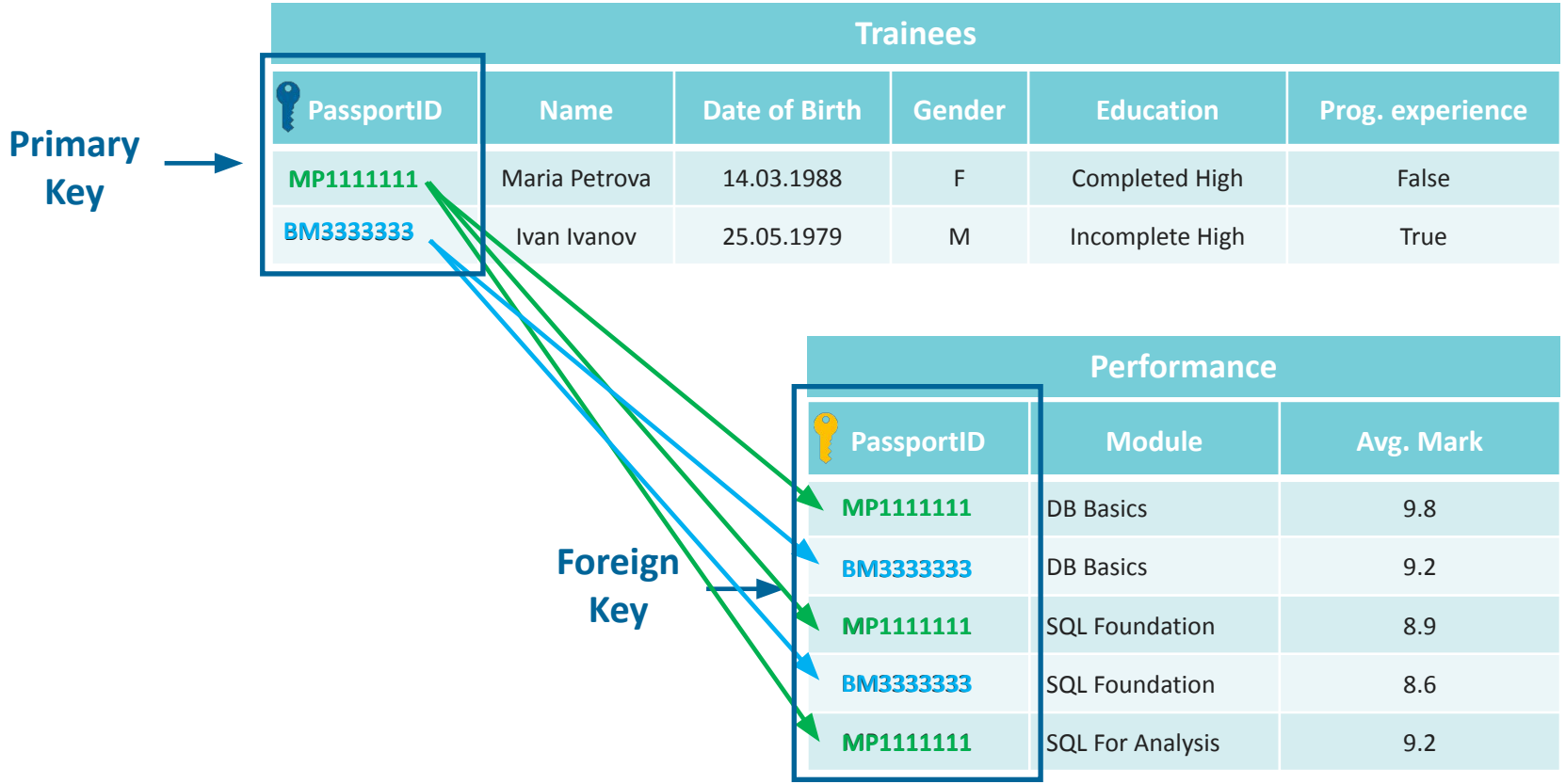
Name	Date of Birth	Gender	Education	Prog. experience	
Maria Petrova	14.03.1988	F	Completed High	False	
Ivan Ivanov	25.05.1979	M	Incomplete High	True	
Petr Pirogov	17.11.1987	M	Super High	True	
Inna Sidorova	01.01.1992	F	Upper High	False	
Volha Hlebava	06.06.1991	F	Completed High	Null	
Igor Lesik	15.10.2020	M	Completed High	True	

As example: **Current Date = 01.01.2020**

Relational DataBase Components: Keys



Relational DataBase Components: Keys



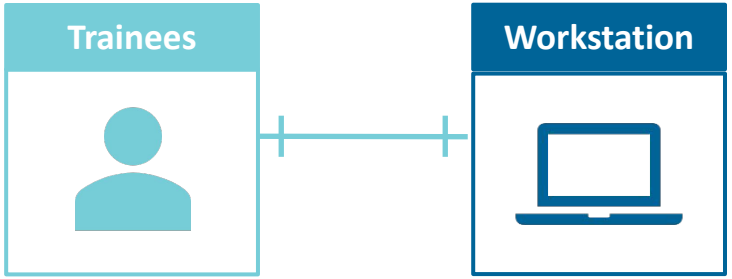
Trainees

PassportID	Name	Date of Birth	Gender	Education	Prog. experience
MP1111111	Maria Petrova	14.03.1988	F	Completed High	False
BM3333333	Ivan Ivanov	25.05.1979	M	Incomplete High	True

Performance

PassportID	Module	Avg. Mark
MP1111111	DB Basics	9.8
BM3333333	DB Basics	9.2
MP1111111	SQL Foundation	8.9
BM3333333	SQL Foundation	8.6
MP1111111	SQL For Analysis	9.2

Relational DataBase Components: relationship 1-to-1



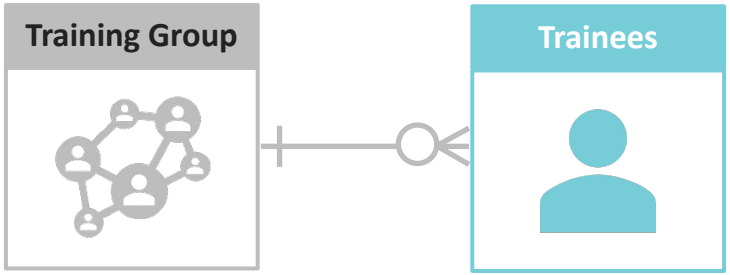
Trainees

PassportID	Name	Date of Birth	Gender	Education	Prog. experience
MP1111111	Maria Petrova	14.03.1988	F	Completed High	False
BM3333333	Ivan Ivanov	25.05.1979	M	Incomplete High	True

Workstation

PassportID	Workstation
MP1111111	CCCCCCC4321
BM3333333	CCCCCCC3322
	CCCCCCC55555

Relational DataBase Components: relationship 1-to-many



Training Group	
GroupID	Group Name
1	Data Training 1
2	.Net Training 1

Trainees						
GroupID	PassportID	Name	Date of Birth	Gender	Education	Prog. exp
1	MP1111111	Maria Petrova	14.03.1988	F	Completed High	False
1	BM3333333	Ivan Ivanov	25.05.1979	M	Incomplete High	True
2	KH8888888	Marta Yakova	96.06.1984	F	Completed High	True

Relational DataBase Components: relationship many-to-many

Trainees

PassportID	Name
MP1111111	Maria Petrova
BM3333333	Ivan Ivanov

Performance

PassportID	ModuleID	Avg. Mark
MP1111111	1	9.8
MP1111111	2	8.9
MP1111111	3	9.2
BM3333333	1	9.2
BM3333333	2	8.6

Modules

ModuleID	Module Name
1	DB Basics
2	SQL Foundation
3	SQL for Analysis

Relational database components

1. Tables
2. Constraints
3. Keys
4. Indexes
5. Views
6. Partitions

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DB Modeling

DB Basics

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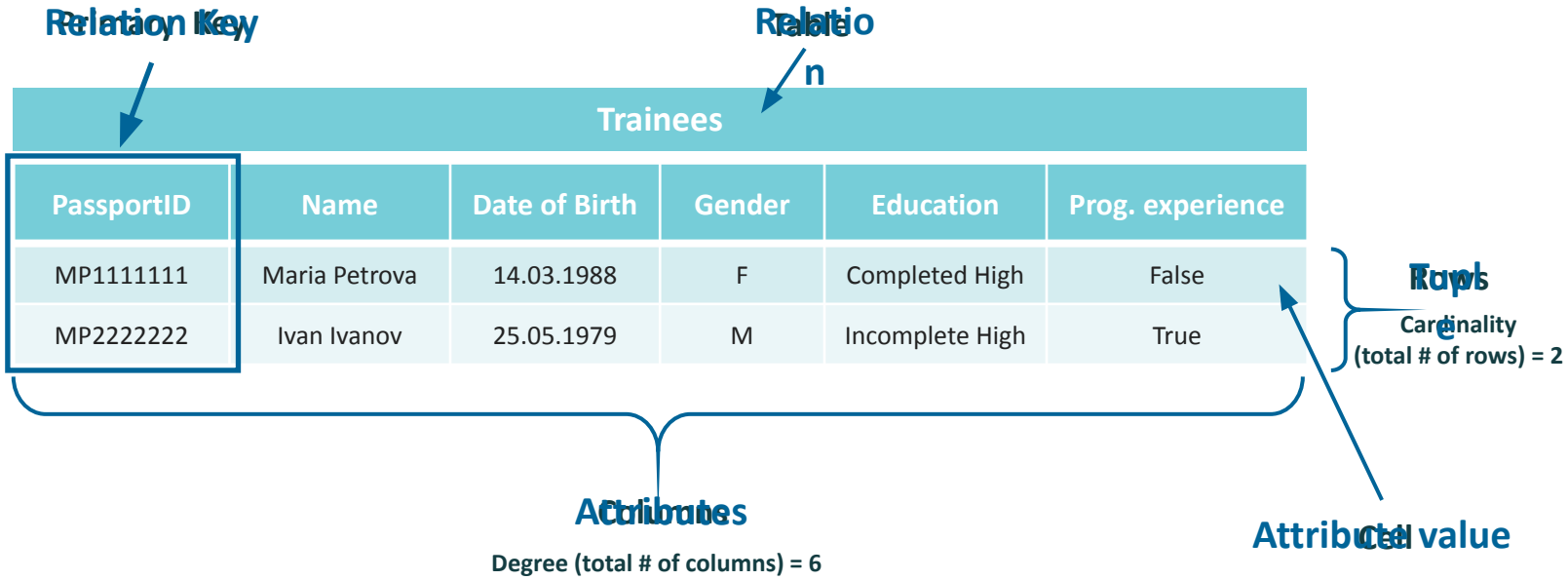
DataBase Structure: Relational Model Terms



DataBase Structure: Rules

Trainees					
PassportID	Name	Date of Birth	Gender	Education	Prog. experience
MP1111111	Maria Petrova	14.03.1988	F	Completed High	False
MP2222222	Ivan Ivanov	25.05.1979	M	Incomplete High	True
MP1313311	Petr Pirogov	17.11.1987	M	Completed High	True
BM1112233	Inna Sidorova	01.01.1992	F	Completed High	False

DataBase Structure: Rules

Trainees					
PassportID	Name	Date of Birth	Gender	Education	Prog. experience
MP1111111	Maria Petrova	14.03.1988	F	Completed High	False
MP2222222	Ivan Ivanov	25.05.1979	M	Incomplete High	True
MP1313311	Petr Pirogov	17.11.1987	M	Completed High	True
BM1112233	Inna Sidorova	01.01.1992	F	Completed High	False
MP2222222	Ivan Ivanov	25.05.1979	M	Incomplete High	True

DataBase Structure: Rules

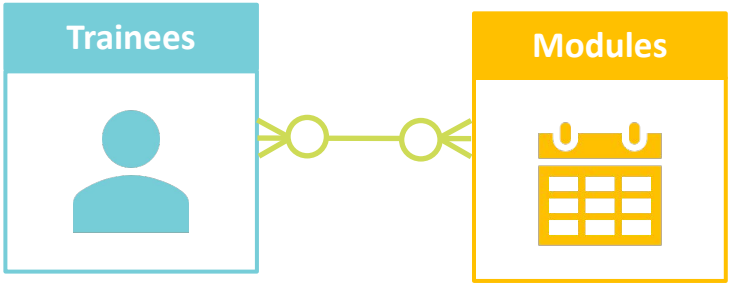
Trainees					
PassportID	Name	PassportName	Gender	Education	Prog. experience
MP1111111	Maria Petrova	Maria Petrova	F	Completed High	False
MP2222222	Ivan Ivanov	Ivan Ivanov	M	Incomplete High	True
MP1313311	Petr Pirogov	Petr Pirogov	M	Completed High	True
BM1112233	Inna Sidorova	Inna Sidorova	F	Completed High	False

DataBase Structure: Rules

Trainings Participations	
PassportID	**Modules**
MP1111111	DB Basics, SQL Foundations, SQL for Analysis
MP2222222	DB Basics, SQL Foundations

Trainings Participations	
PassportID	**Modules**
MP1111111	DB Basics
MP1111111	SQL Foundations
MP1111111	SQL for Analysis
MP2222222	DB Basics
MP2222222	SQL Foundations

DataBase Modeling: Conceptual Model

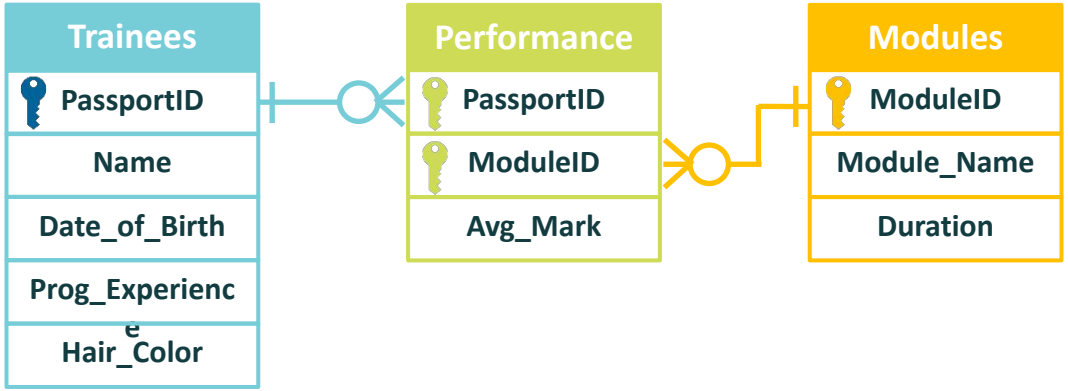


Includes the important entities and the relationships among them

No attributes are specified

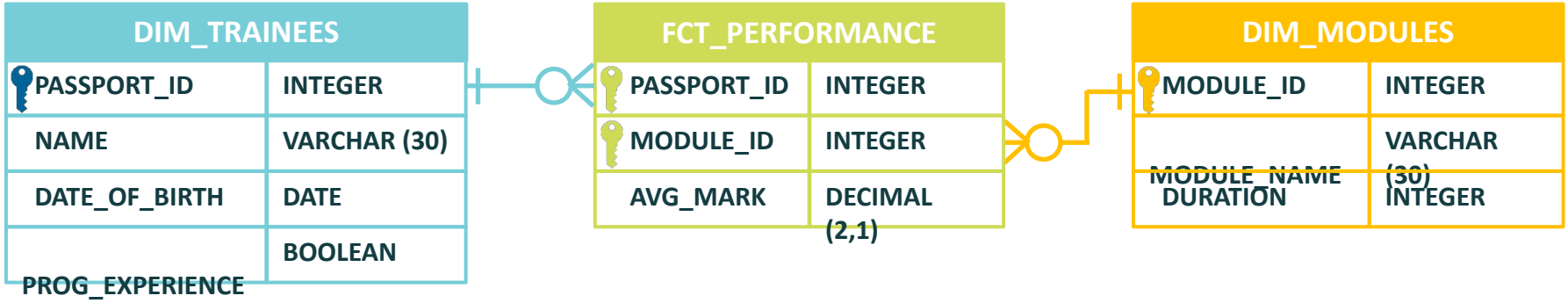
No keys are specified

DataBase Modeling: Logical Model



- All attributes are specified
- The primary key for each entity specified
- Foreign keys are specified
- Relationships are specified
- Normalization occurs at this level

DataBase Modeling: Physical Model



- Convert entities into tables
- Convert attributes into columns
- Convert relationships into foreign keys
- Modify the physical data model based on physical constraints / requirements

DataBase Modeling: Rules

Trainees					
TrainersID	Name	Date_of_Birth	Gender	Education	Prog_Experience
MP1111111	Maria Petrova	14.03.1988	F	Completed High	False
MP2222222	Ivan Ivanov	25.05.1979	M	Incomplete High	True
MP1313311	Petr Pirogov	17.11.1987	M	Completed High	True
BM1112233	Inna Sidorova	01.01.1992	F	Completed High	False

Performance		
PassportID	ModuleID	Avg. Mark
MP1111111	1	9.2
MP1111111	2	8.6

DataBase Structure: Rules

DataBase Tasks

Transactional App

Analytics

Normalization

Purchases

Item	Client	Time	Store	Cashier	Price
Phone	Maria Petrova	2019-12-30 16:19:23		Cashier1	
Laptop	Gleb Petrov	2019-12-30 16:24:17		Cashier2	
TV	Natalia Sidorova	2019-12-30 16:26:15		Cashier3	5240
Phone	Ivan Ivanov	2019-12-30 16:29:05	Store1	Cashier4	1650

Denormalization

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Normalization

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DataBase Modelling Approaches

Trainees

PassportID	Name	Date_of_Birth	Gender	Education	Prog_Eexperience
MP1111111	Maria Petrovakaya	14.03.1988	F	Completed High	False

Modules

ModuleID	Module_Name
1	DB Basics
2	SQL Foundation
3	SQL for Analysis

Performance

PassportID	Name	Date_of_Birth	ModuleID	Module_Name	Avg_Mark
MP1111111	Maria Petrovakaya	14.03.1988	1	DB Basics	9.8
MP1111111	Maria Petrovakaya	14.03.1988	2	SQL Foundation	8.9
MP1111111	Maria Petrovakaya	14.03.1988	3	SQL for Analysis	9.2

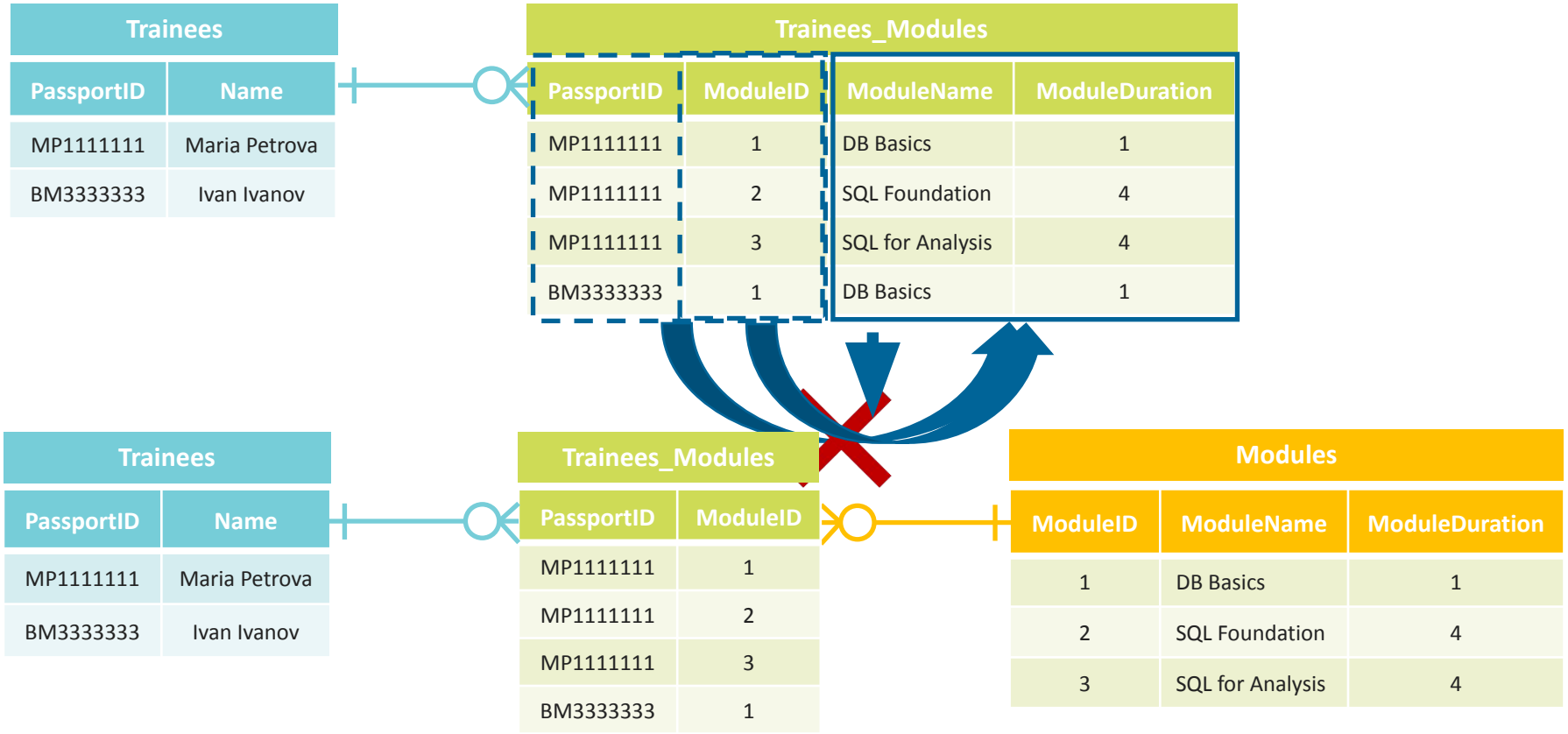
Conversion to 1NF

Trainees						
PassportID	Name	Phone_Number	Date_of_Birth	Gender	Education	Prog_experience
MP1111111	Maria Petrova	375291111111	14.03.1988	F	Completed High	False
BM3333333	Ivan Ivanov	375292222222, 375253333333	25.05.1979	M	Incomplete High	True

Trainees						
PassportID	Name	Phone_Number	Date_of_Birth	Gender	Education	Prog_experience
MP1111111	Maria Petrova	375291111111	14.03.1988	F	Completed High	False
BM3333333	Ivan Ivanov	375292222222	25.05.1979	M	Incomplete High	True
BM3333333	Ivan Ivanov	375253333333	25.05.1979	M	Incomplete High	True

Conversion from 1NF to 2NF

Conversion from 1NF to 2NF



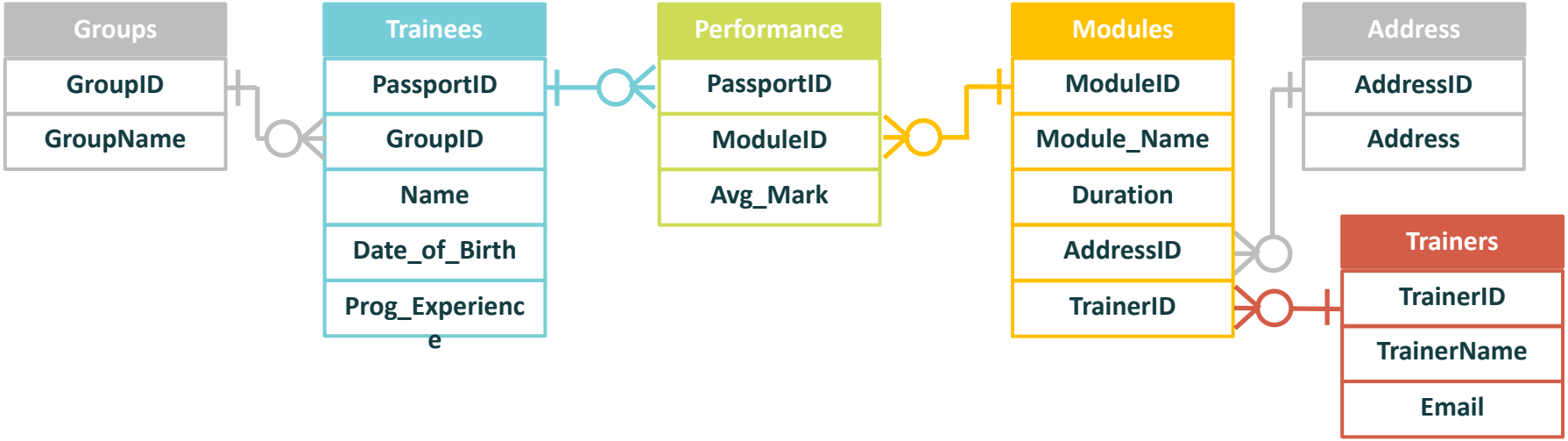
Conversion from 2NF to 3NF

Conversion from 2NF to 3NF

Modules				
ModuleID	ModuleName	ModuleDuration	Address	AddressPhone
1	DB Basics	1	K1/1	+375299876543
2	SQL Foundation	4	DM3	+375293456789
3	SQL for Analysis	4	K1/1	+375299876543

Address	
Address	AddressPhone
K1/1	+375299876543
DM3	+375293456789

Disadvantages of Normalization

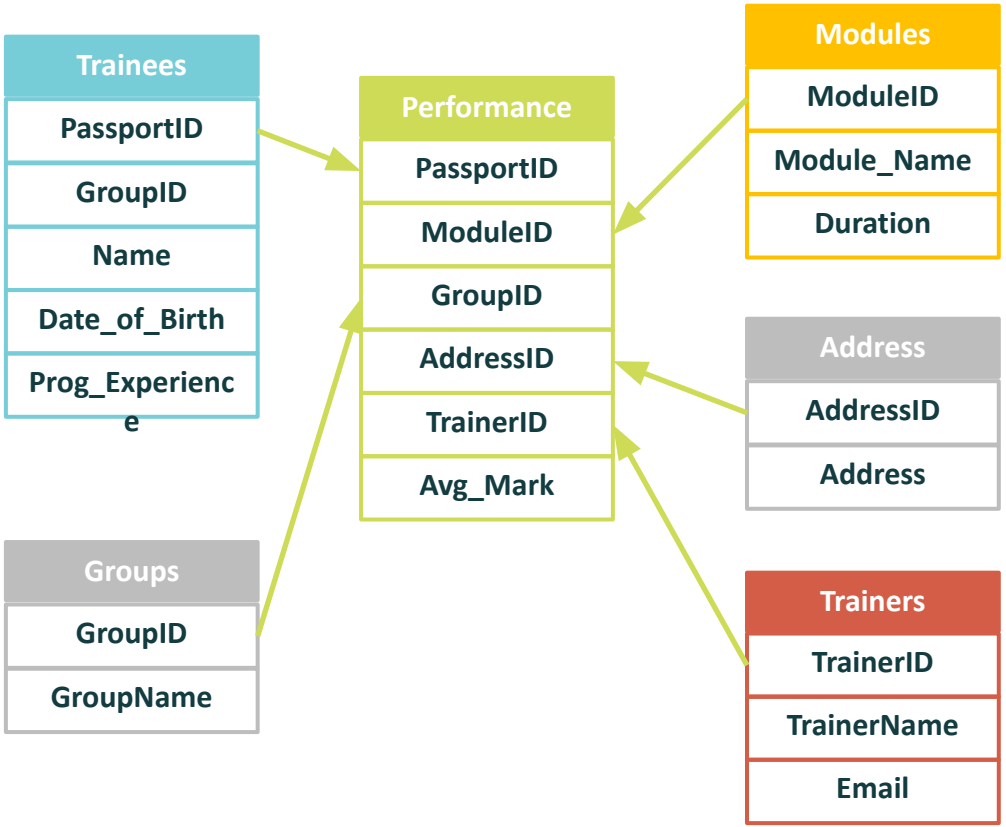


A completely normalized database needs clear and broad understanding of the business

More tables to join: by spreading out your data into more tables, you increase the need to join tables

The data model is optimized for applications, not for Ad-hoc querying

Denormalization



To enhance query performance

To make a database more convenient to manage

To facilitate and accelerate reporting

Does not mean not doing normalization.
It is an optimization technique that is applied **after** doing normalization

Data Warehousing