

Database Management Systems

MySQL - Data Definition

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1 Preliminaries

2 Data Definition

- Database Creation
- Database Modification

3 Problems

Connecting with MySQL

```
$ mysql -u <user_name> -p
Enter password:
mysql> _
mysql> show databases;
mysql> connect <database_name>;
mysql> show tables;
mysql> desc <table_name>;
mysql> exit
$ _
```

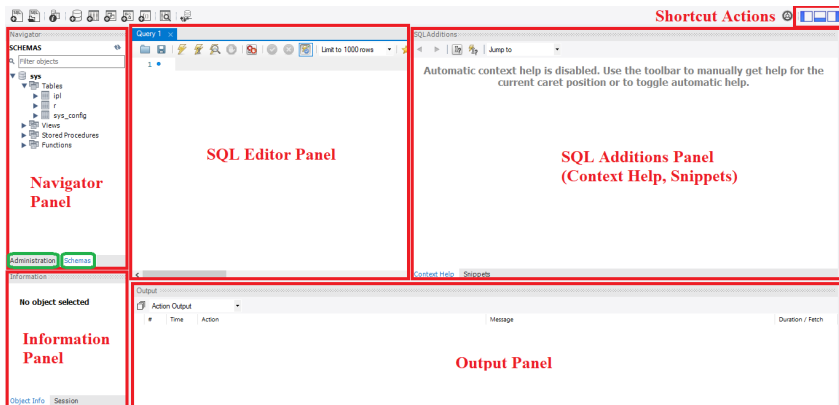
We will be using the accounts with username/password root/mysql (DBA) and student/student123 (general user) on MySQL during the course.

Note: In Oracle SQL, scott/tiger are the general username/password. The default password for the DBA is system.

Connecting with MySQL Workbench

The screenshot shows the MySQL Workbench application window. The title bar reads "MySQL Workbench". The menu bar includes "File", "Edit", "View", "Database", "Tools", "Scripting", and "Help". On the left is a dark sidebar with icons for home, database, and navigation. The main area displays a "Welcome to MySQL Workbench" message. Below the welcome text, there are links for "Browse Documentation", "Read the Blog >", and "Discuss on the Forums >". At the bottom left, there is a "MySQL Connections" section with two connection cards: "Local instance MySQL80" (root, localhost:3306) and "MTech-ISI" (root, 127.0.0.1:3306). A modal dialog box is open in the center, titled "Opening SQL Editor", with a clock icon. The dialog text says: "An SQL editor instance for 'MTech-ISI' is opening and should be available in a moment. Please stand by." There is a "Cancel" button at the bottom right of the dialog.

MySQL Workbench – Panels



Note: The MySQL Workbench developer manual is available at <https://dev.mysql.com/doc/workbench/en>.

The data types in MySQL – Numerics

Type	Size (bits)	Minimum	Maximum
tinyint(dig)	8	-2^7	$2^7 - 1$
unsigned tinyint(dig)	8	0	$2^8 - 1$
smallint(dig)	16	-2^{15}	$2^{15} - 1$
unsigned smallint(dig)	16	0	$2^{16} - 1$
mediumint(dig)	24	-2^{23}	$2^{23} - 1$
unsigned mediumint(dig)	24	0	$2^{24} - 1$
int(dig)	32	-2^{31}	$2^{31} - 1$
unsigned int(dig)	32	0	$2^{32} - 1$
bigint(dig)	64	-2^{63}	$2^{63} - 1$
unsigned bigint(dig)	64	0	$2^{64} - 1$
real(dig, dec)	32	$-3.40E + 38$	$3.40E + 38$
float(dig, dec)	64	$-1.79E + 308$	$1.79E + 308$
decimal(dig, dec)	136	$-10^{38} + 1$	$10^{38} - 1$
numeric(dig, dec)	136	$-10^{38} + 1$	$10^{38} - 1$

Note: Total number of digits (before and after the decimal point) and number of digits only after the decimal point are specified by dig and dec, respectively.

The data types in MySQL – Text

Type	Storage	Maximum
<code>char(size)</code>	Fixed length string	255 characters
<code>varchar(size)</code>	Variable length string	255 characters
<code>tinytext(size)</code>	Character large object/CLOB	255 characters
<code>text(size)</code>	Character large object/CLOB	65,535 characters
<code>mediumtext(size)</code>	Character large object/CLOB	16,777,215 characters
<code>longtext(size)</code>	Character large object/CLOB	4,294,967,295 characters
<code>blob(size)</code>	Binary large object/BLOB	65,535 bytes
<code>mediumblob(size)</code>	Binary large object/BLOB	16,777,215 bytes
<code>longblob(size)</code>	Binary large object/BLOB	4,294,967,295 bytes
<code>enum(x,y,z,etc.)</code>	A list of possible values	65535 values

Note: A string can contain letters, numbers, and special characters. The maximum number of characters in a string can be specified with `size`.

The data types in MySQL – Text

Differences between the data types `char` and `varchar`:

char	varchar
1. It stores character strings of fixed length.	1. It stores character strings of variable length.
2. It uses static memory allocation.	2. It uses dynamic memory allocation.
3. It takes 1 byte for each character.	3. It takes 1 byte for each character and some extra bytes to store length information.
4. Storage size is equal to the length already fixed (in bytes).	4. Storage size is equal to the exact length of the input string (in bytes).
5. Its I/O performance is faster.	5. Its I/O performance is slower.

Consider a table

Table: IPL

YEAR	VENUE	WINNER	PoS
8	India	Rajasthan Royals	Shane Watson
9	South Africa	Deccan Chargers	Adam Gilchrist
10	India	Chennai Super Kings	Sachin Tendulkar
11	India	Chennai Super Kings	Chris Gayle
12	India	Kolkata Knight Riders	Sunil Narine
13	India	Mumbai Indians	Shane Watson
14	India, UAE	Kolkata Knight Riders	Glenn Maxwell
15	India	Mumbai Indians	Andre Russell
16	India	Sunrisers Hyderabad	Virat Kohli
17	India	Mumbai Indians	Ben Stokes
18	India	Chennai Super Kings	Sunil Narine
19	India	Mumbai Indians	Andre Russell
20	UAE	Mumbai Indians	Jofra Archer

Creating a table

The IPL table, on which we will be working on further, can be created with the following SQL query.

```
create table IPL(  
    YEAR tinyint(4) not null,  
    VENUE char(50),  
    WINNER char(30),  
    PoS char(30),  
    primary key (YEAR)  
);
```

Note: The attribute YEAR, which cannot be null, is defined as the primary key of IPL table.

Deleting a table

The IPL table can be deleted from database using the following SQL query.

```
drop table IPL;
```

Altering a table

The IPL table can be altered by adding a new attribute A_p and mentioning its domain D_p (data type) as follows. All the existing tuples will be assigned a null value for the new attribute A_p .

```
alter table IPL add ORGANIZER char(30);
```

Altering a table

The IPL table can be altered by adding a new attribute A_p and mentioning its domain D_p (data type) as follows. All the existing tuples will be assigned a null value for the new attribute A_p .

```
alter table IPL add ORGANIZER char(30);
```

The IPL table can be altered by dropping an existing attribute A_p as follows.

```
alter table IPL drop ORGANIZER;
```

Altering a table

The IPL table can be altered by adding a new attribute A_p and mentioning its domain D_p (data type) as follows. All the existing tuples will be assigned a null value for the new attribute A_p .

```
alter table IPL add ORGANIZER char(30);
```

The IPL table can be altered by dropping an existing attribute A_p as follows.

```
alter table IPL drop ORGANIZER;
```

Note: New primary keys can also be added/dropped in a similar way.

Renaming a table and its attributes

The IPL table and its attributes can be renamed and reused, as and when required, within an SQL query as follows:

```
select IPL1.PoS
from IPL as IPL1, IPL as IPL2
where IPL1.PoS = IPL2.PoS
and
IPL1.YEAR > IPL2.YEAR
and
IPL2.WINNER = 'Mumbai Indians';
```

Renaming a table and its attributes

The IPL table and its attributes can be renamed and reused, as and when required, within an SQL query as follows:

```
select IPL1.PoS
from IPL as IPL1, IPL as IPL2
where IPL1.PoS = IPL2.PoS
and
IPL1.YEAR > IPL2.YEAR
and
IPL2.WINNER = 'Mumbai Indians';
```

This will yield the names of Player of Series (PoS) winners who once won earlier and for 'Mumbai Indians' at a later time.

Delete operation on the tuples

```
delete from IPL
where YEAR < 10;
```

Note: It works on the entire tuple and can not delete values on arbitrary attributes.

Delete operation on the tuples

Table: IPL

YEAR	VENUE	WINNER	PoS
10	India	Chennai Super Kings	Sachin Tendulkar
11	India	Chennai Super Kings	Chris Gayle
12	India	Kolkata Knight Riders	Sunil Narine
13	India	Mumbai Indians	Shane Watson
14	India, UAE	Kolkata Knight Riders	Glenn Maxwell
15	India	Mumbai Indians	Andre Russell
16	India	Sunrisers Hyderabad	Virat Kohli
17	India	Mumbai Indians	Ben Stokes
18	India	Chennai Super Kings	Sunil Narine
19	India	Mumbai Indians	Andre Russell
20	UAE	Mumbai Indians	Jofra Archer

Insert operation

```
insert into IPL
values (8, 'India', 'Rajasthan Royals', 'Shane Watson');
insert into IPL
values (9, 'South Africa', 'Deccan Chargers', 'Adam
Gilchrist');
```

Note: You can optionally mention the attributes as well as follows
"insert into IPL (YEAR, VENUE, WINNER, PoS) values
(9, 'South Africa', 'Deccan Chargers', 'Adam
Gilchrist');".

Insert operation

Table: IPL

YEAR	VENUE	WINNER	PoS
8	India	Rajasthan Royals	Shane Watson
9	South Africa	Deccan Chargers	Adam Gilchrist
10	India	Chennai Super Kings	Sachin Tendulkar
11	India	Chennai Super Kings	Chris Gayle
12	India	Kolkata Knight Riders	Sunil Narine
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Note: Tuples are inserted following the order of primary key, otherwise (no primary key) at the bottom.

Update operation

```
update IPL
set YEAR = YEAR + 2000
where YEAR < 2000;
```

Update operation

Table: IPL

YEAR	VENUE	WINNER	PoS
2008	India	Rajasthan Royals	Shane Watson
2009	South Africa	Deccan Chargers	Adam Gilchrist
2010	India	Chennai Super Kings	Sachin Tendulkar
2011	India	Chennai Super Kings	Chris Gayle
2012	India	Kolkata Knight Riders	Sunil Narine
2013	India	Mumbai Indians	Shane Watson
2014	India, UAE	Kolkata Knight Riders	Glenn Maxwell
2015	India	Mumbai Indians	Andre Russell
2016	India	Sunrisers Hyderabad	Virat Kohli
2017	India	Mumbai Indians	Ben Stokes
2018	India	Chennai Super Kings	Sunil Narine
2019	India	Mumbai Indians	Andre Russell
2020	UAE	Mumbai Indians	Jofra Archer

Using Oracle Live SQL

Try this out!!!

Learn and share SQL – Now running on Oracle Database 19c

<https://livesql.oracle.com>

Problems

- 1 What will be returned by the following set of queries?

```
create table ADDRESS(  
    CITY char(20),  
    STREET varchar(20)  
);  
insert into ADDRESS values('Kolkata','B. T. Road');  
select length(CITY), length(STREET) from ADDRESS;
```


Solution

```
length(CITY)
```

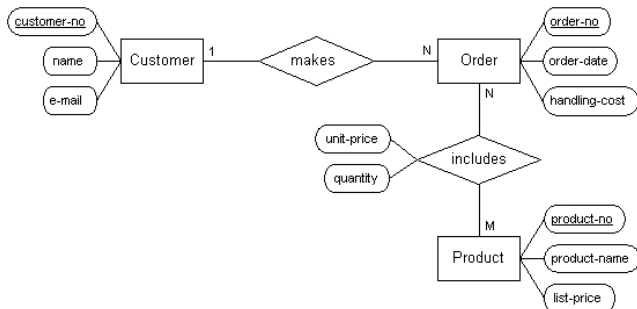
```
20
```

```
length(STREET)
```

```
10
```

Problems

- 2 Consider the following E-R diagram representing the details about products, customers, and orders that were placed by the customers of Flipkart Republic Day Sale during January 19-22, 2021. Create the database and insert data.



Solution

```
create table Customer( ... );  
create table Order( ... );  
create table Product( ... );
```

```
create table makes(  
    customer-no int,  
    order-no int \\  
); \\  
create table includes(  
    order-no int, \\  
    product-no int, \\  
    unit-price real, \\  
    quantity int \\  
);
```

Problems

- 3 Consider the following schema representing assignment submission details of the students in a course.
- ASSIGNMENT = $\langle roll : integer, assignmentnumber : integer, submissiondate : date \rangle$

If the students are not allowed to make multiple submissions, create this table in a way such that it keeps a check of repeated submission of the same assignment and rejects the same.

Solution

```
create table ASSIGNMENT(  
    roll int not null,  
    assignmentnumber int not null,  
    submissiondate date,  
    primary key (roll, assignmentnumber)  
);
```