Database Management Systems

MySQL - Data Definition

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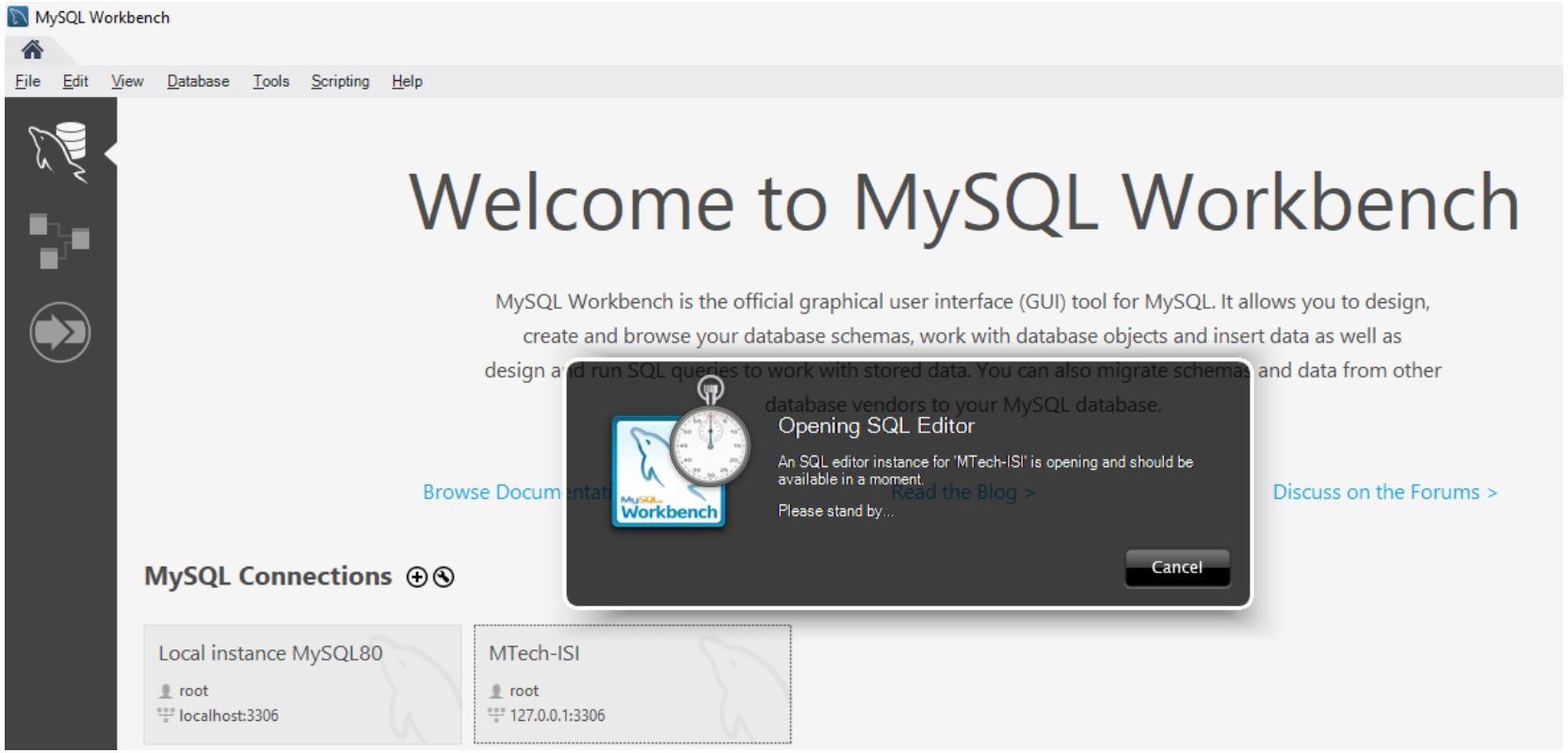
Connecting with MySQL

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

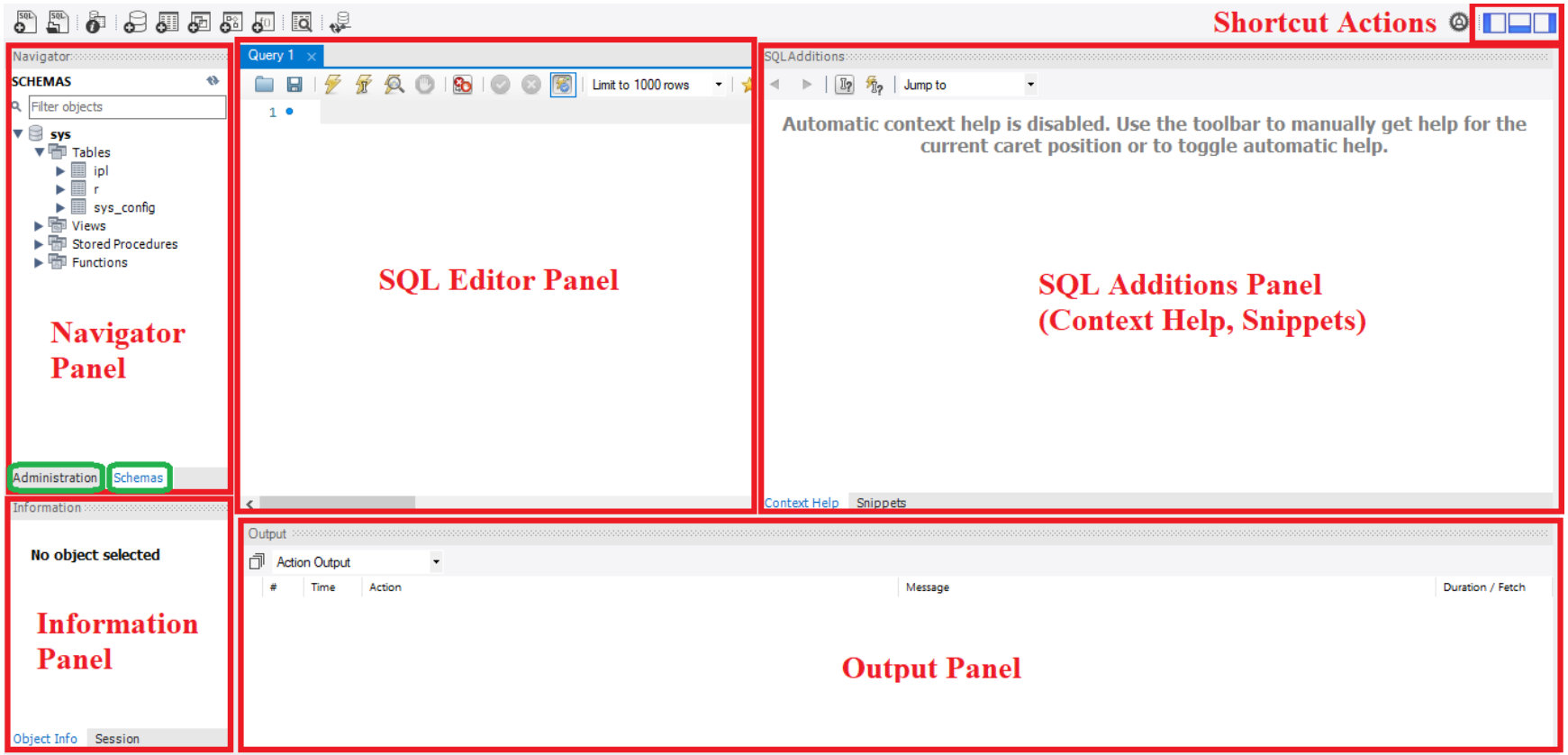
We will be using the accounts with username/password `root/mysql` (DBA) and `student/student123` (general user) on MySQL during the course.

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

Connecting with MySQL Workbench



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
char(size)	Fixed length string	255 characters
varchar(size)	Variable length string	255 characters
tinytext(size)	Character large object/CLOB	255 characters
text(size)	Character large object/CLOB	65,535 characters
mediumtext(size)	Character large object/CLOB	16,777,215 characters
longtext(size)	Character large object/CLOB	4,294,967,295 characters
blob(size)	Binary large object/BLOB	65,535 bytes
mediumblob(size)	Binary large object/BLOB	16,777,215 bytes
longblob(size)	Binary large object/BLOB	4,294,967,295 bytes
enum(x,y,z,etc.)	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*.

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
13	India	Mumbai Indians	Shane Watson
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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

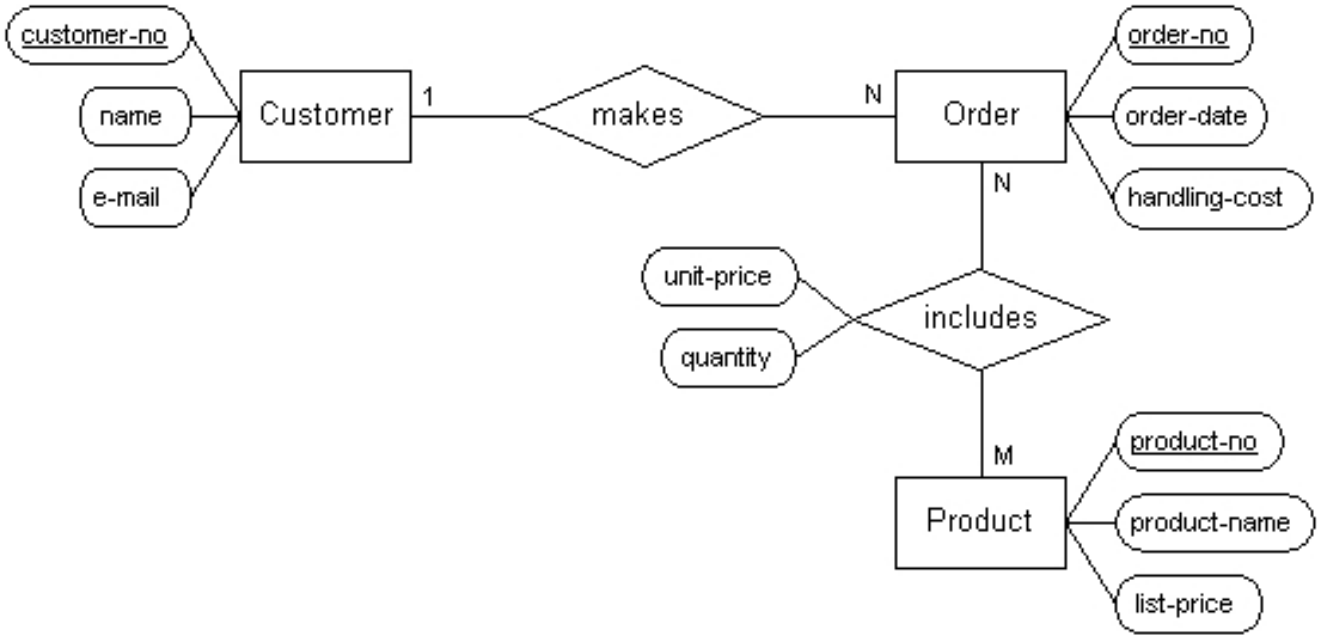
Try this out!!!

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

`https://livesql.oracle.com`

Problems

1. 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

2. 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)
);
```

Problems

3. Consider the following schema representing annual salaries of M.Tech (CS) students from the batch of 2019-21 offered by different companies. Let there be multiple job offers to the same student (denoted by fullname) in the said batch.
   - SALARY $= \langle \underline{jobid} : integer, fullname : string, company : string, salary : real \rangle$

   The primary key is underlined in the above schema and it gets automatically incremented. Write the following queries in SQL.
   (i) Delete the newest tuples from the SALARY table for the records that have duplicate entries in fullname.
   (ii) Delete the tuples from the SALARY table with lower salaries for the records that have multiple job offers (may be due to different positions) to the same person by the same company.

Solution

(i)
```
create table TEMP (select * from SALARY group by
fullname);
drop table SALARY;
create table SALARY select * from TEMP;
drop table TEMP;
```

(ii)
```
create table TEMP (select * from salary order by
salary desc);
drop table SALARY;
create table SALARY (select * from TEMP group by
fullname, company order by salary desc);
drop table TEMP;
```