SQL: Structured Query Language

Reference: Database and SQL for Data Science with Python IBM Coursera

SQL Terminology

① SQL helps _____ (3) efficiently
1. query data
2. update data
3. manipulate data

② Python works with SQL to _____ (2).
1. connect databases together
2. execute SQL queries

③ SQL is _____
a language used for relational databases

④ SQL is used for _____
querying data

Data Terminology

① data is _____
a collection of facts (words, numbers) and/or pictures

② data is a critical asset for _____
business

③ data needs to be _____ (3) because it is important.
1. secured
2. stored
3. access quickly

Database Terminology

① database is _____ (2).
1. a repository of data
2. a program that stores data

② database provides functionality for _____ (3) data.
1. adding
2. modifying
3. querying

③ relational database is _____
data stored in tabular form — columns and rows

④ columns contain _____
properties of an item

⑤ An example of a property of an item could be _____ (2)
1. last name
2. first name

⑥ table is _____
a collection of related things

⑦ T/F Relations between tables can exist.
True

⑧ DBMS (Database Management System) is a _____
software used to manage databases

⑨ Other words that can be used interchangeably for databases are _____ (4).
1. database server
2. database system
3. data server
4. DBMS

RDBMS (Relational DBMS) Terminology

① RDBMS is _____
a set of software tools that controls the data

② Data in RDBMS can be controlled by actions like _____
1. accessibility
2. organization
3. storage

③ Examples of RDBMS _____ (3)
1. MySQL
2. Oracle Database
3. Db2

④ Basic SQL commands are _____ (5)
1. Create a table
2. Insert
3. Select
4. Update
5. Delete

SELECT Statement

① A SELECT statement is _____
a Data Manipulation Language (DML)

② A DML will _____ (2)
1. read data
2. modify data

③ The syntax for SELECT is _____

```
Select * from tablename;
```

④ The diagram between tablename and properties of an item (column) is _____

⑤ The syntax for selecting specific properties from a table is _____

```
select column_a, column_b, ... column_n from tablename;
```

⑥ T/F The order of your columns displayed will always match the order in the SELECT statement.
True

WHERE Clause

① The WHERE clause can restrict the _____
result set

② T/F The WHERE clause always requires a predicate.
True

③ T/F The predicate always evaluates to True, False, or Unknown.
True

④ The syntax for using WHERE clause is _____

```
select column_a, column_b, ..., column_n from tablename
where predicate
```

⑤ An example of using the WHERE clause is _____

```
select book_id, title from Book WHERE book_id='B1';
```

⑥ The 6 comparison operators are _____
1. =
2. >
3. <
4. >=
5. <=
6. <> (not equal to)

⑦ The predicate is also known as _____
condition

COUNT

① Count is a _____
built-in database function

② Count retrieves the number of _____
rows

③ The syntax for querying the total rows of a given table is _____

```
SELECT COUNT(*) FROM tablename;
```

④ The syntax for querying the total rows of a given column equaling x is _____

```
SELECT COUNT( column_name ) FROM tablename
WHERE column_name = 'x';
```

⑤ The syntax for retrieving unique values in a column is _____

```
SELECT DISTINCT column_name FROM tablename;
```

⑥ The output of this syntax:

```
Select DISTINCT COUNTRY FROM MEDALS
    WHERE MEDALTYPE = 'GOLD';
```

is _____.
a list of unique countries that recieved gold medals.

Limit clause

① Limit restricts the number of _____ retrieved from the database
rows

② The Syntax:

```
SELECT * FROM tablename LIMIT 10;
```

will result _____.
the first 10 rows in a table

③ The Syntax:

```
Select * from MEDALS
    where YEAR = 2018 LIMIT 5;
```

will result in _____.
five rows or less of the year 2018

Insert Statement

① The INSERT statement is used to add _____ to a table.
new rows

② T/F The INSERT statement is DML statement.
True

③ The syntax of the INSERT statement is _____

```
INSERT INTO tablename
(column_1, column_2, ..., column_n)
VALUES (value_r11, value_r12, ... value_r1n),
       ⋮          ⋱          ⋮
       (value_rn1, value_rn2, ... value_rnn);
```

Update Statement

(1) T/F UPDATE statement is a DML Statement.
True

(2) UPDATE statement is used to _____.
alter or modify the data

(3) The syntax for UPDATE Statement is _____.

```
UPDATE tablename SET column_a = 'new_a', Column_b = 'new_b',
... column_n = 'new_n' Where predicate;
                          Optional for specificity
```

(4) The syntax to change first name and last name to Lakshmi Katta where AUTHOR_ID = A2 is _____.

```
UPDATE AUTHOR set LASTNAME = 'KATTA', FIRSTNAME = 'LAKSHMI'
  Where AUTHOR_ID = 'A2';
```

DELETE Statement

(1) T/F DELETE Statement is DML Statement.
True

(2) The syntax for DELETE Statement by a column_name is _____.

```
DELETE FROM tablename
  Where column_name in ('property_a', 'property_b',..
                        'property_n');
```

(3) The result of the code

```
DELETE FROM AUTHOR where AUTHOR_ID in ('A2','A3');
```

is _____.
Deletes a row where AUTHOR_ID is either 'A2' or 'A3'.

(4) T/F If you do not specify a where clause, all the rows will be deleted.
True

(5) T/F You do not use DELETE to delete columns.
True

(6) The general syntax for deleting columns is _____

```
ALTER TABLE tablename DROP COLUMN column_name;
```

(7) T/F MySQL, PostgreSQL have the same syntax for dropping multiple columns but SQL Server and Oracle database each have their own syntaxes.
True.

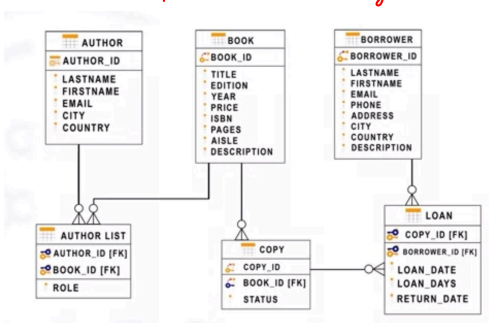
Relational Model

(1) The relational model is the most used data model because it allows for _____
data independence

(2) The three types of independence preserved are _____
1. logical independence
2. physical data independence
3. physical storage independence

(3) An entity relationship (ER) data model is _____
an alternative to relational data model

(4) This is an example of an ERD (entity relationship diagram):



(5) ERD is used to represent _____
entities called table and their relationships.

(6) T/F The ER model is used as a tool to design relational databases.
True

(7) In an ER model, an entity is an _____
object

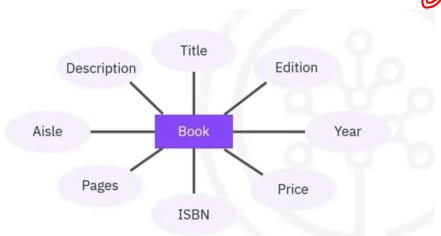
(8) T/F Entities in an ER model exists independently of any entities in the database.

(9) The building blocks of an ER diagram are _____. (2)
1. entities
2. attributes

ER Diagram

(1) An entity can be _____.
noun: person, place, or thing

(2a)



In this diagram, the entity is _____
Book

(2b) In this diagram, the attributes are _____
Title, Edition, etc.

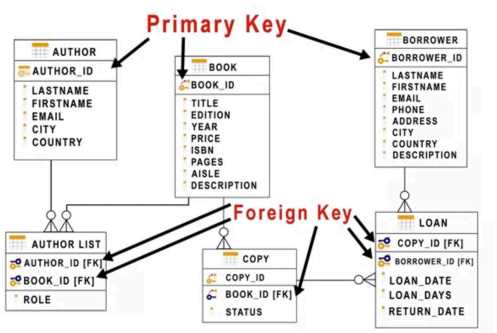
(3) Attributes are _____
data elements that characterize the entity

Entity-Relationship Model

(1) Entity becomes a _____ in the database.
table

(2) Attributes become the _____ in a table.
Columns

Primary keys and foreign keys



(1) T/F Each table is assigned a primary key.
True.

(2) The primary key uniquely identifies each _____ of a table.
tuple or row

(3) The primary key prevents _____.
duplication of data

(4) Foreign keys are _____
primary keys defined in other tables

(5) The foreign key helps create a _____
link between tables

DDL vs DML

(1) You can interchange row with _____
tuple

(2) You can interchange column with _____
attribute

(3) DDL stands for _____
data definition language

(4) DML stands for _____
data manipulation language

(5) DDL statements are used to _____ (3) database objects (such as tables).
1. define
2. change
3. drop

(6) Common DDL statement types are _____. (4)
1. CREATE
2. ALTER
3. TRUNCATE
4. DROP

Common DDL statements

(1) CREATE is used for _____. (2)
1. Creating tables
2. defining its columns

(2) ALTER is used for _____ (2)
1. Adding / dropping columns
2. modifying their datatypes

(3) TRUNCATE is used for _____
deleting data in a table but not the table itself

(4) DROP is used for _____
deleting tables

column
DDL: Create Drop Alter Truncate
(Confident Dill Create DRAT queen)
row
DML: Insert Select Delete Update
(Red Doom is due)

DML Statements

① DML statements are used to _____

read and modify data

② Read and modify data with _____.

CRUD Operations

③ CRUD stands for _____

Create, Read, Update & Delete rows

Common DML statements

① Common DML statements are _____

1. INSERT
2. SELECT
3. UPDATE
4. DELETE

② INSERT is used for _____

inserting a row or several rows of data into a table.

③ SELECT is used for selecting data in a _____

row(s)

④ UPDATE is used for editing

row(s)

⑤ DELETE is used for deleting data in a

row(s)

CREATE TABLE Statement

① The syntax for CREATE TABLE is _____.

```
CREATE TABLE tablename (
    column_1 datatype optional parameters,
    column_2 datatype,
    ...
    column_n datatype
);
```

② A sample code:

```
CREATE TABLE provinces (
    id CHAR(2) PRIMARY KEY NOT NULL;
    name VARCHAR(24) NOT NULL;
    population BIGINT
);
```

2a The Char(2) tells us the datatype is character string for id and has a _____.

fixed length of 2.

2b The varchar is a character string of a _____

variable length

2c varchar(24) means the variable character length can be _____.

up to 24.

ALTER TABLE Statement

① The syntax for ALTER TABLE is _____.

```
ALTER TABLE tablename (
    ADD COLUMN column_1 datatype,
    ...
    ADD COLUMN column_n
);
```

② T/F The ALTER TABLE does not allow you to perform multiple operations (e.g. adding and modifying columns) in a single statement.

True.

③ The actions you can perform with ALTER TABLE _____. (4)

1. Add or remove columns
2. Modify the data types of columns
3. Add or remove keys
4. Add or remove constraints

④ The syntax for modifying the data type is _____.

```
ALTER TABLE tablename
MODIFY column_name datatype;
```

⑤ T/F The CHAR datatype does not include '(', '+', '*'.

True

⑥ To delete a column, the syntax is _____.

```
ALTER TABLE tablename
DROP COLUMN column_name;
```

⑦ The DROP COLUMN is known as a _____ clause

⑧ The code for deleting a table is _____.

```
DROP TABLE tablename;
```

⑨ The code for deleting the data and not the table itself is _____.

```
TRUNCATE TABLE tablename
IMMEDIATE;
```

⑩ IF IMMEDIATE is used to process the statement immediately and the action cannot be undone.

Retrieving Rows of Data: String Patterns

① If you don't know which value to specify in the predicate, (e.g. not knowing the exact value to search for), we can do _____.

String patterns

② Suppose we know the first name of the author begins with 'R'. The code for using String pattern is _____.

```
SELECT * FROM tablename
WHERE column LIKE 'R%';
```

2a The '%' serves as a _____.

placeholder for other characters.

2b T/F You can put '%' before, middle, and after characters.

True

Range

① For numbers, you can use the operators _____. (2)

1. '>=' ... '<='
2. 'BETWEEN' ... 'AND'

② The syntax to use range are _____. (2)

1. SELECT column_name(s) FROM tablename WHERE column_name BETWEEN X AND Y;
   (X, Y ∈ ℝ)
2. SELECT column_name(s) FROM tablename WHERE column_name >= X AND column_name <= Y;
   (X, Y ∈ ℝ).

2a T/F Must prefer the first approach because it is easier and quicker to write.

True

A Set of Values

① If you cannot group numbers into a range, you can use _____.

in operator

② The syntax for in operator is _____

```
SELECT column_name(s) FROM tablename
WHERE column_name IN (value_1, value_2, ...
                      value_n);
```

③ The in operator takes a list of expressions to _____.

compare against

Sorting Results Set: ORDER BY Clause

① The ORDER BY clause is used in a query to sort the result set by _____.

a specified column

② The syntax for ORDER BY is _____.

```
SELECT column_name(s) FROM tablename
ORDER BY column_name;
```

③ By default, the result set is sorted in _____ order.

ascending

④ The syntax for sorting the result set in descending order is _____.

```
SELECT column_name(s) FROM tablename
ORDER BY column DESC;
```

Column Sequence Number

① Another way to specify sort column is to indicate the _____.

column sequence number

② Suppose the second column in the table was named pages. The code to sort the result set using column sequence number for pages is _____.

```
SELECT column_name(s) FROM tablename
ORDER BY 2;
```

Grouping Result Sets: Eliminating Duplicates, DISTINCT Clause

① The DISTINCT clause removes duplicates within a _____

column

② The syntax for using the DISTINCT clause is _____.

```
SELECT DISTINCT (Column_name)
FROM tablename;
```

③ To count the number of unique values of a column, use _____ (2).

COUNT function & GROUP BY Clause

④ The syntax for GROUP BY Clause is _____.

```
SELECT column_name, COUNT(column_name)
FROM tablename GROUP BY column_name;
```

⑤ The GROUP BY clause groups a result into _____ subsets that has matching values for one or more columns

⑥ Example of the code and output using GROUP BY:

```
db2 => select country, count(country)
       from Author GROUP BY country
```

Country	2
AU	1
BR	1
CA	3
CN	6
IN	6
RO	3

6 record(s) selected.

⑥a T/F First the 'country' is grouped. Then they are counted.

True

⑥b The number '2' is displayed as a column name because the column name is _____. not directly available in the table

⑥c The second column in the result set was calculated by the _____.

count function

⑥d We can assign a column name to the result set with this code _____.

```
SELECT column_name, COUNT(column_name)
AS column_name_1 FROM tablename
GROUP BY column_name;
```

⑥e AS is a _____.

keyword

Condition on GROUP BY Clause: HAVING Clause

① T/F The WHERE clause works with the entire result set, but the HAVING Clause only works with GROUP BY clause.

True

② The syntax for using HAVING Clause is _____

```
SELECT column_name, COUNT(column_name)
AS column_name_1 FROM tablename
GROUP BY column_name HAVING predicate;
```

Built-In Database Functions

① Built-in functions allows you to perform operations on data right within _____.

the database itself

② T/F Using database functions reduces the amount of data that needs to be retrieved from the database.

True

②b T/F Database functions can significantly reduce network traffic and use of bandwidth.

True

③ T/F Database functions can speed up data processing because rather than first retrieving the data into your app and then executing functions on retrieved data.

True

④ T/F you can create your own functions called user-defined functions, in the database.

True

Aggregate or Column Functions

① Some examples of aggregate or column functions are _____ (4).

1. SUM()
2. MIN()
3. MAX()
4. AVG()

② The sum function adds up all the values in a _____.

column

③ Suppose the tablename was PETRESCUE. The syntax to use SUM() is _____.

```
SELECT SUM(column_name) FROM tablename;
```

④ T/F When you use an aggregate function, the column in the result set is given a number by default.

True

Column Alias

① T/F It is possible to explicitly name the resulting column.

True

② Suppose we want to call the output column SUM_OF_COST. The code for this is _____.

```
SELECT SUM(COST) AS SUM_OF_COST
FROM PETRESCUE;
```

③ The SUM_OF_COST becomes a _____ in the result set.

the column_name (instead of the default number)

Max & Min

① The Max and min returns the max and min value of the _____, respectively.

column

② The syntax for Max function is _____.

```
SELECT MAX(column_name) FROM PETRESCUE;
```

③ T/F Aggregate functions can be applied on a subset of data instead of an entire column.

True

④ Suppose we want to get the minimum value of a column with a condition within a table. The syntax is _____.

```
SELECT MIN(column_name) FROM tablename
WHERE <Condition>;
```

Average

① T/F you can calculate the mean of a column using the average function.

True

⑩a The syntax for using the average function is _____.

```
SELECT AVG(column_name) FROM tablename;
```

② T/F you can perform mathematical operations between columns and apply aggregate functions on them.

True

③ Suppose we have the COST, QUANTITY, and ANIMAL column. We can calculate the average cost per dog by doing _____.

```
SELECT AVG(COST/QUANTITY) FROM tablename
WHERE ANIMAL = 'Dog';
```

Scalar and String Functions

① Scalar functions perform operations on _____.

every input value

② Some examples of Scalar and string functions are _____ (4).

1. ROUND()
2. LENGTH()
3. UCASE
4. LCASE

③ The following syntax

```
SELECT ROUND(column_name)
FROM tablename;
```

will round every value of the column to the nearest _____.

integer

④ The string functions apply to _____ (2).

1. Char
2. varchar

⑤ The syntax

```
SELECT LENGTH(ANIMAL)
FROM tablename;
```

will retrieve the length of _____.

each char/varchar in ANIMAL

UCASE, LCASE

① The syntax to capitalize every value in a column is _____.

```
SELECT UCASE(column_name)
FROM tablename;
```

② T/F you can use the UCASE/LCASE function in a WHERE clause.

True

③ Suppose you want to find all cat items. You are unsure that the ANIMAL column stores this value as. A solution is to _____.

```
SELECT * FROM tablename
WHERE LCASE(column_name) = 'cat';
```

④ T/F You can have one function operate on the output of another function.

True

⑤ Suppose you want the unique values from a column, regardless of their cases. One solution is _____.

```
SELECT DISTINCT(UCASE(column_name))
FROM tablename;
```

DATE & Time Functions

① In SQL, DATE, TIME, and TIMESTAMP are _____ for dates and times.

datatypes

② The format for DATE is _____.

YYYYMMDD

③ The format for TIME is _____.

HHMMSS

④ The format for TIMESTAMP is _____.

YYYYXXDDHHMMSSZZZZZZ

④a XX represents _____.

month

④b ZZZZZZ represents microseconds.

⑤ Functions like _____ (10) can extract information from the date.

1. YEAR()
2. MONTH()
3. DAY()
4. DAYOFMONTH()
5. DAYOFWEEK()
6. DAYOFYEAR()
7. WEEK()
8. HOUR()
9. MINUTE()
10. SECOND()

⑥ The syntax for using the function DAY() is _____.

SELECT DAY(column_with_time_datatype) FROM tablename;

⑦ Suppose we want to get the number of rescues during the month of May. We could use the functions _____ (2).

1. COUNT()
2. MONTH()

⑧ A solution code for the task above is _____.

SELECT COUNT(*) FROM tablename
WHERE MONTH(column_with_date_datatype) = '05';

Date or Time Arithmetic

① Suppose to calculate future dates is to add x amount of days. A way we do that is to use the _____ function.

DATE_ADD()

② The syntax to use DATE_ADD() is _____.

SELECT DATE_ADD(column_with_date_datatype, INTERVAL X DAY) FROM tablename;

③ The result gives you a new _____.

column

③a For example:

```
Select DATE_ADD(RESCUEDATE, INTERVAL 3 DAY) from PETRESCUE
```

Example 13: Results:

	ID	ANIMAL	QUANTITY	COST	RESCUEDATE	+ 3 DAYS
2018-06-01	1	Cat	9	450.09	2018-05-29	2018-06-01
2018-06-04	2	Dog	3	666.66	2018-06-01	2018-06-04
2018-06-07	3	Dog	1	100	2018-06-04	2018-06-07
2018-06-07	4	Parrot	2	50	2018-06-04	2018-06-07
2018-06-13	5	Dog	1	75.75	2018-06-10	2018-06-13

Special Registers (for Date or Time)

① The special registers for date and time for SQL are _____ (7).

1. CURRENT DATE
2. CURRENT TIME
3. CURRENT TIMESTAMP
4. CURRENT TIMEZONE
5. CURRENT DATACOM MUF_NAME
6. CURRENT DATACOM TSN
7. DATACOM_OPTIMIZATION

FROM_DAYS() & DATEDIFF()

① The FROM_DAYS() function converts a _____ to _____.

numeric representation of a date to DATE format.

② The DATEDIFF() function is used to calculate the difference between _____.

two dates

② T/F The DATEDIFF() function returns the number of _____.

days

③ Suppose we have a column of dates. We want to know how many days have passed since then. We can use functions _____ (2) and special register _____ (1).

functions: FROM_DAYS(), DATEDIFF()
special register: CURRENT_DATE

③a The syntax to answer the task above is _____.

SELECT FROM_DAYS(DATEDIFF(CURRENT_DATE, Column_with_date_dtype)) FROM tablename;

③b An example of the code with result is _____.

```
Select FROM_DAYS(DATEDIFF(CURRENT_DATE, RESCUEDATE)) from PETRESCUE
```

0001-09-21

③c T/F It has been 1 year 9 months & 21 days since the RESCUEDATE.

True

Sub-queries & Nested Selects

① T/F A sub-query is a query inside another query.

True

② An example of a nested query is _____.

SELECT column_1 FROM tablename
WHERE column_2
= (SELECT MAX(column_2) FROM tablename);

Sub-queries to Evaluate Aggregate Functions

③ Suppose we have the table.

EMPLOYEES

EMP_ID	F_NAME	L_NAME	SSN	B_DATE	SEX	ADDRESS	JOB_ID	SALARY	MANAGER_ID	DEP_ID
E1001	John	Thomas	123456	1976-01-09	M	5631 Rice, OakPark,IL	100	100000	30001	2
E1002	Alice	James	123457	1972-07-31	F	980 Berry ln, Elgin,IL	200	80000	30002	5
E1003	Steve	Wells	123458	1980-08-10	M	291 Springs, Gary,IL	300	50000	30002	5

we want to retrieve the list of employees who earned more than the monthly average.

③a T/F We cannot always evaluate aggregate functions (like AVG()) in the WHERE clause.

True

③b An example of an error for not being able to use aggregate function is _____.

```
select * from employees
       where salary > AVG(salary)
```

This query will result in error:

```
SQL0120N Invalid use of an aggregate function or OLAP
function.SQLCODE=-120, SQLSTATE=42903
```

③c Since AVG() function cannot be evaluated in the where clause, we can use a _____.

sub-select expression

Sub-select Expression

① The syntax for using sub-select expression is _____.

SELECT column_1, column_2 FROM tablename
WHERE column_1 <
(SELECT AVG(column_1) FROM tablename);

② An example code and result for using sub-select expression is _____.

```
select EMP_ID, F_NAME, L_NAME, SALARY
       from employees
       where SALARY <
       (select AVG(SALARY) from employees);
```

Result:

EMP_ID	F_NAME	L_NAME	SALARY
E1003	Steve	Wells	50000.00
E1004	Santosh	Kumar	60000.00
E1007	Mary	Thomas	65000.00

③ T/F The sub-select expression does not have to go in the WHERE clause. It can appear elsewhere too.

True

Column Expression

① A column-expression is when you substitute column name with a _____.

sub-query

② T/F You cannot substitute column name directly with AVG() function.

True

③ T/F If you substitute column name directly with AVG() function, you will get an error indicating that no Group By clause is specified.

True

④ A way to substitute a column name by the result of the AVG() function is to use a _____.

sub-query

⑤ The syntax that substitute a column name by a sub-query is _____.

SELECT column_1, column_2,
(SELECT AVG(column_2) FROM tablename)
AS AVG_column_2 FROM tablename;

⑤a An example of the code and result for column expression is _____.

```
select EMP_ID, SALARY,
       ( select AVG(SALARY) from employees )
              AS AVG_SALARY
       from employees ;
```

EMP_ID	SALARY	AVG_SALARY
E1002	80000.00	68888.888888888888888888888
E1003	50000.00	68888.888888888888888888888
E1004	60000.00	68888.888888888888888888888
E1005	70000.00	68888.888888888888888888888
E1006	90000.00	68888.888888888888888888888
E1007	65000.00	68888.888888888888888888888
E1008	65000.00	68888.888888888888888888888
E1009	70000.00	68888.888888888888888888888

Sub-queries in FROM clause

① Sub-queries in FROM clause are sometimes called _____ (2).

1. Derived tables
2. Table expressions

② T/F In a derived table or table expression, the outer query uses the results of the sub query as a data source.

True

③ An example code for a derived table is _____.

```
SELECT * FROM
(SELECT column_1, column_2, column_3
 FROM tablename) AS derived_table_name;
```

④ Derived tables can be useful for _____ (2).

1. Working with multiple tables
2. Doing joins

Multiple Tables

Given these tables:

EMPLOYEES:

EMP_ID	F_NAME	L_NAME	SSN	B_DATE	SEX	ADDRESS	JOB_ID	SALARY	MANAGER_ID	DEP_ID
E1001	John	Thomas	123456	1976-01-09	M	5631 Rice, OakPark,IL	100	100000	30001	2
E1002	Alice	James	123457	1972-07-31	F	980 Berry ln, Elgin,IL	200	80000	30002	5
E1003	Steve	Wells	123458	1980-08-10	M	291 Springs, Gary,IL	300	50000	30002	5

DEPARTMENTS:

DEPT_ID_DEP	DEP_NAME	MANAGER_ID	LOC_ID
5	Software Development	30002	L0002
7	Design Team	30003	L0003

① Suppose we want to retrieve only the employee records from the Employees for which a Department ID exists. We can use a _____ (3).

1. Multiple tables 3. sub-query
2. IN operator

①a The code retrieve employees from the Employees for which a Department ID exists is _____.

```
SELECT * FROM employees
WHERE DEP_ID IN
(SELECT DEPT_ID_DEP FROM departments);
```

② Suppose we want to retrieve only the list of employees from a specific location. Assume the employees table does not have location info, but the departments table has a column called Location_ID. A sample syntax would be _____.

```
SELECT * FROM tablename1 WHERE
column_1 IN
(SELECT column_1_table2 FROM tablename2
 WHERE predicate);
```

②a A sample code and the results for using two tables to refine a search using sub-queries is _____.

Query:

```
select * from employees where DEP_ID IN
    ( select DEPT_ID_DEP from departments where LOC_ID = 'L0002' );
```

Result:

EMP_ID	F_NAME	L_NAME	SSN	B_DATE	SEX	ADDRESS	JOB_ID	SALARY	MANAGER_ID	DEP_ID
E1002	Alice	James	123457	7/31/1972	F	980 Berry ln, Elgin,IL	200	80000	30002	5
E1003	Steve	Wells	123458	8/10/1980	M	291 Springs, Gary,IL	300	50000	30002	5
E1004	Santosh	Kumar	123459	7/20/1985	M	511 Aurora Av, Aurora,IL	400	60000	30004	5
E1010	Ann	Jacob	123415	3/30/1982	F	111 Britany Springs,Elgin,IL	220	70000	30004	5

③ Suppose we want to retrieve the department ID and department name for employees who earn more than $70k. We can get _____.

1. A sub-query on the Employees table to satisfy salary criteria
2. A matching department info by feeding 1. as input to an outer query on departments table

③a A sample code for retrieving department ID and department name for employees who earned more than $70k is _____.

```
SELECT DEPT_ID_DEP, DEP_NAME FROM departments
WHERE DEPT_ID_DEP IN
    (SELECT DEP_ID FROM employees
     WHERE SALARY > 70000);
```

Access Multiple Tables with Implicit Joins

① T/F An Implicit Join is done by specifying 2 tables in the FROM clause.

True

② The syntax for implicit join is _____.

```
SELECT * FROM
tablename1, tablename2;
```

③ T/F The result of an implicit join is a full join.

True

④ A full join is when _____ is joined with _____.

every row in the first table
every row in the second table

Operands to limit Implicit Join

① Suppose we want the result set with matching department ID. A sample code is _____.

```
SELECT * FROM employees, departments
WHERE employees.DEP_ID = departments.DEPT_ID_DEP;
```

Qualify Column Name

② To fully qualify the column name, we prefix the name of the column with the name of the _____.

table

③ T/F it is possible that different tables can have some column names that are exactly the same.

True

④ For table names that are long, you can use shorter _____.

alias

④a An example code for shorter alias is _____.

```
SELECT * FROM employees E, departments D
WHERE E.DEP_ID = D.DEPT_ID_DEP;
```

④b We can access multiple table name in these ways _____ (2).

1.
```
SELECT EMP_ID, DEP_NAME
FROM employees E, departments D
WHERE E.DEP_ID = D.DEPT_ID_DEP;
```
2.
```
SELECT E.EMP_ID, D.DEP_NAME
FROM employees E, departments D
WHERE E.DEP_ID = D.DEPT_ID_DEP;
```

Connecting Databases using Python

① T/F Python supports relational database systems.

True

② T/F Writing Python code to access database is made easier by the presence of the Python database API.

True.

③ The Python database API can be interchanged with _____.

DB-API

④ Some examples of notebook interfaces include _____ (8)

1. Mathematica notebook
2. Maple worksheet
3. Matlab notebook
4. iPython Jupyter
5. R Markdown
6. Apache Zeppelin
7. Apache Spark Notebook
8. Databricks iCloud

⑤ Some of the features of the Jupyter notebook include _____ (4).

1. Supports 40+ languages including Python, R, Julia, and Scala.
2. Jupyter notebook can be shared via email, Dropbox, GitHub, and Jupyter notebook viewer
3. Jupyter notebooks can produce images, videos, LaTex, and customized types.
4. Leverage big data tools such as Apache Spark from Python, R, Scala and explore data using pandas, scikit-learn, ggplot2, and TensorFlow.

Accessing databases using Python

① The Python code connects to the database using _____ API calls.

SQL API

① API stands for _____.

Application Programming Interface

② API is a _____

set of functions

③ You call API so that you can get _____

access to some type of service

④ SQL API consists of _____.

library function calls as an API for DBMS

⑤ An application program calls functions in API to _____.

pass SQL statements to DBMS

APIs used in SQL-based DBMS

① The applications or database and their respective SQL API are _____.

①a MySQL : _____ MySQL C API / Python

①b Postgre SQL : _____ Psycopg2

①c IBM DB2 : _____ ibm_db

①d SQL Server : _____ dblib API

①e Database access for Microsoft Windows OS : _____ ODBC

①f Oracle : _____ OCI

①g Java : _____ JDBC

①h MongoDB : _____ PyMongo

Why Code with DB-API?

① DB-API is _____.

Python's standard API for accessing relational databases

② DB-API allows a _____.

single program that work with multiple databases

③ DB-API allows for _____ (5)

1. Easy implementation and understanding
2. similarity between Python modules used to access databases
3. Consistency
4. portability across databases
5. broad reach of database connectivity from Python

Python DB API : 2 Objects

Connection & Query Objects

① Connection objects are used to _____ (2).

1. Connect to a database
2. manage your transactions.

② Cursor objects are used to _____ (3).

1. run queries
2. Scroll/Scan through result set.
3. Retrieve results

③ The DB-API includes a _____.

Connect Constructor.

④ The connect constructor is used for creating a connection to the _____.

database.

⑤ The connect constructor returns a _____.

Connection object

⑥ A connection object is then used by the _____.

various Connection methods

Connection Methods

① The connection methods used are _____ (4).

1. Cursor method
2. Commit method
3. rollback method
4. Close method

② The cursor method, .cursor(), returns a _____.

new cursor object using the connection

③ The commit method, .commit(), is used to commit _____.

any pending transcation to the database.

④ The rollback method, .rollback(), is used to roll back to _____.

the start of any pending transaction

⑤ The close method, .close(), is used to close _____.

a database connection.

Cursor Methods

① The cursor methods used are _____.

1. Callproc method .callproc()
2. execute method .execute()
3. executemany " " .executemany()
4. fetchone " " .fetchone()
5. fetchmany " " .fetchmany()
6. fetchall " " .fetchall()
7. nextset " " .nextset()
8. arraysize " " .arraysize()
9. close " " .close()

② An object is an instance of a _____.

class

③ A method is a _____ associated with a class or object.

function

④ T/F All methods are objects, but not all objects are methods.

True

⑤ The cursor methods are used to _____.

manage the content of a fetch operation

⑥ Cursors created from the same connection are _____.

linked.

⑦ T/F Any changes done to the database by a cursor are immediately visible by the other cursor.

True

⑧ A database cursor is a _____.

control structure.

⑨ A database cursor enables _____.

traversing over records in a database

⑩ A database cursor behaves like a _____ (2).

1. file name
2. file handle in a programming language

⑪ A program opens a file to access its contents. It opens a cursor to gain _____ access to the query results

⑫ A program closes a file to end its access. It closes a cursor to end access to the _____.

query result

⑬ A file handle keeps track of the program's current position. A cursor keeps track of the program's _____ within the query results.

current position

Syntax for using DB-API in Python

① You import the database module by using the _____.

connect API from that module

⑩ The syntax is _____.

```
from dbmodule import connect
```

② You open up the connection to the database by _____ (3).

1. using the connect constructor
2. pass in parameters
3. The connect constructor returns a connection object

③ The full cycle of writing code using DB-API is _____ (5, in order).

1. Importing database module
2. Create connection object
3. Create cursor object
4. run queries
5. free resources

④ The syntax for importing then creating connection object is _____.

```
from dbmodule import connect

Connection = connect(
        database="databasename",
        user="username",
        password="password")
```

⑤a You create the cursor object on the _____ object.

connection

⑤b The cursor object is used to _____ (2, in order).

1. run queries
2. fetch results

⑤c The syntax for running and fetching queries is _____.

```
Cursor.execute(
    SELECT * FROM tablename
results = Cursor.fetchall())
```

⑥ After the system is done running the queries, apply the _____

Close method

⑦ The close method is used to _____.

free all resources

⑧ The syntax to avoid unused cursor and connection from taking up resources is _____.

```
cursor.close()
connection.close()
```

Analyzing Data with Python

① Suppose we want to create a database table on an SQL server.

T/F We can use sqlite3.

True

② SQLite3 is an _____.

in process Python library

③ SQLite3 implements a _____.

1. self-contained
2. severless
3. zero configuration

transactional SQL database engine

Load CSV to SQLite3 with Panda

① The syntax for loading CSV to SQLite3 is _____.

```
import pandas as pd
import sqlite3
data = pd.read_csv('file_path.csv')
conn = sqlite.connect('databasename.db')
# e.g. conn = sqlite.connect('McDonalds.db')
data.to_sql('tablename', conn)
# e.g. data.to_sql('MCDONALDS_NUTRITION', conn)
```

Using Pandas to Retrieve Data from Database Tables

① T/F To load a table into a dataframe, you use the function pd.read_sql(). True

1a The syntax for loading a table into a dataframe is _____.

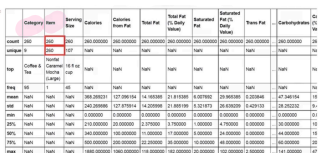
```
df = pd.read_sql(
    "SELECT * FROM tablename",
    conn)
print(df)
```

Learn About Data using Pandas:

Using Categorical Scatter Plots

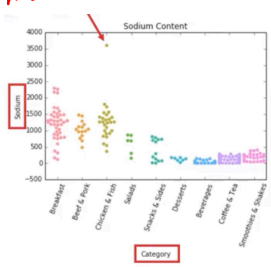
① T/F df.head() returns the first few rows of the dataframe.

② The df.describe(include='all') allows you to see statistics about each _____ of the table. column



③ A categorical scatterplot shows _____ for different items by category. the values

④ An example of a categorical scatterplot is _____.



4a A code for creating categorical scatterplots is _____.

```
1  import matplotlib.pyplot as plt
   %matplotlib inline
   import seaborn as sns
2  plot = sns.swarmplot(x="Category",
           y="Sodium", data=df)
   plt.setp(plot.get_xticklabels(), rotation=70)
   plt.title("Sodium Content")
   plt.show()
```

Basic Data Analysis

① To get the count, mean, std, min, quartile in the 25%, 50%, 75%, and max, we use the function _____.

describe()

② An example of using describe is _____.

```
In [17]: df['Sodium'].describe()
Out[17]: count     260.000000
         mean      495.750000
         std       577.026323
         min         0.000000
         25%       107.500000
         50%       190.000000
         75%       865.000000
         max      3600.000000
         Name: Sodium, dtype: float64
```

③ T/F The results shown from applying the describe() function is known as a summary of statistics. True.

Finding the ROW of the Max Value

① To find the row of the max value of a column, we can use the function _____. .idxmax()

② A code for finding the row with max value of a column is _____.

df['column_name'].idxmax().

③ T/F A way to find the item with the maximum value is through the at function. True

④ A code to find an associated column of the maximum value is _____.

```
row_max_value = df['column_name'].idxmax()
df.at[row_max_value, 'column_name_1']
```

4a An example code of the routine above is _____.

```
1   df['Sodium'].idxmax()
out 82
2   df.at[82,'Item']
out 'Chicken McNuggets (40 pieces)'
```

Data Exploration

① For initial data exploration, _____ is very useful. Visualization

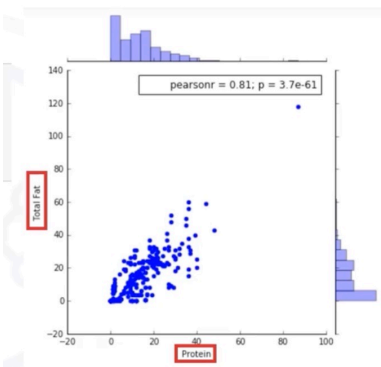
1a Visualizations are useful for _____. (3)
understanding
1. relationships
2. patterns, and
3. outliers
in the data.

Making Scatter Plots (with Seaborn)

① To make a scatter plot using seaborn, we can use the _____ function. jointplot

② A code for scatterplot is _____.

```
1  import matplotlib.pyplot as plt
   %matplotlib inline
   import seaborn as sns
2  plot = sns.jointplot(x="Protein", y="Total Fat", data=df)
   plot.show()
```



③ A correlation is _____. a measure

3a Correlation measures the _____. association between two variables

3b T/F correlation has a value between -1 and 1. True

3c On the top and to the right are _____. histograms

3d The top represents _____. protein

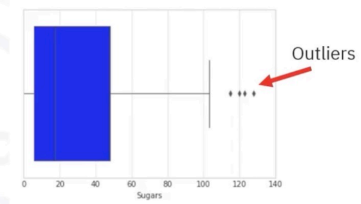
3e The right represents _____. Total fat

Box Plots

① To indicate the distribution of one or more variable, we can use _____. box plots

② A sample code for boxplot is _____.

```
1: import matplotlib.pyplot as plt
   %matplotlib inline
   import seaborn as sns
2: plot = sns.set_style("whitegrid")
   ax = sns.boxplot(x=df["Sugars"])
   plot.show()
```



Seaborn and Matplotlib

① Seaborn is _____. a python library

② Seaborn is used for _____. data visualization

③ Seaborn is built on top of _____. matplotlib

④ Matplotlib is a _____. python visualization library

CSV files

① T/F Many real data set are csv files. True

② CSV stands for _____. comma separated values

③ T/F CSV files are text files separated by a separator. That separator can be a semicolon too. True

④ T/F In many cases, the first row in the table contains attribute labels. True

⑤ The attribute labels map to _____. column names in a table

5a An example of the first row of csv file is _____.
Id, Name of Dog, Breed (dominant breed if not pure breed)
1, Wolfie, German Shepherd
2, Fluffy, Pomeranian
...

CSV Row Header

① T/F The header row contains the names of the attributes.
True

② Suppose you are using phpMyAdmin tool to load the data into databases. The steps to import into the database are _____ (2).
1. Browse file to import.
2. Select CSV from drop down for the format.

②a If the CSV has header, select the format to indicate that the first line contains the _____.
table column name

Indicating Column Names

① T/F To indicate a column name in SQL, it is often an accepted practice to use backticks around column name.
True

② T/F To indicate a column name in SQL, single and double quotes will not work.
True

Splitting queries to Multiple Lines (in Jupyter)

① To split the query into multiple lines, use the _____.
backslash "\"

② An example of splitting the query is _____.

```
%%sql SELECT Id, `Name of Dog`, \
      FROM dogs \
      WHERE `Name of Dog` = 'Huggy';
```

③ T/F If you do not use back slash in python to split queries into multiple lines, you may get an error.
True

④ T/F %%%sql enables the content of the cell to be interpreted as SQL code.
True

⑤ T/F you do not need backslashes to split queries in SQL code.
True

⑥ An example of splitting queries using SQL code is _____.

```
%%%sql
SELECT Id, `Name of Dog`,
      FROM dogs
      WHERE Name of Dog = 'Huggy';
```

Using Pandas to Query

① The steps to use pandas to execute SQL code are _____ (3).
1. Create query statement variable
2. Create connection variable
3. Apply read_sql

② An example of using pandas to query is _____.

```
query_statement = 'SELECT "Name of Dog" FROM dogs'
data = pandas.read_sql(query_statement,
       connection_variable)
```

③ In the case that the query already has a single quote, use _____.
the backslash

②a An example of correctly using backslash for query_statement is _____.

```
query_statement = 'SELECT * FROM
dogs WHERE "Name of Dog" = \'Huggy\''
```

④ Long queries include _____ (2).
1. Join query
2. sub queries

List the Tables in a Database

① T/F Database systems typically contain system or catalog tables from where you can query the list of tables and get their properties.
True

② A chart of DBMS and their catalog:

DBMS	catalog
DB2	SYSCAT.TABLES
SQL Server	information_schema.tables
SQLite3	sqlite_master
MySQL	Show TABLES

③ The query to get a list of tables and their properties in SQLite3 is _____.

```
SELECT name FROM sqlite_master
WHERE type = "table"
```

Getting Table Attributes

① Table attributes include _____.
column headers

② In SQLite3, you can get table attribute with _____.
PRAGMA table_info (tablename)

③ In MySQL, you can get table attribute with _____.
DESCRIBE table_name

View

① A view is an alternative way of representing _____.
data that exists in one or more tables or views

② A view can include all or some of the _____ from one or more base tables or existing views.

③ Creating a view creates a _____ of a result table.
named specification

④ The name specification from a view can be _____.
queried in the same way as a table

⑤ T/F you can change the data in the base table with insert, update, and delete queries against the view.
True

⑥ T/F Views are virtual tables and do not store data physically. Base table stores actual data physically in the database.
True

⑦ T/F The definition of the view is stored not the data.
True

When to use View

① Views can _____ (3).
1. Show a selection of data for a given table
2. Combine two or more tables in meaningful ways
3. simplify access to data

CREATE VIEW statement

① The syntax for using the CREATE VIEW statement is _____.

```
CREATE VIEW viewname column_alias_1,
column_alias_2, ..., column_alias_n
    AS SELECT column_1, column_2, ..., column_n
    FROM tablename
    WHERE predicate;
```

①a T/F Viewname can be up to 128 characters long.
True

①b column_alias_1, column_alias_2, ..., column_alias_n are the columns you _____ want to include

①c column_1, column_2, ..., column_n to specify the columns in the _____.
view

①d The tablename represents the _____ base table name

①e The WHERE clause refines the _____ rows in the view

② An example of using CREATE VIEW is _____.

```
CREATE VIEW EMPINFO (EMP_ID, FIRSTNAME,
LASTNAME, ADDRESS, JOB_ID, MANAGER_ID, DEP_ID)
AS SELECT EMP_ID, F_NAME, L_NAME, ADDRESS,
JOB_ID, MANAGER_ID, DEP_ID
FROM EMPLOYEES;
```

②a To get the view, the code is _____.

```
SELECT * FROM EMPINFO
```

②b An example of a code for view is _____.

```
CREATE VIEW EMPINFO (EMP_ID, FIRSTNAME,
LASTNAME, ADDRESS, JOB_ID, MANAGER_ID,
DEP_ID)
    AS SELECT EMP_ID, F_NAME, L_NAME, ADDRESS,
    JOB_ID, MANAGER_ID, DEP_ID
FROM EMPLOYEES
WHERE MANAGER_ID = '30002'
```

③ T/F The SELECT statement that is used to create the view can name other views and tables.
True

③a T/F The SELECT statement that is used to create the view can use the WHERE, GROUP BY, and HAVING clause.
True

③b T/F The SELECT statement that is used to create the view can not use ORDER BY or name a host variable.
True

④ To remove a view completely, you can use _____.

DROP VIEW viewname;

Stored Procedure

① A stored procedure is a _____.

set of SQL statements

② A stored procedure is _____.

stored and executed on the database server.

③ T/F Instead of sending multiple SQL statements from the client to server, the stored procedure on the server can send one statement from the client to execute them.

True

④ T/F You can write stored procedures in many different languages.

True (e.g PL, PL/SQL, Java, C, ...)

④ Stored procedures can accepe information in the form of _____.

parameters

④a T/F Stored procedures can also perform, create, read update and delete i.e. CRUD operations.

True

⑤ Stored procedures return results to the _____.

client

Benefits of Stored Procedures

① There is reduction in network traffic because _____.

only one call is needed to execute multiple statements

② There is improvement in performance because _____.

the processing happens on the server

②a The server is where the _____ is stored.

data

②b Only the final _____ is passed back to the client.

result

③ There is reuse of code and this is good because _____

multiple applications can use the same stored procedure for the same job

④ There is increase in security because _____. (2)

1. You do not need to expose all of your table and column info to client side developers
2. You can use server-side logic to validate data before accepting it into the system.

⑤ The syntax for creating stored procedure in SQL is _____.

```
DELIMITER $$
CREATE PROCEDURE procedure_name (
param_1, param_2, ..., param_n)
BEGIN
    SQL statement(s)
END
$$
DELIMETER ;
```

⑤a T/F The default delimeter to end the code for stored procedure is $$.

True

⑤b If you want to change back to SQL's default delimeter, you can write _____.

DELIMETER ;

⑤c T/F To write the stored procedure in a different language, you can _____. declare it

LANGUAGE plpgSQL;

⑤d PL/pgSQL is the native procedural language for _____.

PostgreSQL

⑤d To use stored procedure, you can use the _____. (2)

1. CALL statement
2. pass the required parameters

Transaction

① A transaction is a _____.

indivisible unit of work

② T/F A transaction can consist of one or more SQL statements.

True

③ A successful transaction means _____. (1 or the other)

1. All SQL statements are completed successful leaving database in new stable state, or
2. None must complete leaving the database as it was before the transaction

ACID Transactions

① ACID stands for _____.

Atomic
Consistent
Isolated
Durable

② Transactions are atomic because _____.

either all statements are successful or none are.

③ Transactions are consistent because _____.

data is consistently the same

④ Transactions are isolated because _____.

while the transaction is running, the data remains unchanged

⑤ Transactions are durable because _____.

once a change occurs by the transaction, they persist.

ACID commands

① To start an ACID transaction, you can use _____.

BEGIN command

①a T/F The BEGIN command is implicit, so you do not need to call it out explicitly.

True

② T/F The BEGIN command will persist until it hits a COMMIT or ROLLBACK command.

True

③ If all the statements are completed successfully, you can use the _____.

COMMIT command

④ The commit command lets you _____.

save everything in the database to a consistent stable state

⑤ If any of the commands fail, you can issue a _____.

ROLLBACK command

⑥ The ROLLBACK command lets you _____.

undo all the changes and leave the database in its previously consistent stable state.

Calling ACID commands

① T/F ACID commands can be called by Java, C, R, and Python.

True

①a If you call ACID commands by Java, C, R, or Python, you are required to use _____ database specific APIs or connectors

①b Examples of database specific APIs or connectors are _____. (2)

1. JDBC (Java Database Connectivity) for Java
2. (specific connector) ibm_db for Python

EXEC SQL

① Most languages use the EXEC SQL commands to initiate a _____.

SQL command

①a Some SQL commands include _____. (2)

1. COMMIT
2. ROLLBACK

ERROR checking

① An example of incorporating error checking is _____.

```
Void main()
{
    EXEC SQL UPDATE ... ;
    EXEC SQL UPDATE ... ;
    FINISHED:
    EXEC SQL COMMIT WORK;
    return;
SQLERR:
    EXEC SQL WHENEVER SQLERROR CONTINUE;
    EXEC SQL ROLLBACK WORK;
    return;
}
```

JOIN Operator

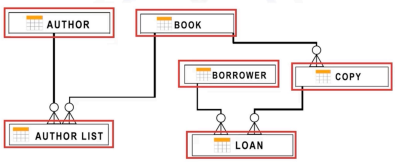
① The JOIN operator combines _____.

rows from two or more tables

② The JOIN operator combines rows from two or more tables based on _____.

a relationship between certain columns in these tables

③ Assume you have the following ER-Diagram. Suppose you want to which borrower has which copy of a book out on a loan.



We will need tables _____. (3)

Borrower, Copy, loan

④ The first step to use the JOIN operator is to identify the relationship between _____.

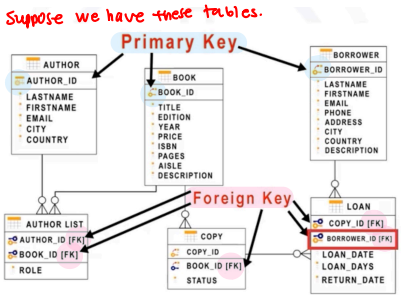
these tables

⑤ The relationship between tables is defined as _____.

the column(s) that will be used to link the tables together

ER Diagram with Primary + Foreign keys

Suppose we have these tables.



① The primary key uniquely identifies each _____.

row in a table

② FK stands for _____.

foreign keys

③ A foreign key is a _____.

set of columns refering to a primary key of another entity

④ T/F The loan entity has the borrower ID attribute.

True

⑤ T/F The borrower_ID attribute is the foreign key in the loan entity.

True

⑥ Foreign key refers to a _____.

primary key of another table

⑦ T/F The Borrower-ID attribute in the loan entity refers to the primary key for the borrower entity.

True

Joining Three or More Tables

① Suppose we want to find out which borrower has a book out on loan.

We will need tables _____. (2)

borrower and loan

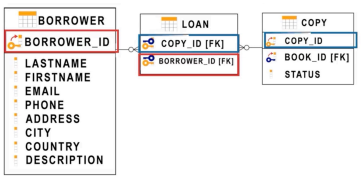
② To join the table, you will need _____.

borrower_ID from both tables

③ To join multiple tables, you can join _____.

two tables at a time

④ An example of joining multiple tables is the following _____.



1. Join Borrower and loan with Borrower_ID
2. Join 1. and Copy table with Copy_ID.

Types of Joins

① T/F You can extract a data set up to the point of selecting the combination of all the data from these two tables.

True

② The inner join displays only _____.

the rows from two tables that have matching value in a common column

②a The common column is usually the primary key of one table that exits as a _____.

foreign key in the second table

③ The outer join returns the _____. (2)

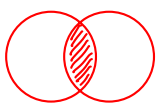
1. matching rows
2. rows from one table that don't match

④ T/F There are also left outer join and right outer join to refine result set.

True

Inner Join

① The diagram for inner join is _____.



② The syntax for inner join would be _____.

```
SELECT  Alias_table_1.column_1,
        Alias_table_1.column_2,
        ...
        Alias_table_1.column_n,
        Alias_table_2.column_1,
        Alias_table_2.column_2,
        Alias_table_2.column_n

FROM    table_1 Alias_table_1
        INNER JOIN  table_2  Alias_table_2

ON      Alias_table_1.join_column = Alias_table_2.join_column
```

②a Suppose we want to apply inner to Borrower and Loan entity.

The code would be _____.

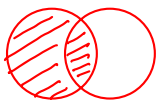
```
SELECT B.BORROWER_ID, B.LASTNAME, B.COUNTRY,
       L.BORROWER_ID, L.LOAN_DATE
FROM BORROWER B  INNER JOIN LOAN L
  ON B.BORROWER_ID = L.BORROWER_ID
```

Outer Joins: LEFT JOIN, RIGHT JOIN, FULL JOIN

① T/F SQL offers three types of outer joins: left outer join, right outer join, and full. True

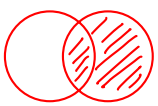
② In a left outer join, all rows from the left table and _____.

any matching rows from the right table



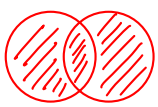
③ In a right outer join, all the rows from the right table and _____.

any matching rows from the left table



④ A full join returns all rows from _____.

both tables



⑤ The syntax for outer join is _____.

```
SELECT  Alias_table_1.column_1,
        Alias_table_1.column_2,
        ...
        Alias_table_1.column_n,
        Alias_table_2.column_1,
        Alias_table_2.column_2,
        Alias_table_2.column_n

FROM    table_1 Alias_table_1
        LEFT_JOIN   table_2  Alias_table_2

ON      Alias_table_1.join_column = Alias_table_2.join_column
```

⑥ If there are no matching rows for the table, you will get _____.

null value(s)