

Tutorial

Levin Noronha

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Introduction

- TAs
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- Tutorials time
 - (T01) Tues 1:30pm - 2:20pm ETB 238
 - (T02) Mon 12:30pm - 1:20pm ETB 235
 - (T03) Wed 11:30am - 12:20pm ETB 235

Tutorial Agenda

- Relational Model and Keys
- Connect to DB2 servers and troubleshooting

Relational Model

- A model for representing data as relations (i.e., tables)
- **Relational database** is a collection of relations (or tables)

Relation

- **Relation schema** specifies the table name, name of all attributes, and the domain of each attribute
 - Students(*sid*: integer, *name*: string, *login*: string, *age*: integer, *gpa*: real)
- **Relation instance** (or simply **relation**) is a table

<i>sid</i>	<i>name</i>	<i>login</i>	<i>age</i>	<i>gpa</i>
50000	Dave	dave@cs	19	3.2
53666	Jones	jones@cs	18	3.3
53688	Smith	smith@ee	18	3.2
53650	Smith	smith@math	19	3.7
53831	Madayan	madayan@music	11	1.8
53832	Guldu	guldu@music	12	2.0

Definitions

- A **table** (or **relation**) consists of rows and columns.
- **Columns**, also known as **fields** and **attributes**, represent basic data components.
- **Rows**, also known as **tuples** or **records**, are a set of related attributes.

<i>sid</i>	<i>name</i>	<i>login</i>	<i>age</i>	<i>gpa</i>
50000	Dave	dave@cs	19	3.2
53666	Jones	jones@cs	18	3.3
53688	Smith	smith@ee	18	3.2
53650	Smith	smith@math	19	3.7
53831	Madayan	madayan@music	11	1.8
53832	Guldu	guldu@music	12	2.0

Keys

- Superkey: A set of attributes K is a superkey for a relation R if R cannot contain two distinct tuples t_1 and t_2 such that $t_1[K] = t_2[K]$
 - If K is a superkey, then so is any superset of K

Example

<i>sid</i>	<i>name</i>	<i>login</i>	<i>age</i>	<i>gpa</i>
50000	Dave	dave@cs	19	3.2
53666	Jones	jones@cs	18	3.3
53688	Smith	smith@ee	18	3.2
53650	Smith	smith@math	19	3.7
53831	Madayan	madayan@music	11	1.8
53832	Guldu	guldu@music	12	2.0

- Superkeys:
 - {name, age}
 - {login}
 - {name, login}
 - {sid}
 - {sid, name, login, age, gpa}
 - etc...

Keys

- Superkey: A set of attributes K is a superkey for a relation R if R cannot contain two distinct tuples t_1 and t_2 such that $t_1[K] = t_2[K]$
 - If K is a superkey, then so is any superset of K
- Candidate Key: K is a candidate key for R if K is a minimal superkey

Example

<i>sid</i>	<i>name</i>	<i>login</i>	<i>age</i>	<i>gpa</i>
50000	Dave	dave@cs	19	3.2
53666	Jones	jones@cs	18	3.3
53688	Smith	smith@ee	18	3.2
53650	Smith	smith@math	19	3.7
53831	Madayan	madayan@music	11	1.8
53832	Guldu	guldu@music	12	2.0

- Superkeys:

- {name, age}
- {login}
- {name, login}
- {sid}
- {sid, name, login, age, gpa}
- etc...

- Candidate keys:

- {login}
- {sid}
- {name, age}*
• {age, gpa}*

* Enforcing the highlighted keys might prevent the addition of new student tuples to the table. For e.g., {age, gpa} would enforce that two students can have the same age or gpa, but not both!

Keys

- Superkey: A set of attributes K is a superkey for a relation R if R cannot contain two distinct tuples t_1 and t_2 such that $t_1[K] = t_2[K]$
 - If K is a superkey, then so is any superset of K
- Candidate Key: K is a candidate key for R if K is a minimal superkey
- Primary Key: One candidate key that is chosen by the database designer as the principal means of identifying tuples within a relation
 - Only one candidate key can be primary key

Example

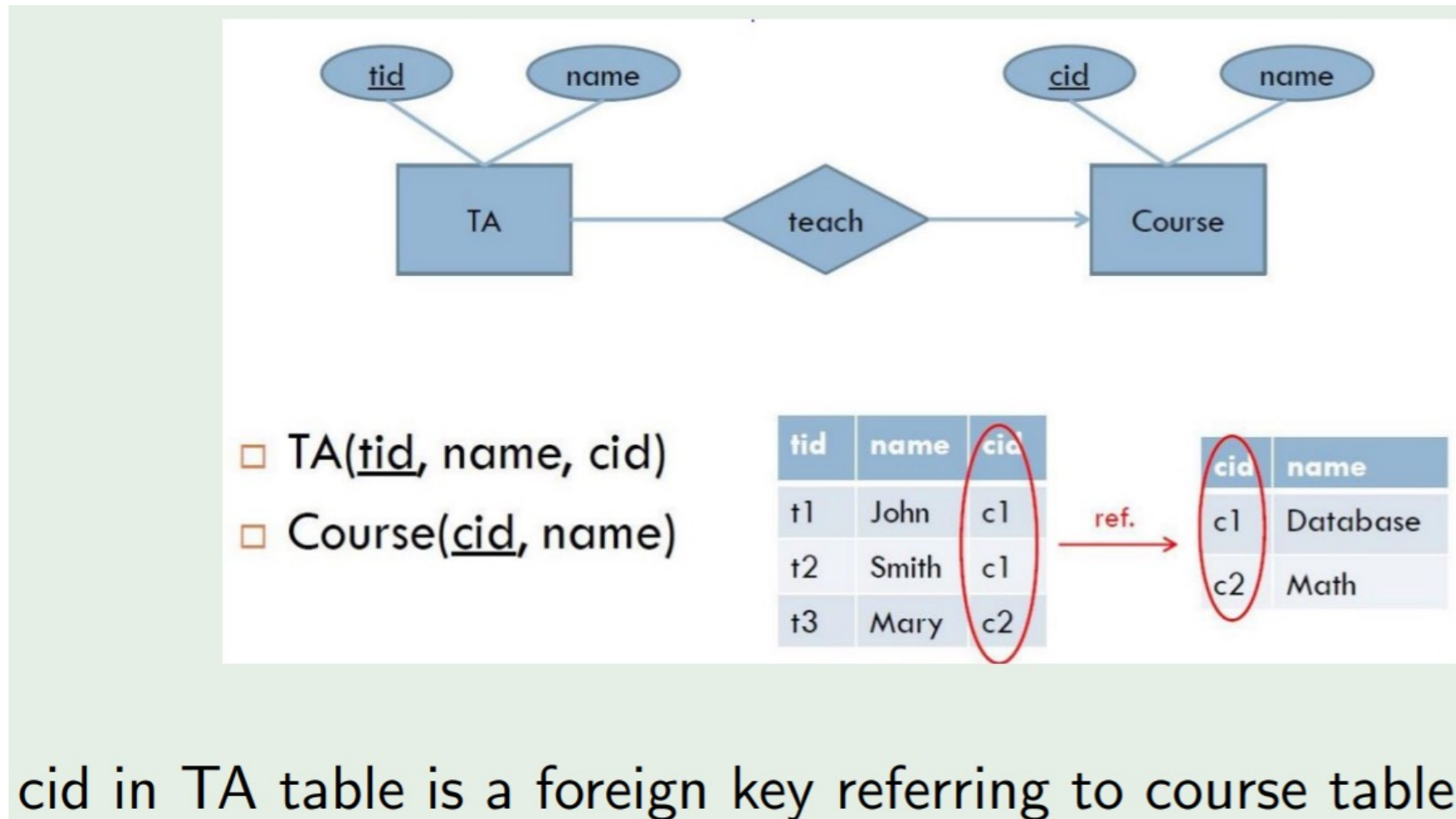
<i>sid</i>	<i>name</i>	<i>login</i>	<i>age</i>	<i>gpa</i>
50000	Dave	dave@cs	19	3.2
53666	Jones	jones@cs	18	3.3
53688	Smith	smith@ee	18	3.2
53650	Smith	smith@math	19	3.7
53831	Madayan	madayan@music	11	1.8
53832	Guldu	guldu@music	12	2.0

- Superkeys:
 - {name, age}
 - {login}
 - {name, login}
 - {sid}
 - {sid, name, login, age, gpa}
 - etc...
- Candidate keys:
 - {login}
 - {sid}
 - {name, age}
 - {age, gpa}
- Primary keys:
 - {sid}

Keys

- **Super key:** A set of attributes K is a super key for a relation R if it can uniquely identify a tuple, i.e., R cannot contain two distinct tuples t_1 and t_2 such that $t_1[K] = t_2[K]$
 - If K is a super key, then so is any superset of K
- **Candidate Key:** K is a candidate key for R if K is a minimal super key, i.e., no attributes can be removed from K without losing the unique identification property.
- **Primary Key:** One candidate key that is chosen by the database designer as the principal means of identifying tuples within a relation
 - Only one candidate key can be the primary key
- **Foreign Key:** A foreign key requires that the values on a set X of attributes of a relation R_1 must appear as values of the primary key of another relation R_2

Example



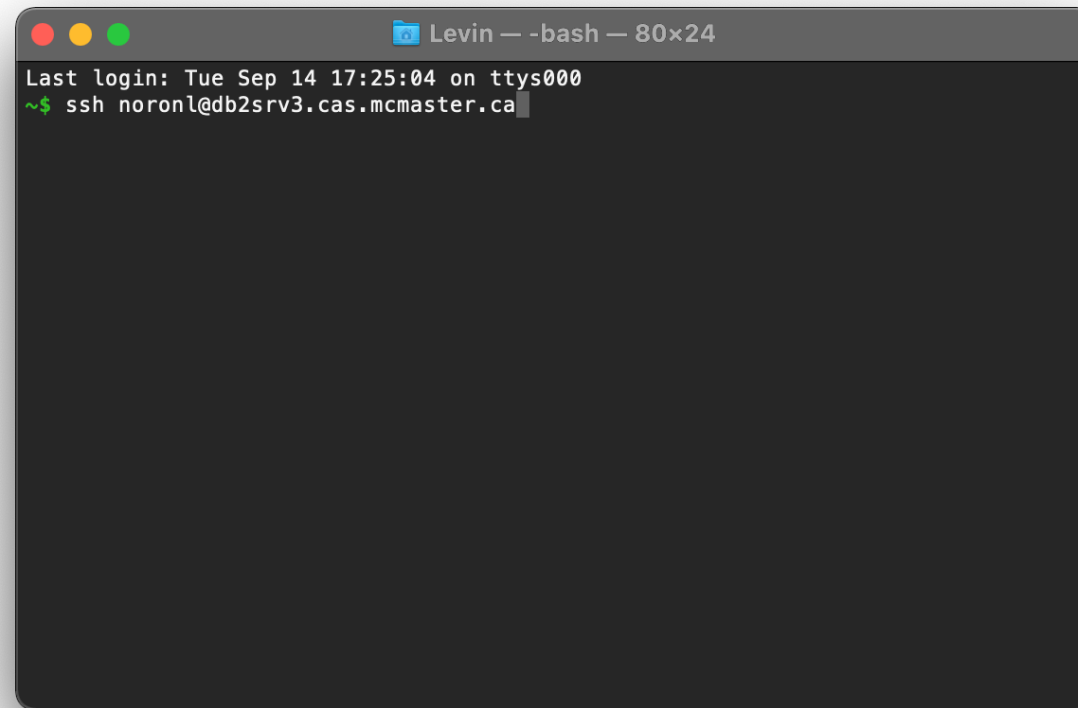
Environment setup

- Department DB2 server
 - db2srv3.cas.mcmaster.ca
- To access db2srv3, you must either:
 - a) Use the McMaster VPN, or
 - b) SSH to mills.mcmaster.ca first, then SSH to a DB2 server

How to connect to db2srv3.cas.mcmaster.ca

- Windows: use PuTTY, Xshell or another SSH client.
- macOS/Linux: In a bash terminal, type:
 - `ssh <macid>@db2srv3.cas.mcmaster.ca`

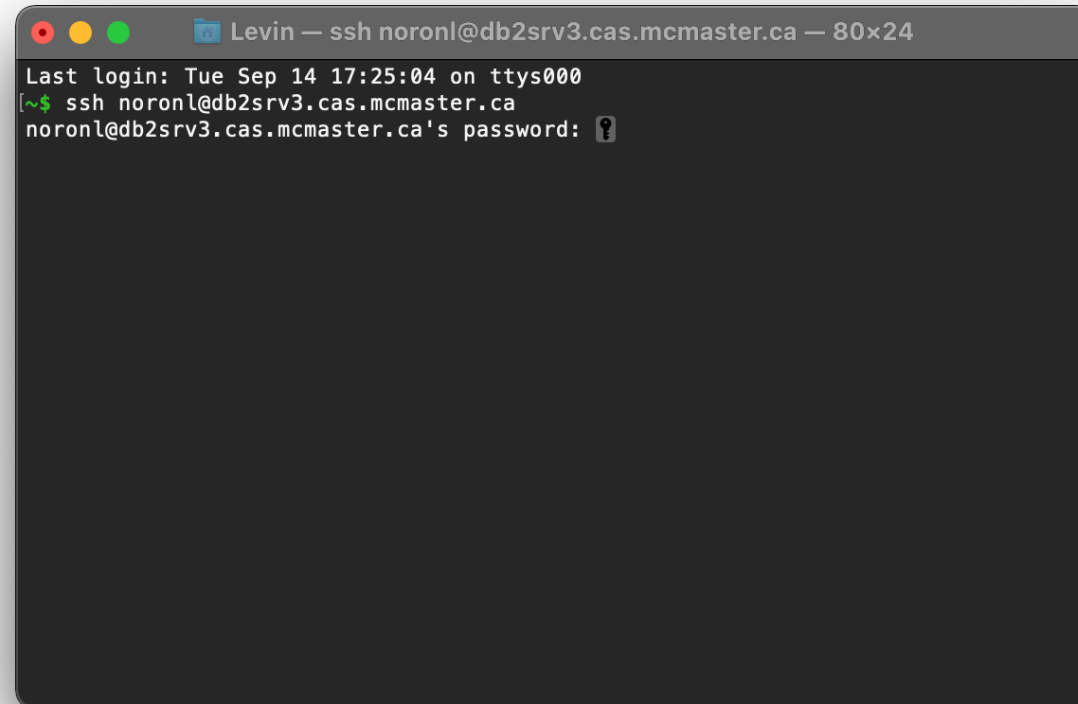
Bash example (macOS, Linux)



A screenshot of a terminal window on a macOS system. The window title bar shows 'Levin — -bash — 80x24'. The terminal content displays the last login information: 'Last login: Tue Sep 14 17:25:04 on ttys000'. Below this, the prompt '~\$' is followed by the command 'ssh noronl@db2srv3.cas.mcmaster.ca' which has been entered but not yet executed, as indicated by the cursor at the end of the line.

```
Levin — -bash — 80x24
Last login: Tue Sep 14 17:25:04 on ttys000
~$ ssh noronl@db2srv3.cas.mcmaster.ca
```

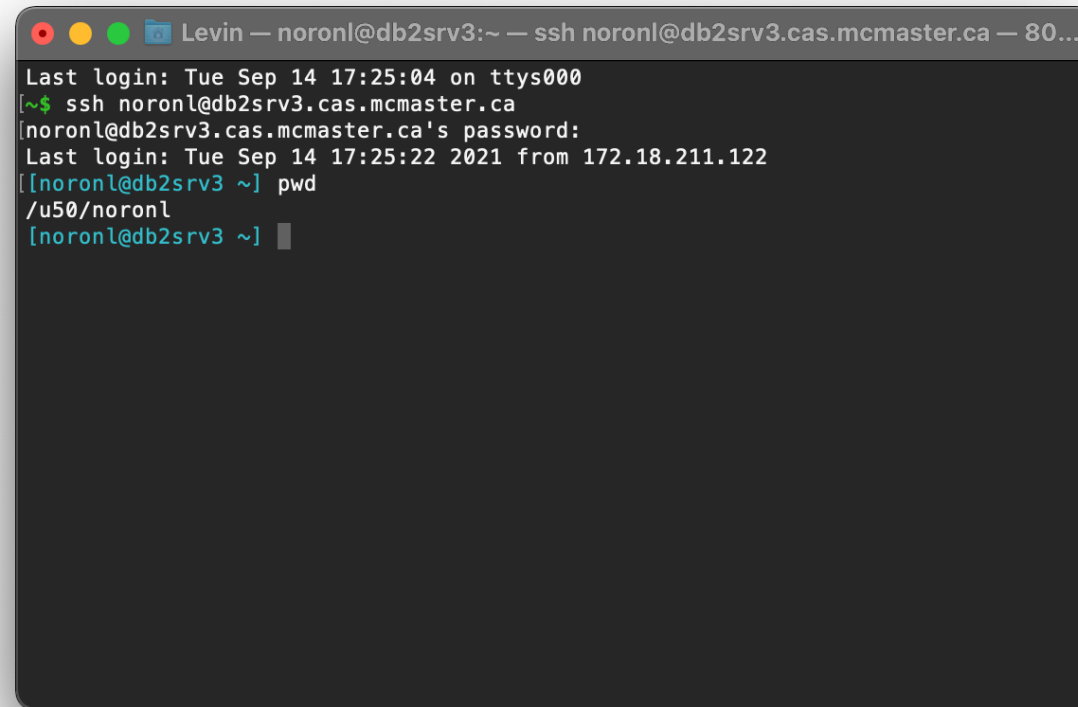
Bash example (macOS, Linux)

A terminal window with a dark background and light text. The title bar at the top reads "Levin — ssh noronl@db2srv3.cas.mcmaster.ca — 80x24". The terminal content shows a login sequence: "Last login: Tue Sep 14 17:25:04 on ttys000", followed by a prompt "[~]\$ ssh noronl@db2srv3.cas.mcmaster.ca" and the response "noronl@db2srv3.cas.mcmaster.ca's password: " with a cursor icon.

```
Levin — ssh noronl@db2srv3.cas.mcmaster.ca — 80x24
Last login: Tue Sep 14 17:25:04 on ttys000
[~]$ ssh noronl@db2srv3.cas.mcmaster.ca
noronl@db2srv3.cas.mcmaster.ca's password: 
```

In most cases, your CAS account password should be the same as your macOS password.

Bash example (macOS, Linux)

A terminal window with a dark background and light text. The window title bar shows 'Levin — noronl@db2srv3:~ — ssh noronl@db2srv3.cas.mcmaster.ca — 80...'. The terminal content shows a successful SSH login session. The user 'noronl' has logged in from '172.18.211.122'. The prompt is '[noronl@db2srv3 ~]'. The user has entered the command 'pwd', and the output is '/u50/noronl'.

```
Levin — noronl@db2srv3:~ — ssh noronl@db2srv3.cas.mcmaster.ca — 80...
Last login: Tue Sep 14 17:25:04 on ttys000
[~$ ssh noronl@db2srv3.cas.mcmaster.ca
noronl@db2srv3.cas.mcmaster.ca's password:
Last login: Tue Sep 14 17:25:22 2021 from 172.18.211.122
[noronl@db2srv3 ~] pwd
/u50/noronl
[noronl@db2srv3 ~]
```

IMPORTANT: Verify that you have a home directory (/u50/<macID>) on the DB2 server using command “pwd”

Troubleshooting

- If you have any login problems with your CAS account
 - 1) Follow the instructions on <https://www.cas.mcmaster.ca/account/>
 - 2) If 1) doesn't resolve the problem, please contact the TAs
- All login problems should be fixed before Sept. 22
 - Otherwise, you will not be able to complete the assignments

Change your CAS password

- Your new password must be at least 8 characters long and contain at least one letter and one digit.
- You will receive an e-mail confirming the password change.
- If you don't know your CAS password, you can use your MacID to authenticate and reset CAS account here: <https://www.cas.mcmaster.ca/reset>

Username:

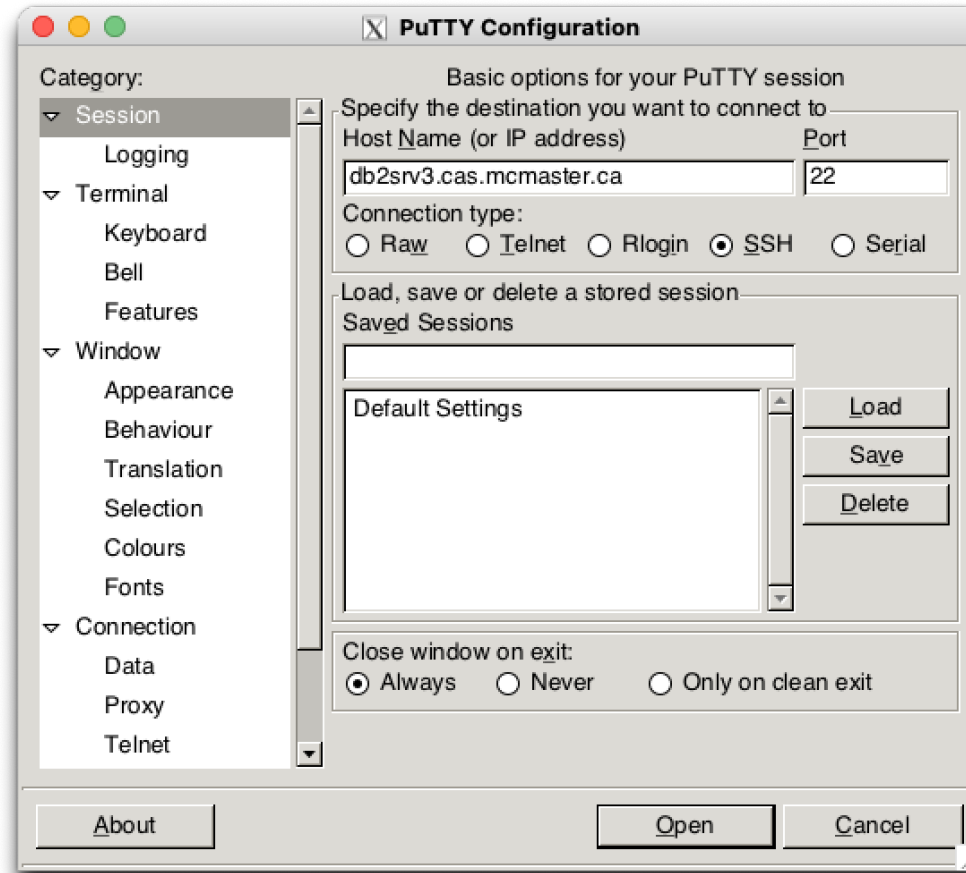
Old password:

New password:

New password (confirm):

Change Password

PuTTY example (Windows)



PuTTY example (Windows)



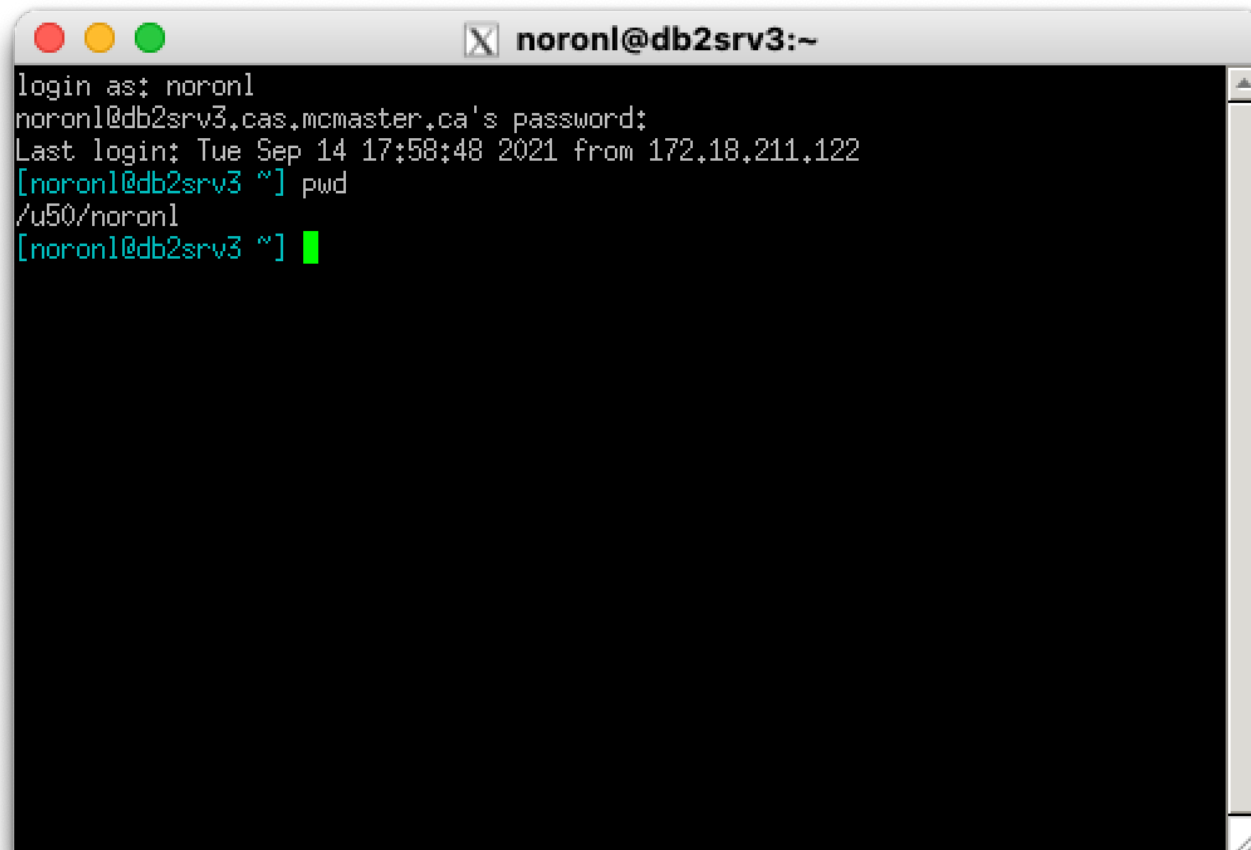
In most cases, your CAS account password should be the same as your macOS password.

PuTTY example (Windows)



In most cases, your CAS account password should be the same as your macOS password.

PuTTY example (Windows)



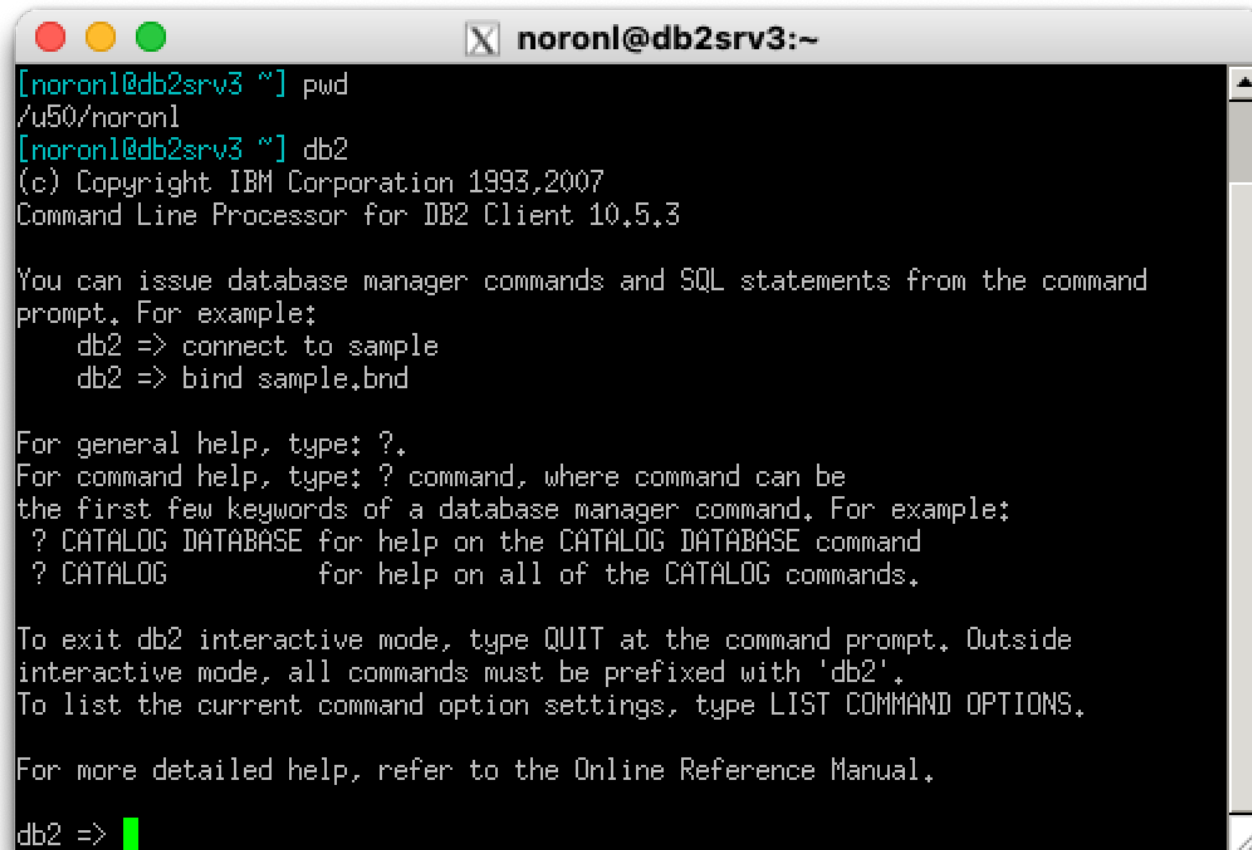
```
login as: noronl
noronl@db2srv3.cas.mcmaster.ca's password:
Last login: Tue Sep 14 17:58:48 2021 from 172.18.211.122
[noronl@db2srv3 ~] pwd
/u50/noronl
[noronl@db2srv3 ~] █
```

IMPORTANT: Verify that you have a home directory (/u50/<macID>) on the DB2 server using command “pwd”

Basic Commands

- Start application by typing “db2”

Example

A terminal window titled 'noronl@db2srv3:~' with standard macOS window controls (red, yellow, green buttons). The terminal shows the execution of 'pwd' and 'db2' commands. The 'db2' command outputs copyright information and a list of example commands. It then displays help text for '?', '? command', and '? CATALOG'. Finally, it shows instructions on how to exit and list command options, ending with a prompt 'db2 =>' followed by a green cursor.

```
[noronl@db2srv3 ~] pwd
/u50/noronl
[noronl@db2srv3 ~] db2
(c) Copyright IBM Corporation 1993,2007
Command Line Processor for DB2 Client 10.5.3

You can issue database manager commands and SQL statements from the command
prompt. For example:
    db2 => connect to sample
    db2 => bind sample.bnd

For general help, type: ?.
For command help, type: ? command, where command can be
the first few keywords of a database manager command. For example:
    ? CATALOG DATABASE for help on the CATALOG DATABASE command
    ? CATALOG           for help on all of the CATALOG commands.

To exit db2 interactive mode, type QUIT at the command prompt. Outside
interactive mode, all commands must be prefixed with 'db2'.
To list the current command option settings, type LIST COMMAND OPTIONS.

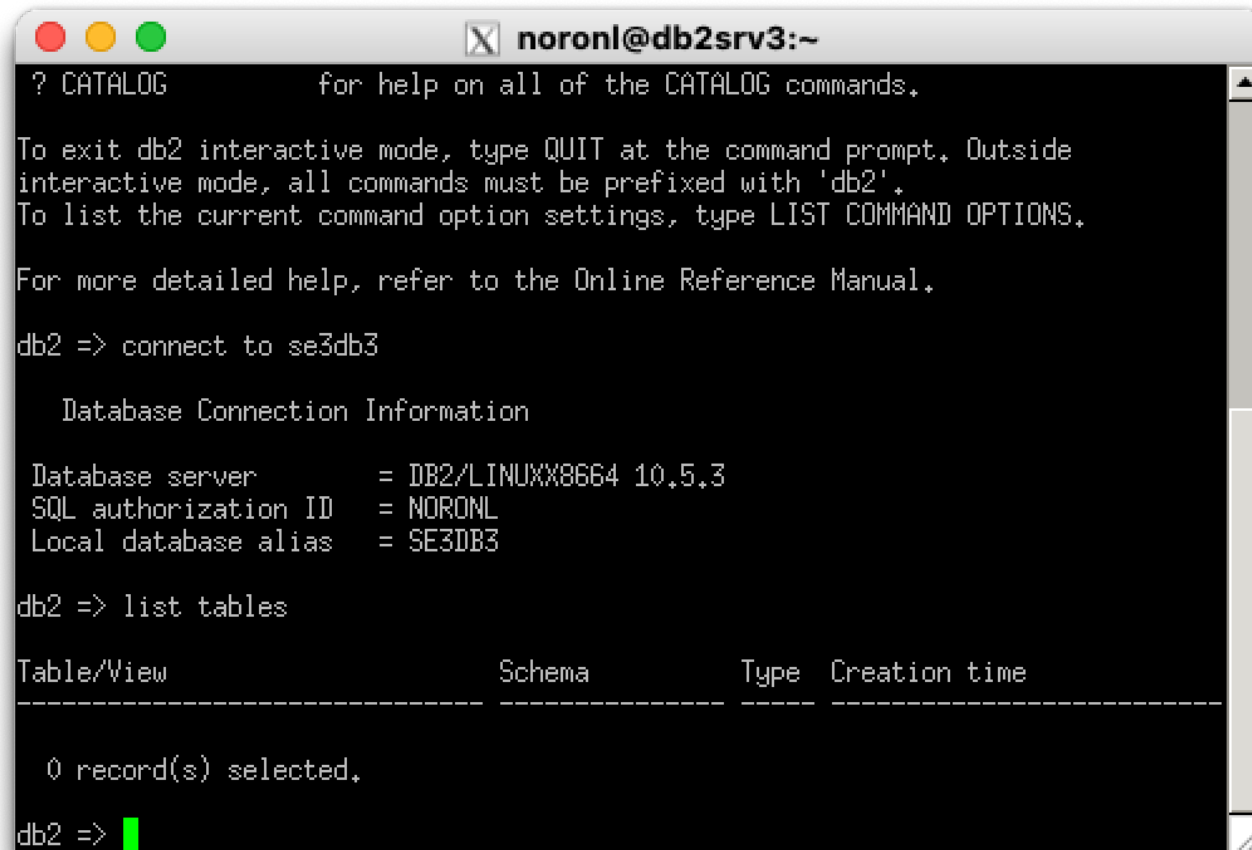
For more detailed help, refer to the Online Reference Manual.

db2 => █
```

Basic Commands

- Write a comment: - - this is a comment
- Make a connection to database: connect to se3db3
- List tables: list tables

Example



```
noronl@db2srv3:~  
? CATALOG          for help on all of the CATALOG commands.  
  
To exit db2 interactive mode, type QUIT at the command prompt. Outside  
interactive mode, all commands must be prefixed with 'db2'.  
To list the current command option settings, type LIST COMMAND OPTIONS.  
  
For more detailed help, refer to the Online Reference Manual.  
  
db2 => connect to se3db3  
  
      Database Connection Information  
  
Database server      = DB2/LINUX8664 10.5.3  
SQL authorization ID = NORONL  
Local database alias = SE3DB3  
  
db2 => list tables  
  
Table/View          Schema      Type      Creation time  
-----  
  
0 record(s) selected.  
  
db2 => █
```

Upload script

- Windows: use WinSCP client if you use Putty; use Xftp client if you use Xshell.
- macOS, Linux: use scp command
 - For e.g., `scp <files_src_path> <macid>@mills.mcmaster.ca:<dest_path >`
 - `scp /Users/script.ddl <macid>@db2srv3.mcmaster.ca:/u50/path/`
- Run your script in server
 - `db2 -tnf script.ddl`