Tutorial

Levin Noronha

Sep 13, 2021

Slides by: Zheng Zheng
Modified by: Levin Noronha

Introduction

- TAs
  - Morteza Alipour Langouri
    - Email: alipoum@mcmaster.ca
    - Office hours: Fri 2:00pm – 3pm on MS Teams
  - Levin Noronha
    - Email: noronl@mcmaster.ca
    - Office hours: Thurs 2:30pm – 3:30pm on MS Teams
  - Lucia Cristiano
    - Email: cristial@mcmaster.ca
    - Office hours: Tue 3:00pm – 4:00pm on MS Teams
- 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

sid	*name*	*login*	*age*	*gpa*
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.

sid	*name*	*login*	*age*	*gpa*
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

sid	*name*	*login*	*age*	*gpa*
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

sid	*name*	*login*	*age*	*gpa*
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

sid	*name*	*login*	*age*	*gpa*
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

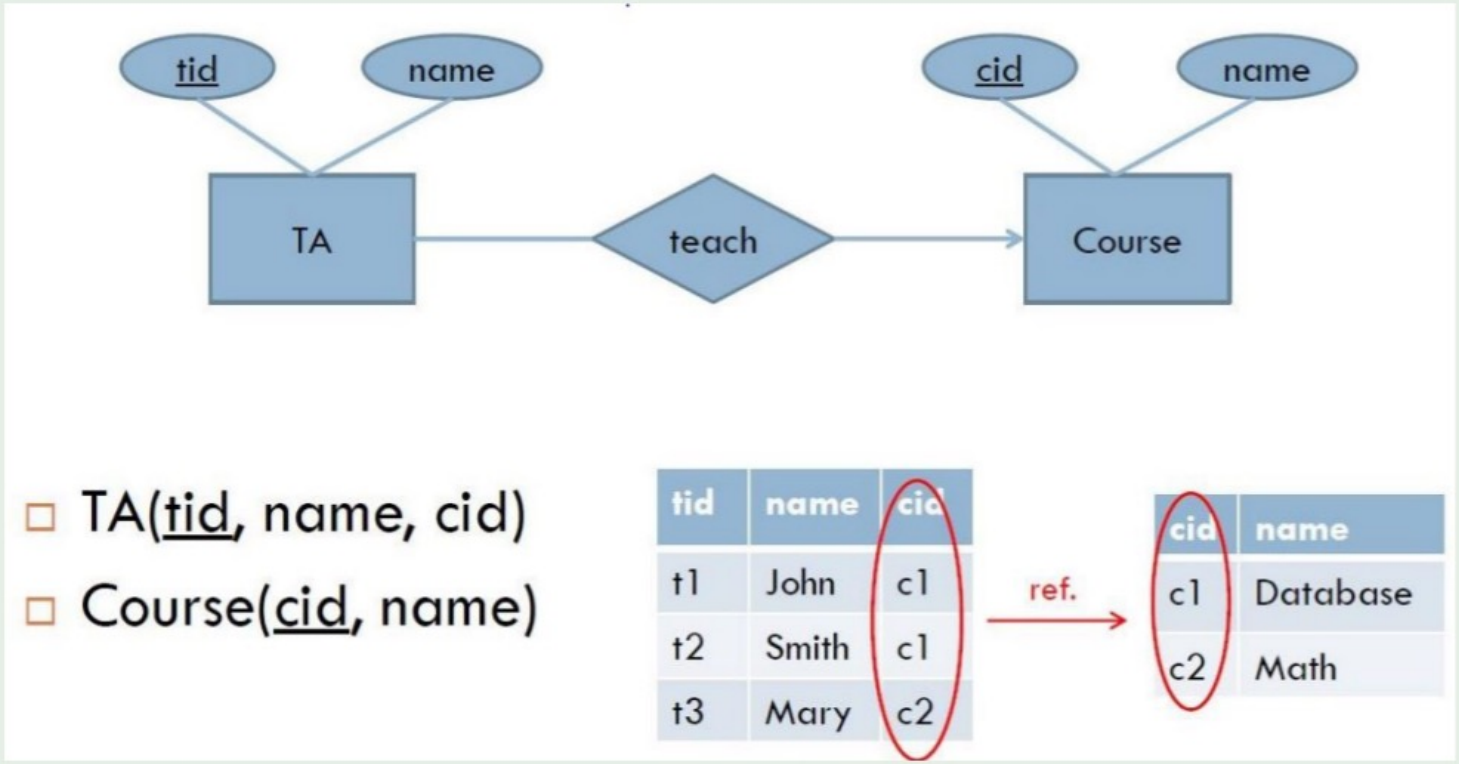
- **Super key**: A set of attributes K is a super key for a relation R if it can uniquely identify a tuple, i.e., R cannot contain two distinct tuples t_1 and t_2 such that t_1[K] = t_2[K]
  - If K is a super key, then so is any superset of K

- **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



- TA(tid, name, cid)
- Course(cid, name)

tid	name	cid
t1	John	c1
t2	Smith	c1
t3	Mary	c2

ref.

cid	name
c1	Database
c2	Math

cid in TA table is a foreign key referring to course table

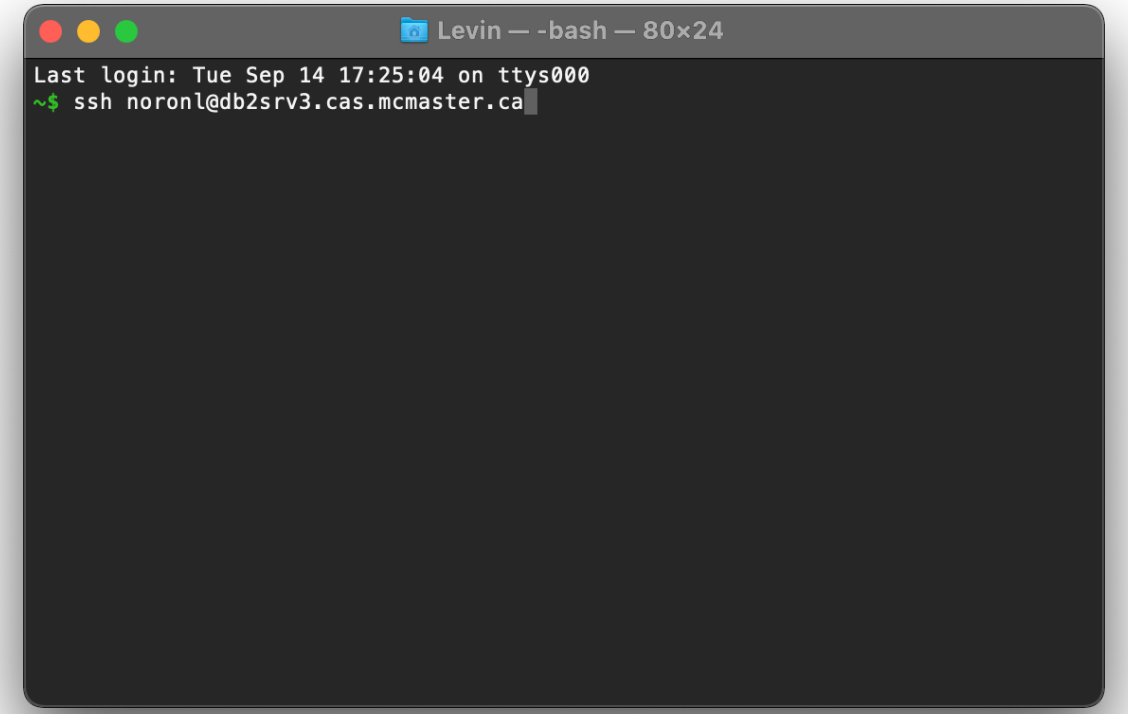
Environment setup

- 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

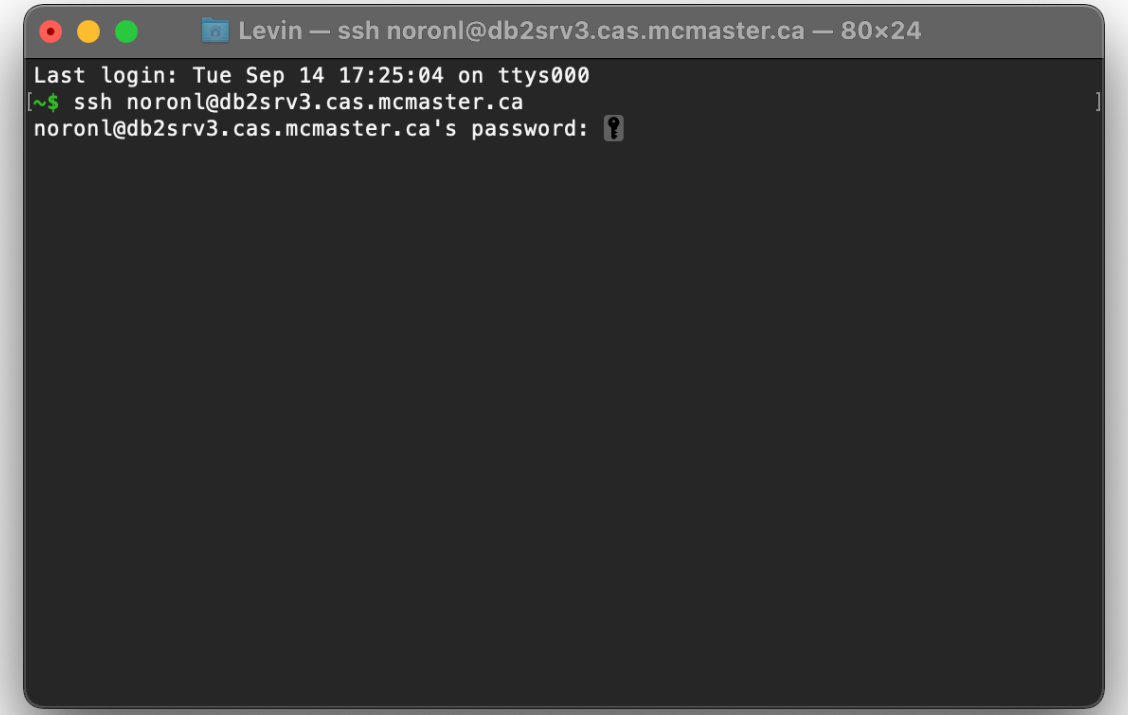
How to connect to db2srv3.cas.mcmaster.ca

- 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)

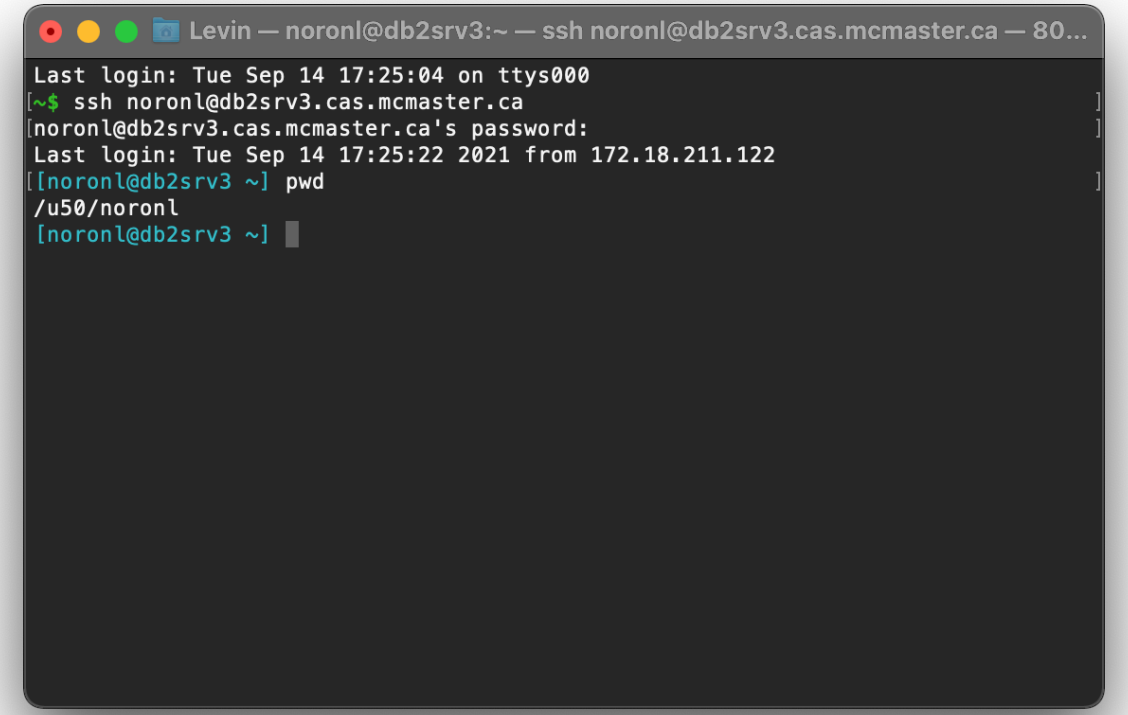


Bash example (macOS, Linux)



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

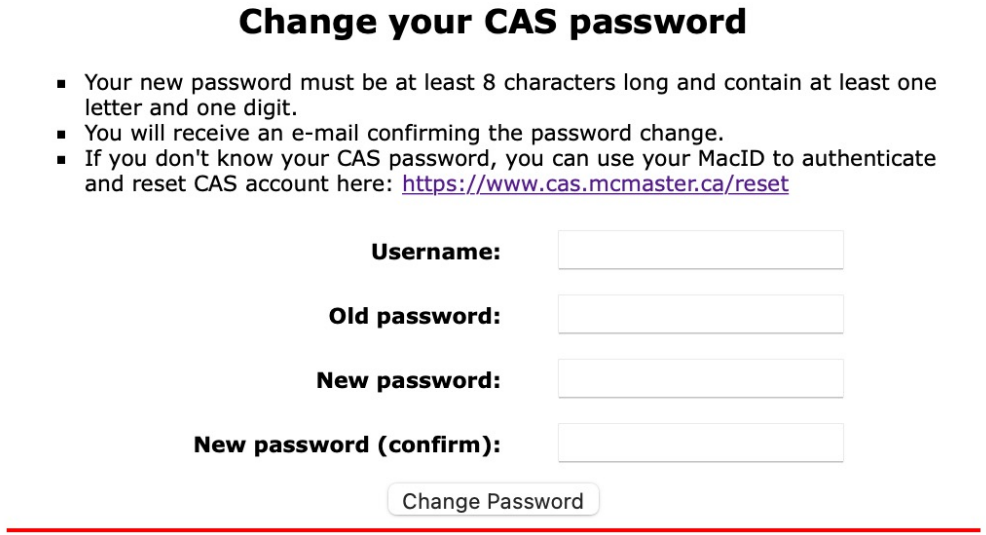
Bash example (macOS, Linux)



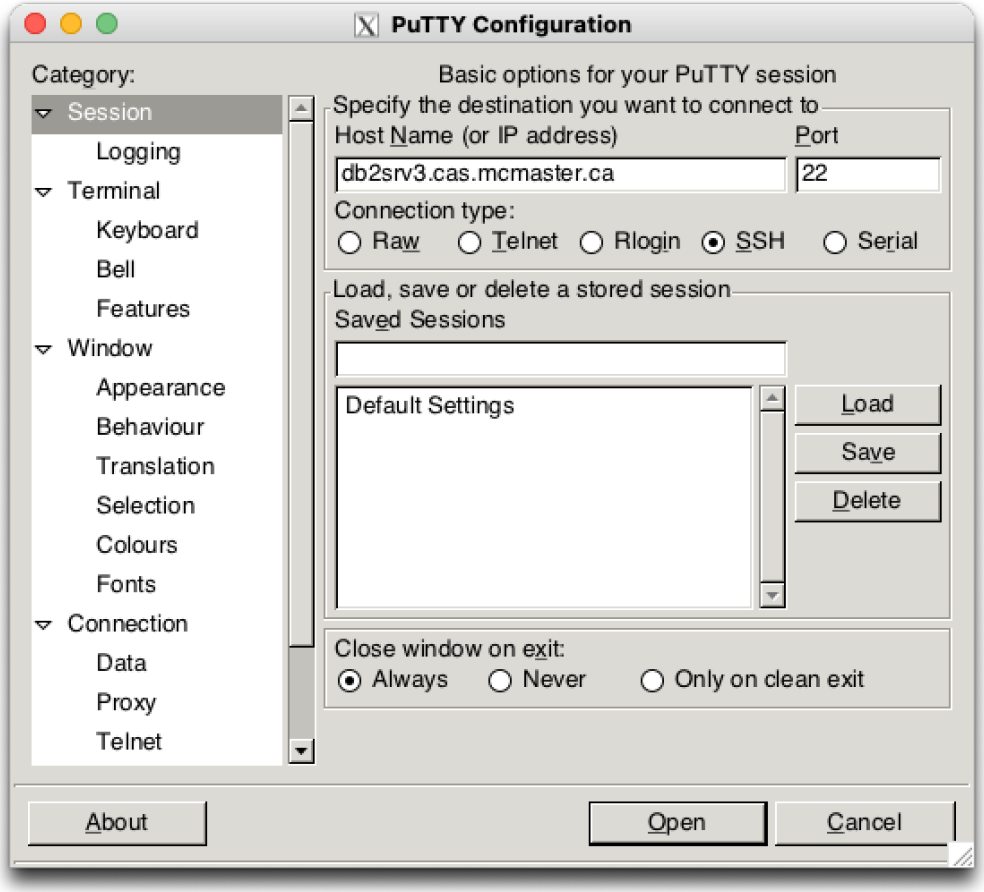
IMPORTANT: Verify that you have a home directory (/u50/<macID>) on the DB2 server using command “pwd”

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



PuTTY example (Windows)



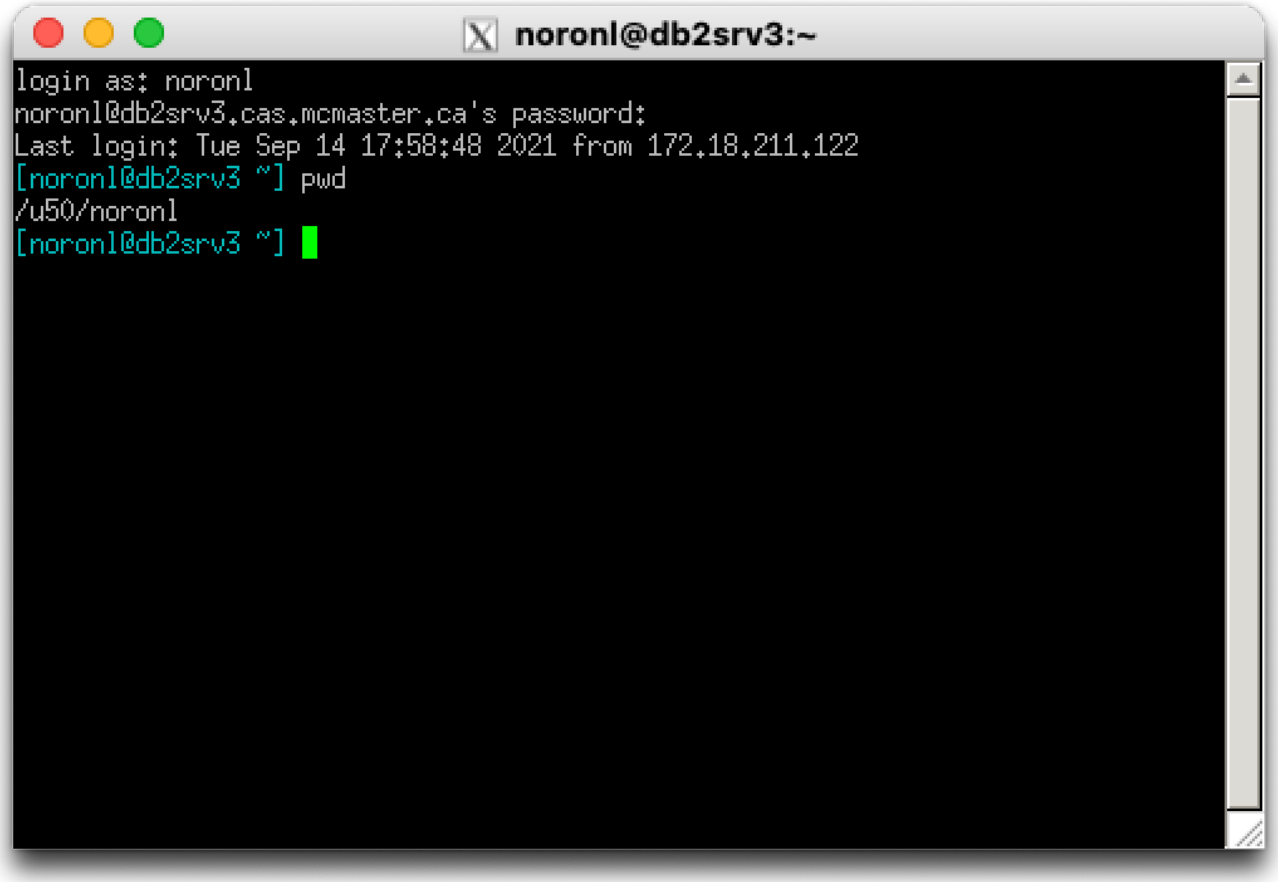
PuTTY example (Windows)

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

PuTTY example (Windows)

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

PuTTY example (Windows)

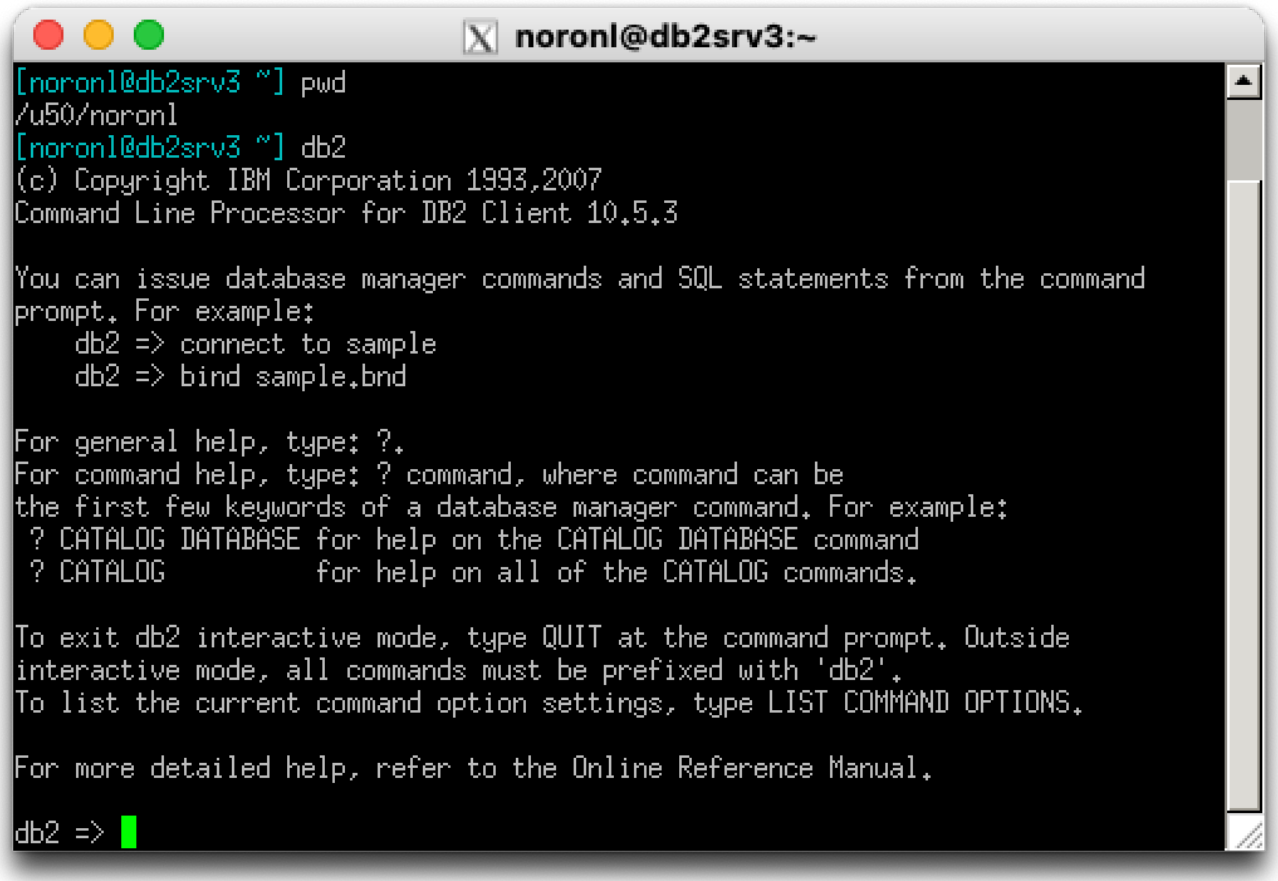


IMPORTANT: Verify that you have a home directory (/u50/<macID>) on the DB2 server using command “pwd”

Basic Commands

- Start application by typing “db2”

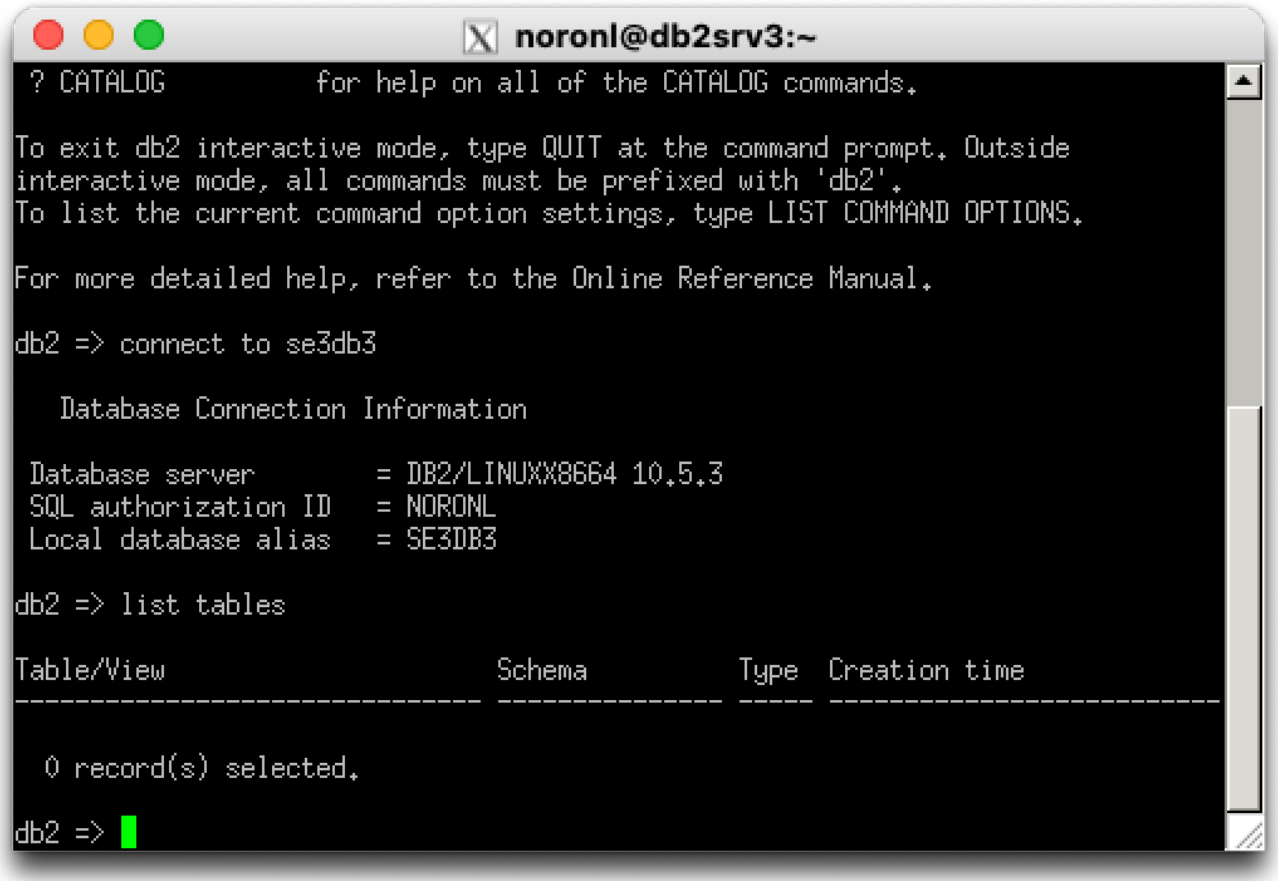
Example


noronl@db2srv3:~
[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/LINUXX8664 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