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Launching into Cyber Security

Week 8 Seminar

Announcement

- Collaborative discussion 2

- Individual essay – formative feedback

Discussion outline

- Intro to Python
- Intro to MySQL
- Integration of Python and MySQL
- Application to PACs

Discussion outline

- **Intro to Python**
- Intro to MySQL
- Integration of Python and MySQL
- Application to PACs

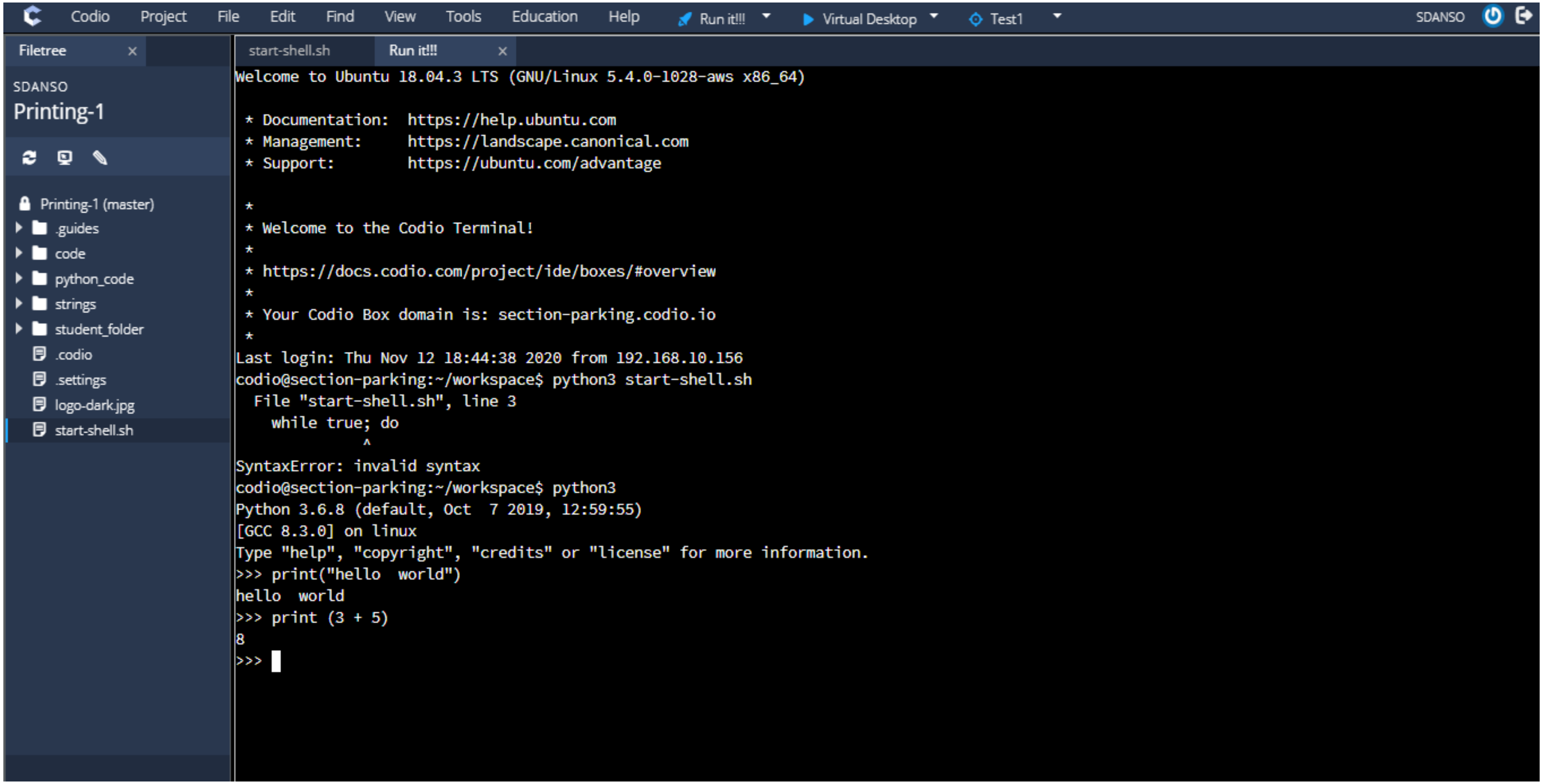
Intro to Python

- Python began in 1989
- High level - scripting language
- Supports object oriented programming
- Scalable – pluggable & modular architecture
- Extensible – core security modules can be written in another language
- Portable across multiple architectures and operating systems – ANSI C compiler
- Easy to learn - few keywords
- Easy to read – understandable to a non programmer
- Easy to maintain

Intro to Python

- Installation options
  - Unix-based systems
  - Windows/DOS
  - Build it yourself
- Running
  - Interactive
  - Running as a script
  - From GUI via IDE which has additional features

Intro to Python: interactive

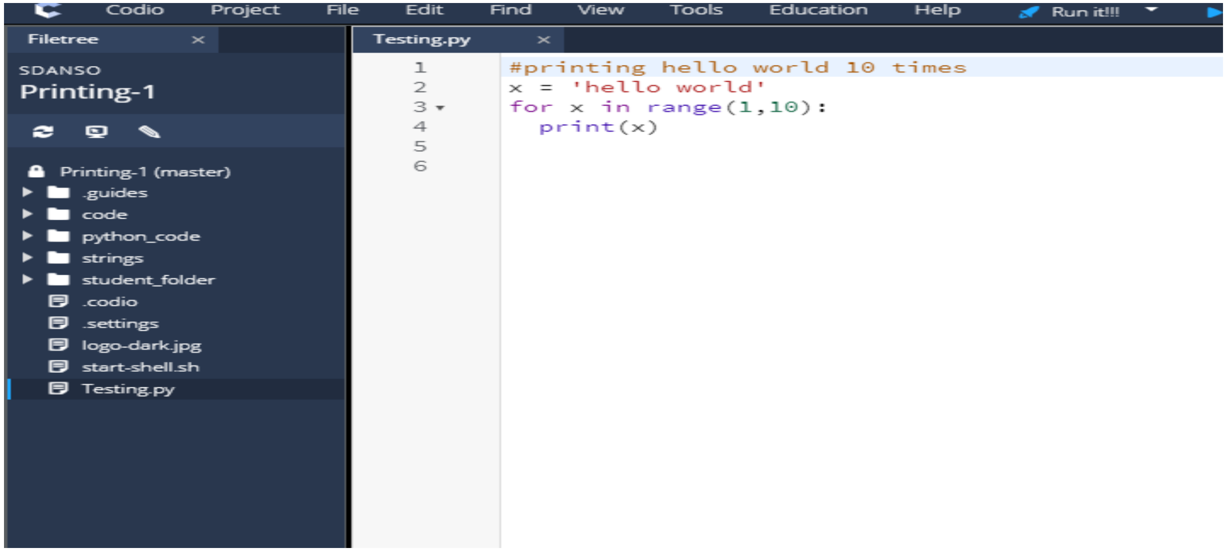


```
Welcome to Ubuntu 18.04.3 LTS (GNU/Linux 5.4.0-1028-aws x86_64)

 * Documentation:  https://help.ubuntu.com
 * Management:     https://landscape.canonical.com
 * Support:        https://ubuntu.com/advantage

 *
 * Welcome to the Codio Terminal!
 *
 * https://docs.codio.com/project/ide/boxes/#overview
 *
 * Your Codio Box domain is: section-parking.codio.io
 *
Last login: Thu Nov 12 18:44:38 2020 from 192.168.10.156
codio@section-parking:~/workspace$ python3 start-shell.sh
  File "start-shell.sh", line 3
    while true; do
              ^
SyntaxError: invalid syntax
codio@section-parking:~/workspace$ python3
Python 3.6.8 (default, Oct  7 2019, 12:59:55)
[GCC 8.3.0] on linux
Type "help", "copyright", "credits" or "license" for more information.
>>> print("hello  world")
hello  world
>>> print (3 + 5)
8
>>> 
```

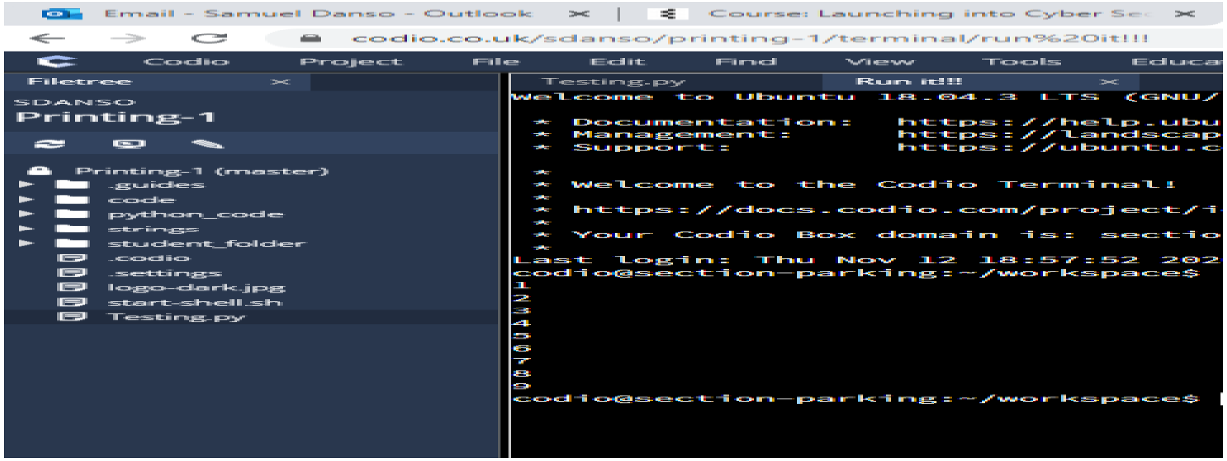
Intro to Python: script



```
#printing hello world 10 times
x = 'hello world'
for x in range(1,10):
  print(x)
```

Script:

- Filename ..e.g testing.py
- Code
- Comments



```
Welcome to Ubuntu 18.04.3 LTS (GNU/

  * Documentation:   https://help.ubu
  * Management:      https://landscap
  * Support:         https://ubuntu.c

  *
  * Welcome to the Codio Terminal!
  *
  * https://docs.codio.com/project/i
  *
  * Your Codio Box domain is: sectio
  *
Last login: Thu Nov 12 18:57:52 202
codio@section-parking:~/workspace$
1
2
3
4
5
6
7
8
9
codio@section-parking:~/workspace$
```

Output

Intro to Python: IDE

Integrated Development Environment

Open source

- IDLE
- PythonWin
- Ipython
- IDE studio
- Eclipse
- Text editors
- Codio

Commercial

- WingIDE Python IDE by WingWare
- Komodo IDE by ActiveState

Intro to Python: getting started

- Output and print statement

```
>>myString = ‘hello world’
>>print (mystring)
   hello world
```

- Input and the raw_input() built-in function

```
>>user = raw_input (‘Enter login name: ’)
Enter login name: root
>> print (‘Your login is: ’, user)
Your login is: root
```

Intro to Python: getting started

- **Comments**

```
>># my first comment
>>print (‘hello world’) #  my other commnet
hello world
```

- **Operators**

  □ + - * / // % **

```
>> print (-2 * 4 + 3 ** 2)
1
```

  □ <   <=   >   >=   ==   !=   <>

```
>>  2 < 4
True
```

  □ and   or   not

```
>>  2 < 4 and 2 == 4
False
```

Intro to Python: getting started

- **Variables and assignments**
  - case sensitive;
  - no pre-declaration;
  - type (and value) are assigned during initialisation
  - equal signs are used for assignments

```
>> counter = 0
>> miles = 1000.0
>> name = ‘John’
>> counter = counter + 1
>> kilometers  = 1.609 * miles
>> print (‘%f miles is the same as %f km’ % (miles, kilometers) )
    1000.00000 miles is the same as 1609.000000 km
```

Intro to Python: getting started

- **Numbers**
  - int (signed integers) - e.g 0101 84 -353 -0x80 017 -0X92
  - int bool (Boolean value) - e.g True, False
  - float (floating point real numbers) 3.14159 4.2E-10 -90. 6.022e23
  - Complex - e.g square root of -1 (6.23+1.5j)
  - Decimal - need importing decimal module

```
>> print(decimal.Decimal('1.1')
1.1
```

Intro to Python: getting started

- **Strings**
  - Continues set of characters in between double or single quotation marks
  - Subsets of strings can extracted using index ([ ]) or slice ([:])

```
>> pytstr =  ‘Python’
>> iscool = ‘is cool!’
>>pystr[0]
‘P’
>>pystr[2:5]
‘tho’
```

Intro to Python: getting started

- **List and Tuples**
  - Generic arrays used to hold a Python objects
  - Items are ordered and are accessible via index offsets
  - Lists are enclosed in brackets ([ ]) and their elements can be changed
  - Tuples are enclosed in parenthesis (( )) and cannot be updated - they are read-only
  - Subsets of can be taken with slice operator ([ ]) and ([:])

```
>>aList = [ 1, 2, 3, 4]
>> aList
[ 1, 2, 3, 4]
>> aList[0]
[1]
>>aList[2:]
[ 3, 4]
```

Intro to Python: getting started

```
>>aTuple = (‘robots’, 77, 99,  ‘try’)
>>aTuple
(‘robots’,  77,  99 , ‘try’)
>>aTuple[:3]
(‘robots’,  77,  99 )


>>aList[1] = 5
[ 1, 5, 3, 4]


>>aTuple[1] = 5  # ???
```

Intro to Python: getting started

- **Dictionaries**
  - ‘dict’ for short
  - Made up of key-value pairs
  - Keys are numbers of strings
  - Enclosed by curly brackets ({ })

```
>> aDict = {‘username’: ‘root’ }

>>aDict[‘port’] = 80

>> aDict

{‘username’: ‘root’,  ‘port’: 80 }

>>aDict.keys()

[‘username’, ‘port’ ]

>> aDict[‘username’]

‘root’
```

Intro to Python: getting started

- **Looping over dictionaries**

```
>> for key in aDict:
        print (key, aDict[key] )
```

```
username  root
port 80
```

Intro to Python: getting started

Conditional statement:

- If statement
  - □ if and else;
  - □ if, elif and else

- While loop

```
>>counter = 0
>> while counter< 3:
          print (counter)
         counter += 1
```

Intro to Python: getting started

- **Opening files**

```
>>  filename = raw_input(‘Enter file name’)
>>fobj = open (filename, ‘r’)
>>data = jobj.readlines()
>>fobj.close()
>> for eachLine in  data:
           print eachLine,
```

Intro to Python: getting started

Functions

- **Inbuilt functions:**
  - file ()
  - open()

- **Self-declared functions:**

```
>> def addMe2Me(x):
        ‘apply + operation to argument ’
        return (x + x)
```

- **Calling functions:**

```
>> addMe2Me(7)
14
```

Intro to Python: getting started

Classes

- A core part of OOP and serves as the container for related data and logic
- They provide a mechanism for creating objects called instances
- Have attributes
- Have optional documentation string
- May have methods (functions) declarations

Intro to Python: getting started

Class example

```
class FooClass(object):
      “””my very first class: FooClass”””
       version = 0.1
def __init__(self, nm=‘John Doe’):
       “”constructor””
       self.name=nm
       print (‘Create a class instance for’, nm)
def showname (self):
      print( ‘Your name is’ , self.name)
def addMe2Me (self, x):
     return  x + x
```

Intro to Python: getting started

Using the Class

```
>> fool = FooClass ()


>> fool.showname ()
Your name is John Doe


>>print(fool.addMe2Me(6) )
12
```

Intro to Python: getting started

Modules

- A logical way to physically organise and distinguish related Python code into individual files.
- May contain executable code, functions, classes.

```
>>import  sys

>>sys.stdout.write(‘Hello World!\n’)

Hello World!

>>sys.platform

‘win32’
```

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Intro to Python: getting started

List of Python keywords				
False	await	else	import	pass
None	break	except	in	raise
True	class	finally	is	return
and	continue	for	lambda	try
as	def	from	nonlocal	while
assert	del	global	not	with
async	elif	if	or	yield

source: https://www.programiz.com/python-programming/keyword-list

Discussion outline

- Intro to Python
- **Intro to MySQL**
- Integration of Python and MySQL
- Application to PACs

Intro to MySQL

- A database requires a database management system
- MySQL is a Structured Query Language (SQL) based relational database management system
- MySQL is compatible with standard SQL
- Mostly used by PHP and Perl, and now Python

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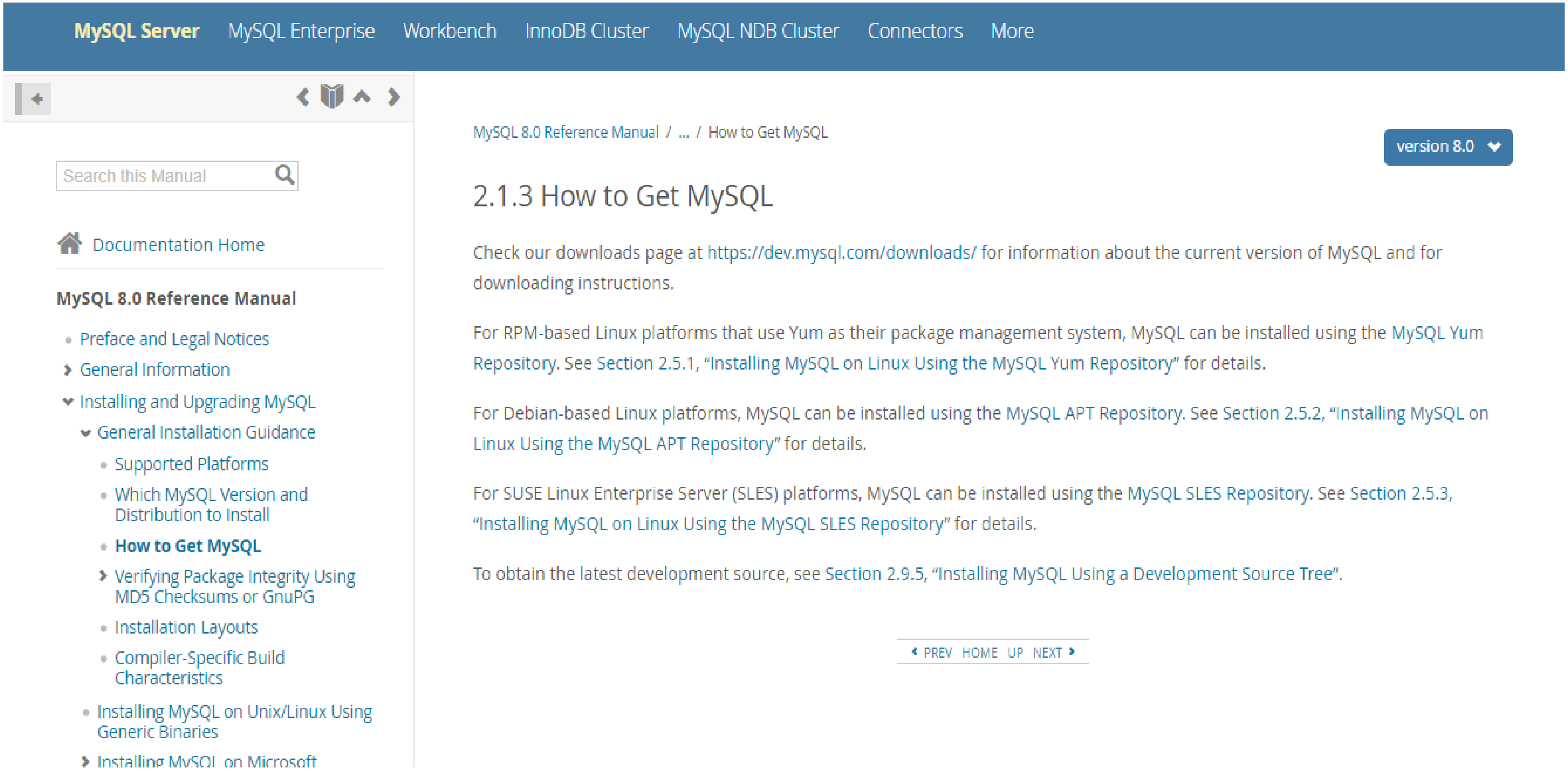
Intro to MySQL



MySQL 8.0 Reference Manual

- Preface and Legal Notices
- General Information
- Installing and Upgrading MySQL
  - General Installation Guidance
    - Supported Platforms
    - Which MySQL Version and Distribution to Install
    - **How to Get MySQL**
    - Verifying Package Integrity Using MD5 Checksums or GnuPG
    - Installation Layouts
    - Compiler-Specific Build Characteristics
  - Installing MySQL on Unix/Linux Using Generic Binaries
  - Installing MySQL on Microsoft

MySQL 8.0 Reference Manual / ... / How to Get MySQL

2.1.3 How to Get MySQL

Check our downloads page at https://dev.mysql.com/downloads/ for information about the current version of MySQL and for downloading instructions.

For RPM-based Linux platforms that use Yum as their package management system, MySQL can be installed using the MySQL Yum Repository. See Section 2.5.1, “Installing MySQL on Linux Using the MySQL Yum Repository” for details.

For Debian-based Linux platforms, MySQL can be installed using the MySQL APT Repository. See Section 2.5.2, “Installing MySQL on Linux Using the MySQL APT Repository” for details.

For SUSE Linux Enterprise Server (SLES) platforms, MySQL can be installed using the MySQL SLES Repository. See Section 2.5.3, “Installing MySQL on Linux Using the MySQL SLES Repository” for details.

To obtain the latest development source, see Section 2.9.5, “Installing MySQL Using a Development Source Tree”.

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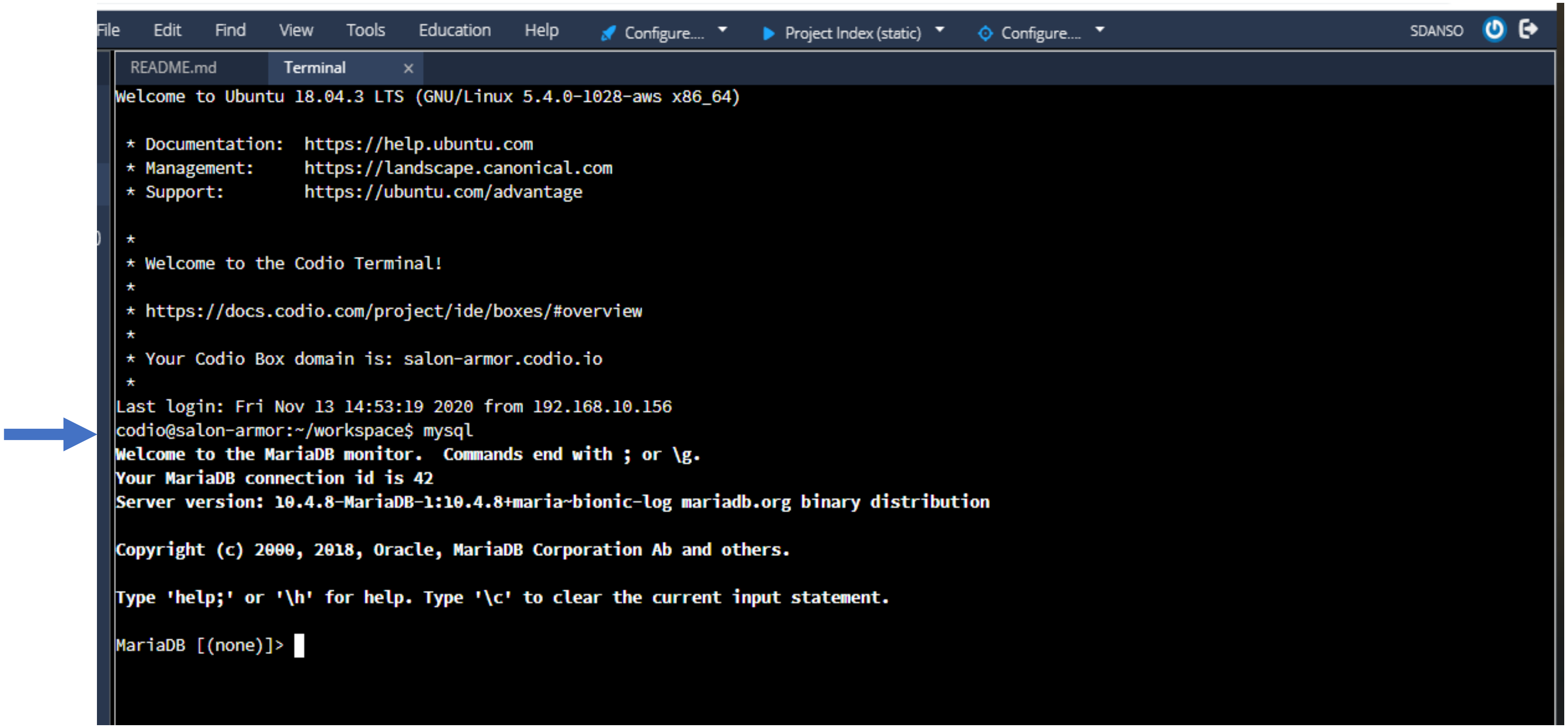
Intro to MySQL: accessing MySQL

>mysql –u [username] –p

>Enter password:[password]



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Welcome to Ubuntu 18.04.3 LTS (GNU/Linux 5.4.0-1028-aws x86_64)

 * Documentation:  https://help.ubuntu.com
 * Management:     https://landscape.canonical.com
 * Support:        https://ubuntu.com/advantage

 *
 * Welcome to the Codio Terminal!
 *
 * https://docs.codio.com/project/ide/boxes/#overview
 *
 * Your Codio Box domain is: salon-armor.codio.io
 *
Last login: Fri Nov 13 14:53:19 2020 from 192.168.10.156
codio@salon-armor:~/workspace$ mysql
Welcome to the MariaDB monitor.  Commands end with ; or \g.
Your MariaDB connection id is 42
Server version: 10.4.8-MariaDB-1:10.4.8+maria~bionic-log mariadb.org binary distribution

Copyright (c) 2000, 2018, Oracle, MariaDB Corporation Ab and others.

Type 'help;' or '\h' for help. Type '\c' to clear the current input statement.

MariaDB [(none)]> 
```

Intro to MySQL: prompts and meaning

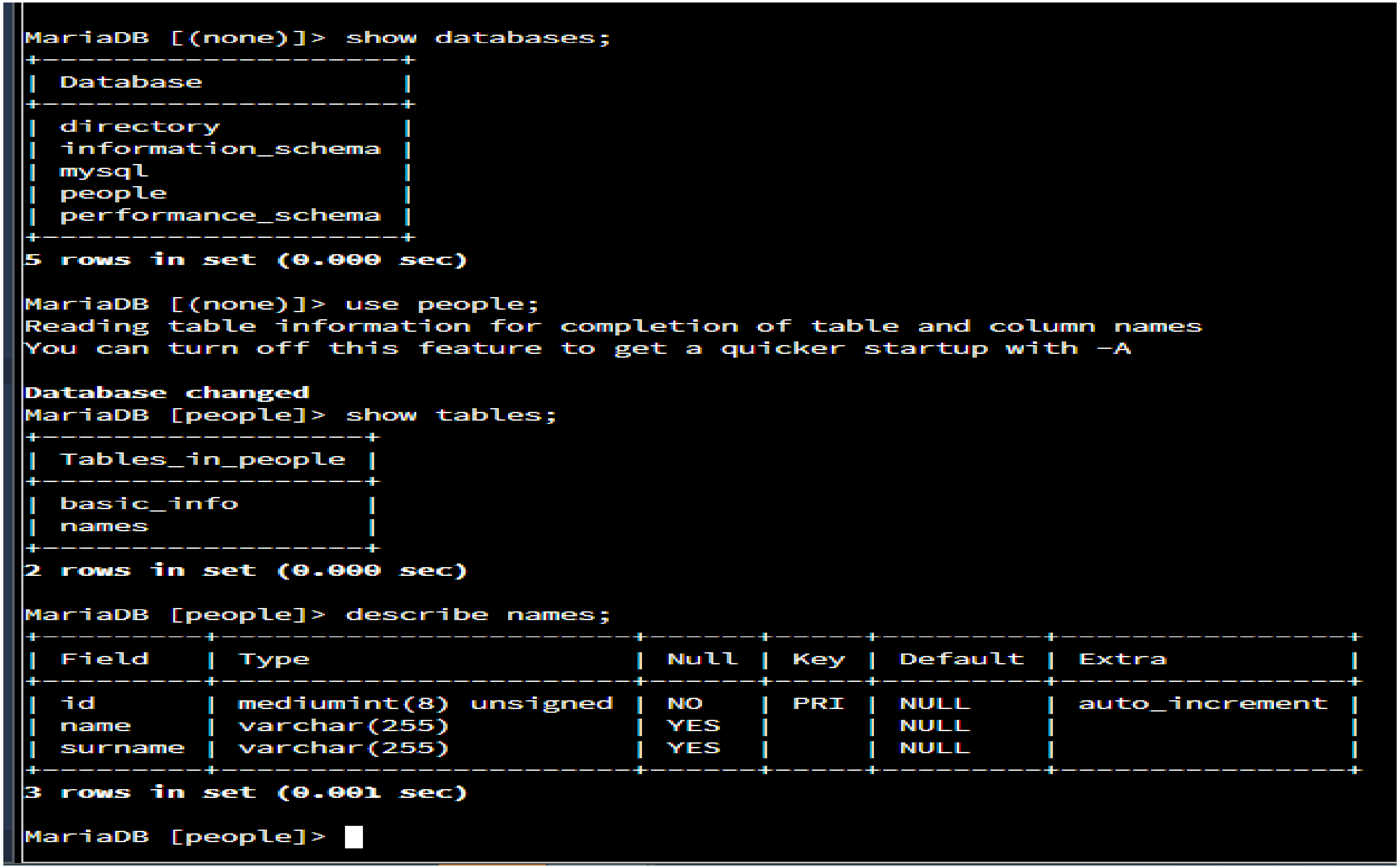
prompt	meaning
mysql>	Ready for new command.
->	Waiting for next line of multiple-line command.
‘>	Waiting for next line, waiting for completion of a string that began with a single quote (“'”).
“>	Waiting for next line, waiting for completion of a string that began with a double quote (“"”).
` >	Waiting for next line, waiting for completion of an identifier that began with a backtick (“`”).
/*>	Waiting for next line, waiting for completion of a comment that began with /*.

Taken from: kent.edu

Intro to MySQL: command

- Prompt (mysql>) sends it to the server for execution
- mysql> displays the results
- Prints another mysql>
- A command could span multiple lines
- A command show have an SQL statement followed by a semicolon
- Help---------> \h
- Quit--------->/exit or \q
- Cancel the command ---------> \c
- Change database ---------> use

Intro to MySQL: info about databases and tables



```
MariaDB [(none)]> show databases;
+--------------------+
| Database           |
+--------------------+
| directory          |
| information_schema |
| mysql              |
| people             |
| performance_schema |
+--------------------+
5 rows in set (0.000 sec)

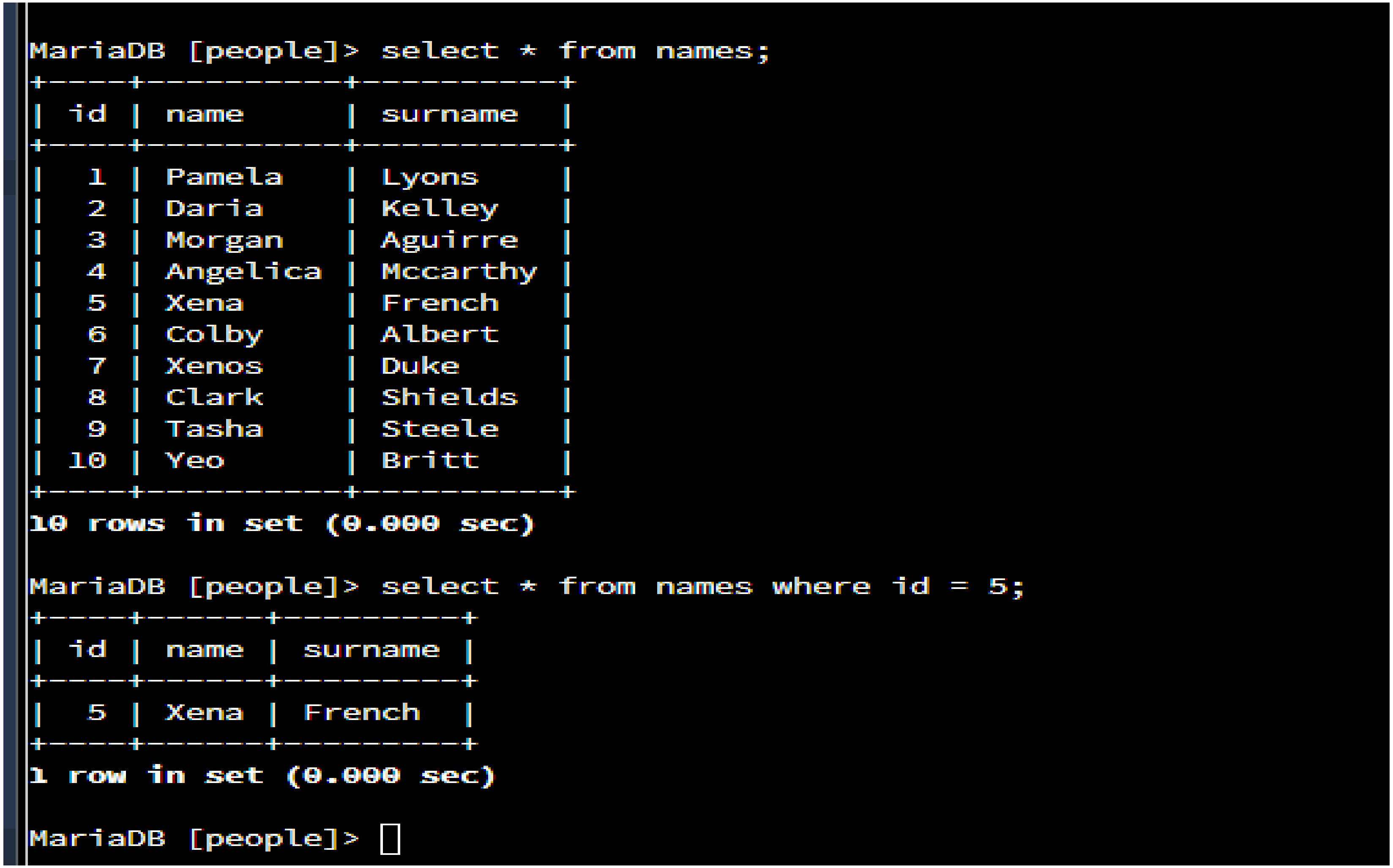
MariaDB [(none)]> use people;
Reading table information for completion of table and column names
You can turn off this feature to get a quicker startup with -A

Database changed
MariaDB [people]> show tables;
+------------------+
| Tables_in_people |
+------------------+
| basic_info       |
| names            |
+------------------+
2 rows in set (0.000 sec)

MariaDB [people]> describe names;
+---------+-----------------------+------+-----+---------+----------------+
| Field   | Type                  | Null | Key | Default | Extra          |
+---------+-----------------------+------+-----+---------+----------------+
| id      | mediumint(8) unsigned | NO   | PRI | NULL    | auto_increment |
| name    | varchar(255)          | YES  |     | NULL    |                |
| surname | varchar(255)          | YES  |     | NULL    |                |
+---------+-----------------------+------+-----+---------+----------------+
3 rows in set (0.001 sec)

MariaDB [people]> 
```

Intro to MySQL: query

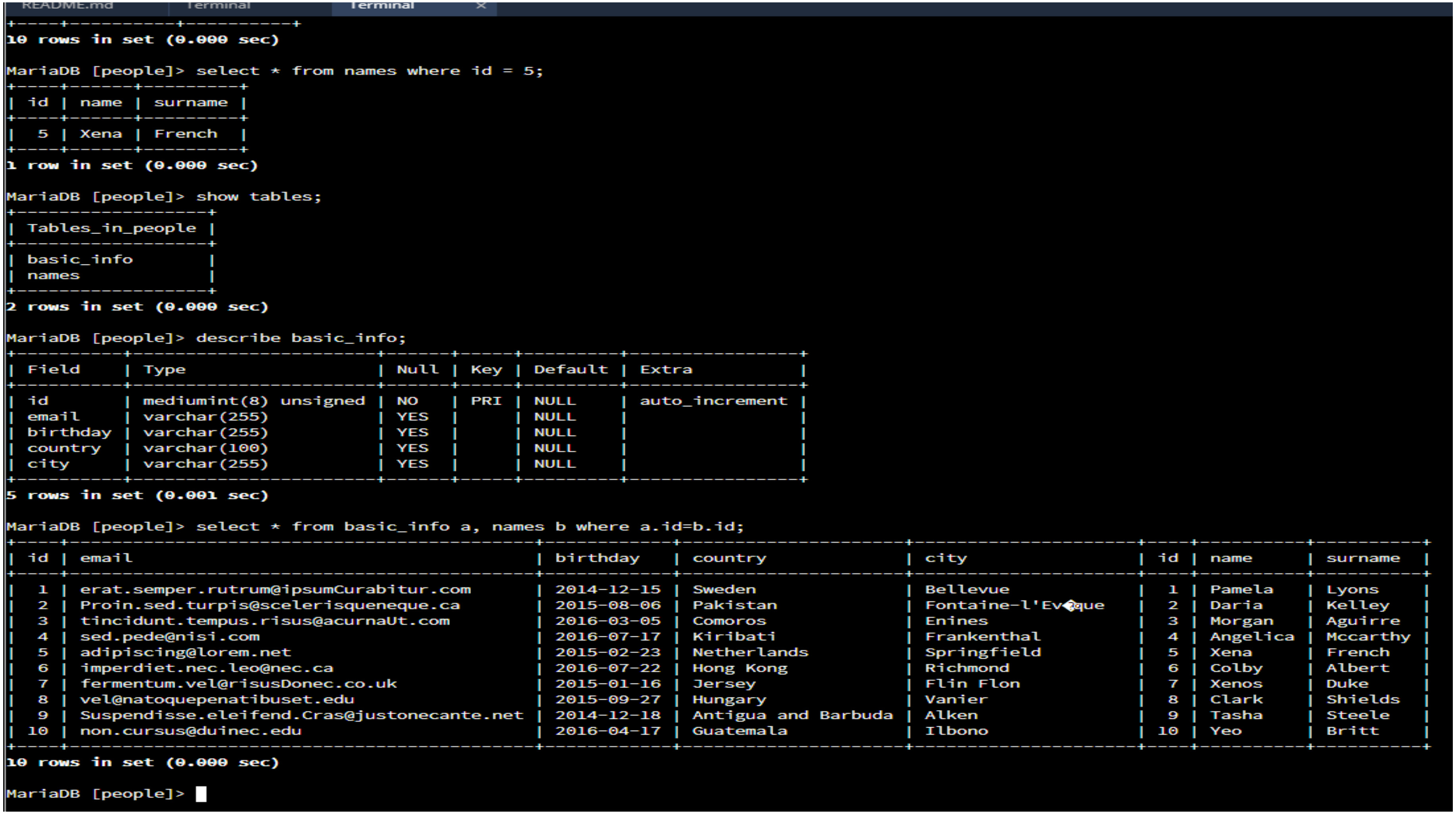


```
MariaDB [people]> select * from names;
+----+----------+-----------+
| id | name     | surname   |
+----+----------+-----------+
|  1 | Pamela   | Lyons     |
|  2 | Daria    | Kelley    |
|  3 | Morgan   | Aguirre   |
|  4 | Angelica | Mccarthy  |
|  5 | Xena     | French    |
|  6 | Colby    | Albert    |
|  7 | Xenos    | Duke      |
|  8 | Clark    | Shields   |
|  9 | Tasha    | Steele    |
| 10 | Yeo      | Britt     |
+----+----------+-----------+
10 rows in set (0.000 sec)

MariaDB [people]> select * from names where id = 5;
+----+------+---------+
| id | name | surname |
+----+------+---------+
|  5 | Xena | French  |
+----+------+---------+
1 row in set (0.000 sec)

MariaDB [people]> 
```

Intro to MySQL: data from multiple tables using relational joins



```
+----+----------+----------+
10 rows in set (0.000 sec)

MariaDB [people]> select * from names where id = 5;
+----+------+---------+
| id | name | surname |
+----+------+---------+
|  5 | Xena | French  |
+----+------+---------+
1 row in set (0.000 sec)

MariaDB [people]> show tables;
+-------------------+
| Tables_in_people  |
+-------------------+
| basic_info        |
| names             |
+-------------------+
2 rows in set (0.000 sec)

MariaDB [people]> describe basic_info;
+----------+-----------------------+------+-----+---------+----------------+
| Field    | Type                  | Null | Key | Default | Extra          |
+----------+-----------------------+------+-----+---------+----------------+
| id       | mediumint(8) unsigned | NO   | PRI | NULL    | auto_increment |
| email    | varchar(255)          | YES  |     | NULL    |                |
| birthday | varchar(255)          | YES  |     | NULL    |                |
| country  | varchar(100)          | YES  |     | NULL    |                |
| city     | varchar(255)          | YES  |     | NULL    |                |
+----------+-----------------------+------+-----+---------+----------------+
5 rows in set (0.001 sec)

MariaDB [people]> select * from basic_info a, names b where a.id=b.id;
+----+--------------------------------------------+------------+---------------------+---------------------+----+----------+----------+
| id | email                                      | birthday   | country             | city                | id | name     | surname  |
+----+--------------------------------------------+------------+---------------------+---------------------+----+----------+----------+
|  1 | erat.semper.rutrum@ipsumCurabitur.com      | 2014-12-15 | Sweden              | Bellevue            |  1 | Pamela   | Lyons    |
|  2 | Proin.sed.turpis@scelerisqueneque.ca       | 2015-08-06 | Pakistan            | Fontaine-l'Ev�que   |  2 | Daria    | Kelley   |
|  3 | tincidunt.tempus.risus@acurnaUt.com        | 2016-03-05 | Comoros             | Enines              |  3 | Morgan   | Aguirre  |
|  4 | sed.pede@nisi.com                          | 2016-07-17 | Kiribati            | Frankenthal         |  4 | Angelica | Mccarthy |
|  5 | adipiscing@lorem.net                       | 2015-02-23 | Netherlands         | Springfield         |  5 | Xena     | French   |
|  6 | imperdiet.nec.leo@nec.ca                   | 2016-07-22 | Hong Kong           | Richmond            |  6 | Colby    | Albert   |
|  7 | fermentum.vel@risusDonec.co.uk             | 2015-01-16 | Jersey              | Flin Flon           |  7 | Xenos    | Duke     |
|  8 | vel@natoquepenatibuset.edu                 | 2015-09-27 | Hungary             | Vanier              |  8 | Clark    | Shields  |
|  9 | Suspendisse.eleifend.Cras@justonecante.net | 2014-12-18 | Antigua and Barbuda | Alken               |  9 | Tasha    | Steele   |
| 10 | non.cursus@duinec.edu                      | 2016-04-17 | Guatemala           | Ilbono              | 10 | Yeo      | Britt    |
+----+--------------------------------------------+------------+---------------------+---------------------+----+----------+----------+
10 rows in set (0.000 sec)

MariaDB [people]> █
```

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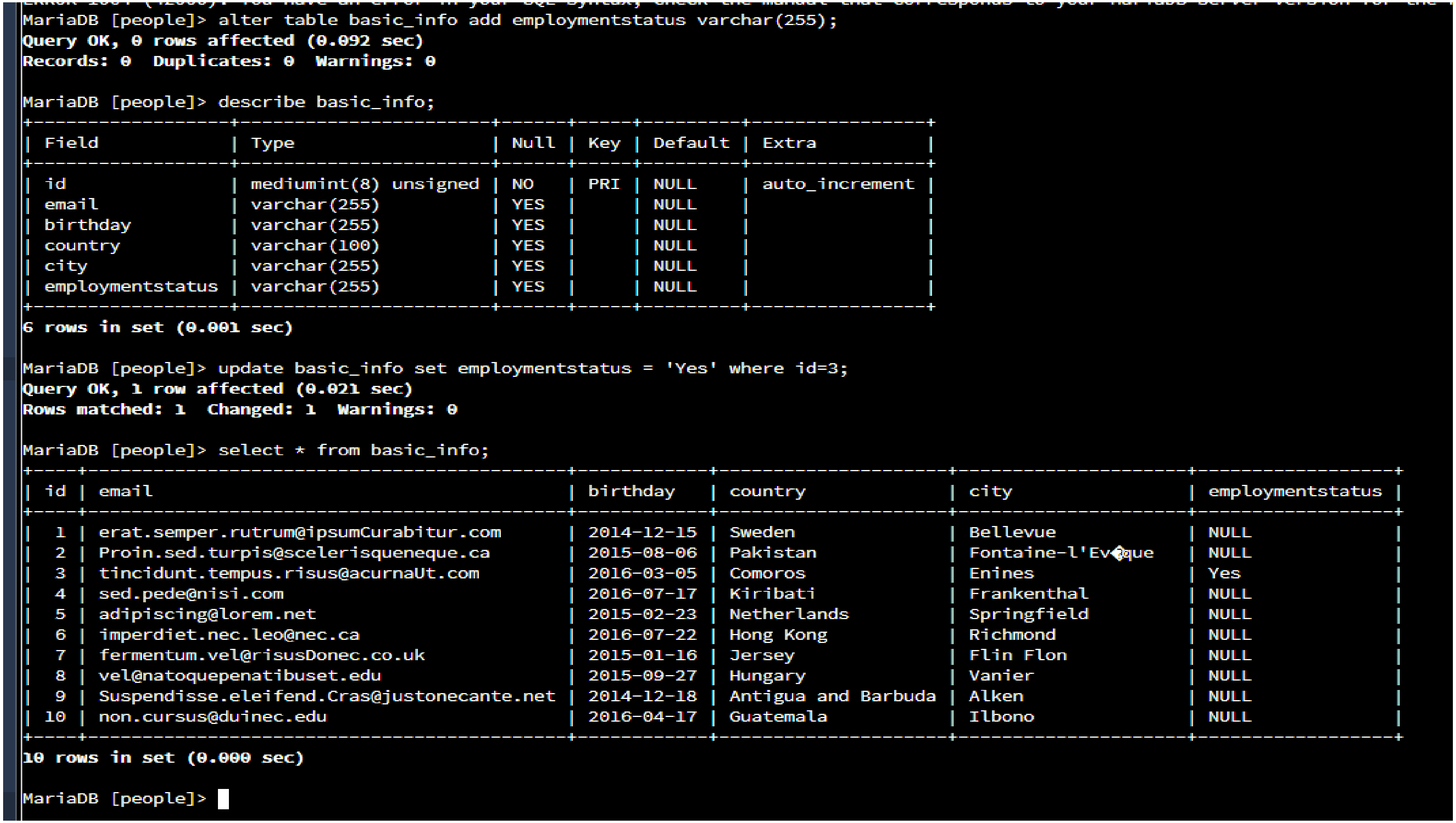
Intro to MySQL: database modifications



```
ERROR 1064 (42000): You have an error in your SQL syntax; check the manual that corresponds to your MariaDB server version for the
MariaDB [people]> alter table basic_info add employmentstatus varchar(255);
Query OK, 0 rows affected (0.092 sec)
Records: 0  Duplicates: 0  Warnings: 0

MariaDB [people]> describe basic_info;
+------------------+-----------------------+------+-----+---------+----------------+
| Field            | Type                  | Null | Key | Default | Extra          |
+------------------+-----------------------+------+-----+---------+----------------+
| id               | mediumint(8) unsigned | NO   | PRI | NULL    | auto_increment |
| email            | varchar(255)          | YES  |     | NULL    |                |
| birthday         | varchar(255)          | YES  |     | NULL    |                |
| country          | varchar(100)          | YES  |     | NULL    |                |
| city             | varchar(255)          | YES  |     | NULL    |                |
| employmentstatus | varchar(255)          | YES  |     | NULL    |                |
+------------------+-----------------------+------+-----+---------+----------------+
6 rows in set (0.001 sec)

MariaDB [people]> update basic_info set employmentstatus = 'Yes' where id=3;
Query OK, 1 row affected (0.021 sec)
Rows matched: 1  Changed: 1  Warnings: 0

MariaDB [people]> select * from basic_info;
+----+---------------------------------------------+------------+---------------------+---------------------+------------------+
| id | email                                       | birthday   | country             | city                | employmentstatus |
+----+---------------------------------------------+------------+---------------------+---------------------+------------------+
|  1 | erat.semper.rutrum@ipsumCurabitur.com       | 2014-12-15 | Sweden              | Bellevue            | NULL             |
|  2 | Proin.sed.turpis@scelerisqueneque.ca        | 2015-08-06 | Pakistan            | Fontaine-l'Ev�que   | NULL             |
|  3 | tincidunt.tempus.risus@acurnaUt.com         | 2016-03-05 | Comoros             | Enines              | Yes              |
|  4 | sed.pede@nisi.com                           | 2016-07-17 | Kiribati            | Frankenthal         | NULL             |
|  5 | adipiscing@lorem.net                        | 2015-02-23 | Netherlands         | Springfield         | NULL             |
|  6 | imperdiet.nec.leo@nec.ca                    | 2016-07-22 | Hong Kong           | Richmond            | NULL             |
|  7 | fermentum.vel@risusDonec.co.uk              | 2015-01-16 | Jersey              | Flin Flon           | NULL             |
|  8 | vel@natoquepenatibuset.edu                  | 2015-09-27 | Hungary             | Vanier              | NULL             |
|  9 | Suspendisse.eleifend.Cras@justonecante.net  | 2014-12-18 | Antigua and Barbuda | Alken               | NULL             |
| 10 | non.cursus@duinec.edu                       | 2016-04-17 | Guatemala           | Ilbono              | NULL             |
+----+---------------------------------------------+------------+---------------------+---------------------+------------------+
10 rows in set (0.000 sec)

MariaDB [people]> █
```

Database design: creating database and tables

```
CREATE DATABASE databasename;


CREATE TABLE Persons (
    PersonID int,
    LastName varchar(255),
    FirstName varchar(255),
    Address varchar(255),
    City varchar(255)
);
```

For more on SQL:

https://www.w3schools.com/sql/sql_create_db.asp

Database design considerations

- Content
  - Data to be stored and associated cost
- Access
  - Security to ensure who have access to what data
- Logical structure
  - Assembling the data to make sense to the user
- Physical organisation
  - The physical location of data storage

Discussion outline

- Intro to Python
- Intro to MySQL
- **Integration of Python and MySQL**
- Application to PACs

Database design: integration with Python

```
>>import mysql.connector

>>from mysql.connector import errorcode

>>conn = mysql.connector.connect(host=“localhost", user=“john", password=‘***’)

>>curs = conn.cursor()

>>db = ‘use people’

>>curs.execute(db)
```

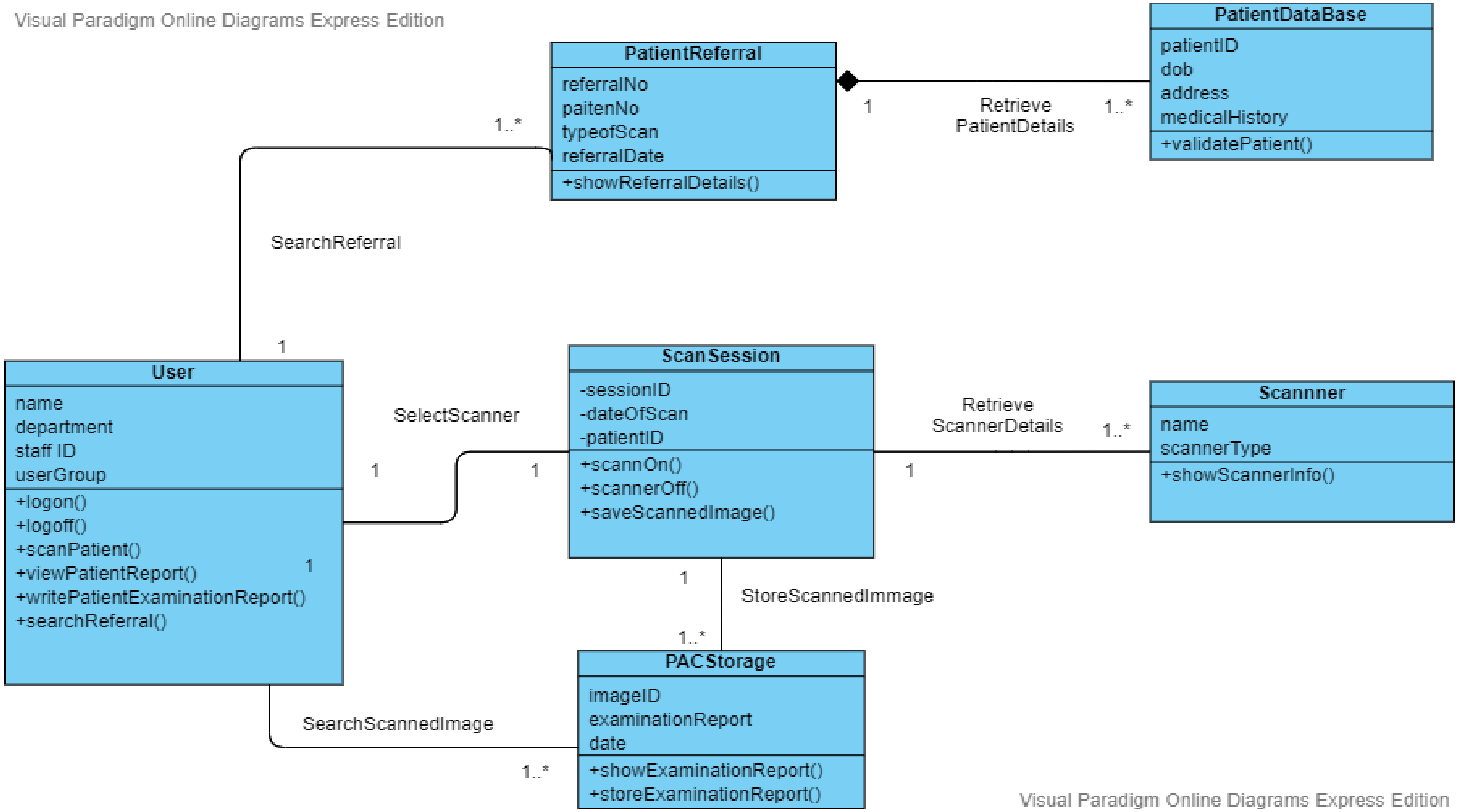
Database design: integration with Python

```
def  addNewMember(id, email,  birthday, country, employmentstatus):
            id = id
            email = email
            birthday = birthday
            country = country
            status = employmentstatus
            to_db = [id, email, birthday, country, status]
            curs.execute(“insert into basic_info (id, email, birthday, country, status)
values (%s,%s,%s,%s,%s); ",    to_db)
            conn.commit()
```

Discussion outline

- Intro to Python
- Intro to MySQL
- Integration of Python and MySQL
- **Application to PACs**

Application to PACs



PatientReferral

referralNo
paitenNo
typeofScan
referralDate

+showReferralDetails()

PatientDataBase

patientID
dob
address
medicalHistory

+validatePatient()

User

name
department
staff ID
userGroup

+logon()
+logoff()
+scanPatient()
+viewPatientReport()
+writePatientExaminationReport()
+searchReferral()

ScanSession

-sessionID
-dateOfScan
-patientID

+scannOn()
+scannerOff()
+saveScannedImage()

Scannner

name
scannerType

+showScannerInfo()

PACStorage

imageID
examinationReport
date

+showExaminationReport()
+storeExaminationReport()

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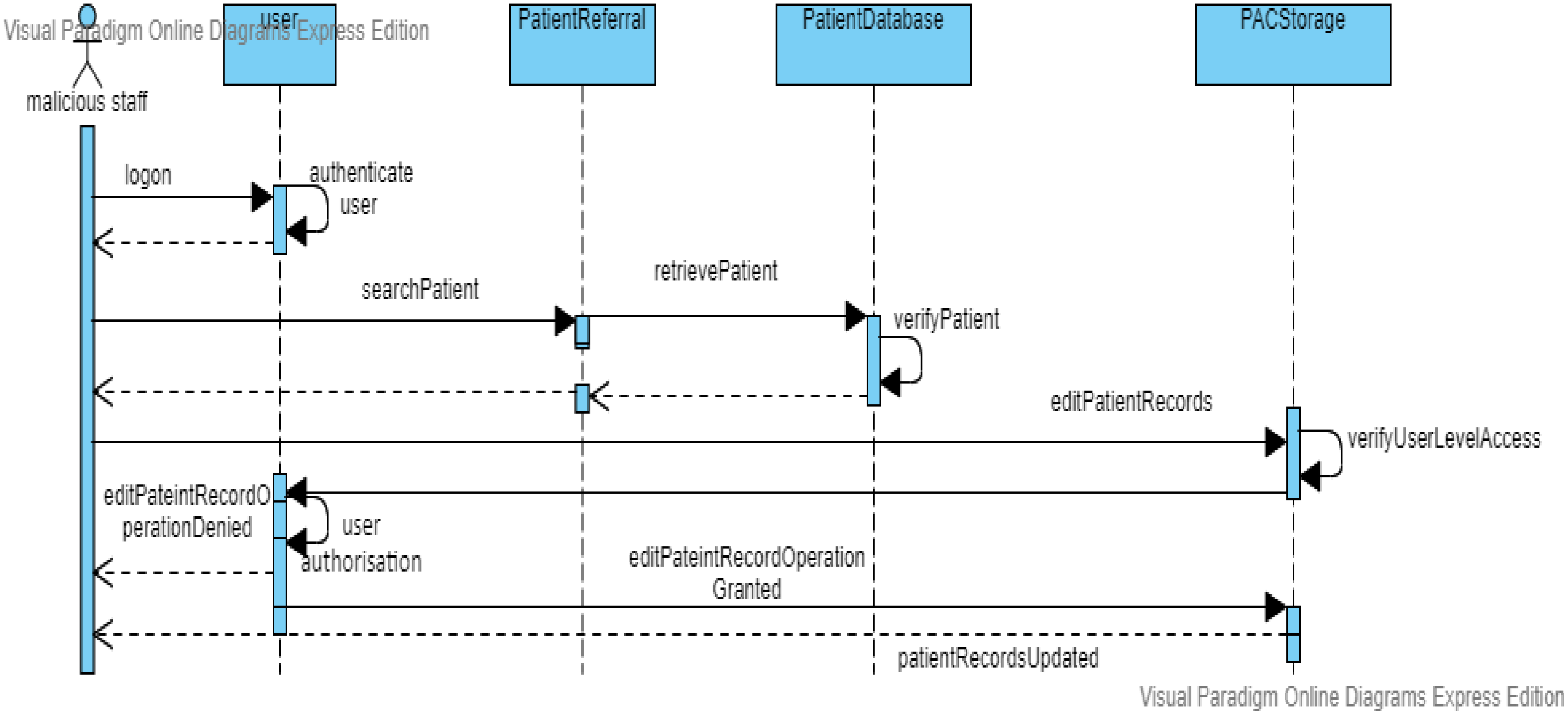
Online

Application to PACs



Exercise

Implement PACs solution using OOP with Python and MySQL