MANIPAL INSTITUTE OF TECHNOLOGY

MANIPAL

A Constituent Institution of Manipal University

DEPARTMENT OF COMPUTER SCIENCE & ENGINEERING

CERTIFICATE

This is to certify that Ms./Mr. ……..……

Reg. No. …..…… Section: …… Roll No: ……... has satisfactorily completed the lab exercises prescribed for WEB PROGRAMMING LAB [CSE 3243] of Third Year B. Tech. (Computer Science and Engineering) Degree at MIT, Manipal, in the academic year 2024-2025.

Date: …….....

Signature
Faculty in Charge

CONTENTS

Course Objectives

- Acquire in-depth understanding of web application architecture.
- Understand techniques to improve user experience in web applications.
- Gain knowledge about how to interact with database.

Course Outcomes

At the end of this course, students will be able to

- Develop a basic website using a modern web development tool.
- Design websites with a better look and feel.
- Create real-world web applications that interact with database.

Evaluation plan

- Internal Assessment Marks: 60%
  - Continuous Evaluation: 25%

    Continuous evaluation component (for each evaluation):3 marks

    The assessment will depend on punctuality, program execution, and the ability to upload the solution on time.
  - Project Evaluation: 25%
  - Viva Voce: 10%
- End semester assessment of two-hour duration: 40 %
- Total (Internal assessment + End semester assessment): 100 marks

INSTRUCTIONS TO THE STUDENTS

Pre- Lab Session Instructions

1. Students should carry the Lab Manual Book and the required stationery to every lab session
2. Be in time and follow the institution dress code
3. Must Sign in the log register provided
4. Make sure to occupy the allotted seat and answer the attendance
5. Adhere to the rules and maintain the decorum
6. Students must come prepared for the lab in advance

In- Lab Session Instructions

- Follow the instructions on the allotted exercises
- Show the program and results to the instructors on completion of experiments
- On receiving approval from the instructor, copy the program and results in the Lab record
- Prescribed textbooks and class notes can be kept ready for reference if required

General Instructions for the exercises in Lab

- Implement the given exercise individually and not in a group.
- The programs should meet the following criteria:
  - Programs should be interactive with appropriate prompt messages, error messages if any, and descriptive messages for outputs. ○ Observation book should be complete with program, proper input output clearly showing the parallel execution in each process.
- Plagiarism (copying from others) is strictly prohibited and would invite severe penalties in evaluation.
- The exercises for each week are divided into three sets:
  - Solved example
  - Lab Assignments - to be completed during lab hours
  - Home Assignments - to be completed outside the lab or in the lab to enhance the skill
- In case a student misses a lab class, he/ she must ensure that the experiment is completed during the repetition lab with the permission of the faculty concerned but credit will be given only to one day's experiment(s).
- Questions for lab tests and examinations are not necessarily limited to the questions in the manual but may involve some variations and/or combinations of the questions.

- A sample note preparation is given as a model for observation.

THE STUDENTS SHOULD NOT

- Bring mobile phones or any other electronic gadgets to the lab.
- Go out of the lab without permission.

Lab No: 1 HTML and CSS BASICS

LAB ASSIGNMENTS:

1. Write a simple poem and represent it as a web page. Give a title for the poem. Make rhyming words in the poem as bold.
2. Assume you have brought a new car. Write down the list of additional accessories you need for the car as an unordered list in HTML. Also, list the travel plans on the car as an ordered list.
3. Complete the following website name “Share your Winter Vacation Videos”. The required video files are located inside the compressed folder “Week 1 Assignment Files/Media/”.

Hint: Add a <video> element to a <figure> element that will either play paris.mp4, paris.webm or paris.ogv in the element. Test in different browsers

HOME ASSIGNMENTS:

1. Create the following output in HTML
2. Create an array of JavaScript objects for the data in question 1 and display each row in the table form through JavaScript code

Country	Population (In Crores)	
INDIA	1998	85
	1999	90
	2000	100
USA	1998	30
	1999	35
	2000	40
UK	1998	25
	1999	30
	2000	35

Lab No: 2 JQuery

Objectives:

In this lab, student will be able to

1. Develop responsive web pages using jquery
2. Familiarize with DOM manipulation and animations

jQuery

jQuery is a fast and concise JavaScript library to develop web based application.

Here is the list of important core features supported by jQuery −

- *DOM manipulation* − The jQuery made it easy to select DOM elements, negotiate them and modifying their content by using cross-browser open source selector engine called Sizzle.
- *Event handling* − The jQuery offers an elegant way to capture a wide variety of events, such as a user clicking on a link, without the need to clutter the HTML code itself with event handlers.
- *AJAX Support* − The jQuery eases developing a responsive and feature rich site using AJAX technology.
- *Animations* − The jQuery comes with plenty of built-in animation effects which you can use in your websites.
- *Lightweight* − The jQuery is very lightweight library - about 19KB in size (Minified and gzipped).
- *Cross Browser Support* − The jQuery has cross-browser support, and works well in IE 6.0+, FF 2.0+, Safari 3.0+, Chrome and Opera 9.0+
- *Latest Technology* − The jQuery supports CSS3 selectors and basic XPath syntax.

You can download jQuery library from https://jquery.com/download/ on your local machine and include it in your HTML code.

Solved Example:

<html>

```
  <head>
    <title>The jQuery Example</title>
    <script type = "text/javascript" src = "jquery-3.4.1.js">
    </script>
    <script type = "text/javascript" language = "javascript">
      $(document).ready(function() {
        $("div").click(function() {alert("Hello, world!");});
      });
    </script>
  </head>
  <body>
    <div id = "mydiv">
      Click on this to see a dialogue box.
    </div>
</body>
</html>
```

A good rule of thumb is to put your JavaScript programming (all your <script> tags) after any other content inside the <head> tag, but before the closing </head> tag. The *$(document).ready()* function is a built-in jQuery function that waits until the HTML for a page loads before it runs your script.

When a web browser loads an HTML file, it displays the contents of that file on the screen and also the web browser remembers the HTML tags, their attributes, and the order in which they appear in the file—this representation of the page is called the *Document Object Model*, or DOM for short.

Selector: jQuery offers a very powerful technique for selecting and working on a collection of elements—CSS selectors. The basic syntax is like this:

$('selector') use a CSS class selector like this:

$('.submenu')

```
    <script type = "text/javascript" language = "javascript">
      $(document).ready(function() {
        $("p").css("background-color", "yellow");
        $("#myid").css("background-color", "red");
      });
    </script>
  </head>
```

```
  <body>
    <div>
      <p class = "myclass">This is a paragraph.</p>
      <p id = "myid">This is second paragraph.</p>
      <p>This is third paragraph.</p>
    </div>
</body>
```

We can select tag available with the given class in the DOM. For example $('.someclass') selects all elements in the document that have a class name as some-class.

Get And Set Atrributes:

```
<script type = "text/javascript" language = "javascript">
        $(document).ready(function()        {
var title = $("p").attr("title");
          $("#divid").text(title);
          $("#myimg").attr("src", "/jquery/images/jquery.jpg");
        });
    </script>
  </head>
  <body>
    <div>
      <p title = "Bold and Brave">This is first paragraph.</p>
      <p id = "myid">This is second paragraph.</p>
      <div id = "divid"></div>
      <img id = "myimg" alt = "Sample image" />
    </div>
</body>
</html>
```

You can replace a complete DOM element with the specified HTML or DOM elements.

selector.replaceWith(content)

```
<script type = "text/javascript" language = "javascript">
        $(document).ready(function() {
          $("div").click(function () {
            $(this).replaceWith("<h1>JQuery is Great</h1>");
          });
        });
    </script>
```

Events

To make your web page interactive, you write programs that respond to events.
Mouse events: click, dblclick, mousedown, mouseup, mouseover, etc
Document/Window Events: load, resize, scroll, unload etc
Form Events: submit, reset, focus, and change

```
<script type = "text/javascript" language = "javascript">
        $(document).ready(function() {
          $('#button').click(function() {
            $(this).val("Stop that!");
              }); // end click
        });
      </script>
  </head>
  <body>
    <div id = "mydiv">
      Click on this to see a dialogue box.
        <input type="button" id="button">
    </div>
  </body>
```

- The hover(over, out) method simulates hovering (moving the mouse on, and off, an object).

```
<script type = "text/javascript" language = "javascript">
        $(document).ready(function() {
          $('div').hover(
            function () {
              $(this).css({"background-color":"red"});
            },
            function () {
              $(this).css({"background-color":"blue"});
            }
          );
        });     </script>
```

The bind() method is a more flexible way of dealing with events than jQuery's event specific functions like click() or mouseover(). It not only lets you specify an event and a

function to respond to the event, but also lets you pass additional data for the event-handling function to use.

```
$('#theElement').bind('click', function() {
// do something interesting
}); // end bind
```

- checked selector selects all checked check-boxes or radio buttons. Let us understand this with an example.

```
<html>
<head>
   <title></title>
   <script src="jquery-1.11.2.js"></script>
   <script type="text/javascript">
      $(document).ready(function () {
$('#btnSubmit').click(function () {
            var result = $('input[type="radio"]:checked');
if (result.length > 0) {
               $('#divResult').html(result.val() + " is checked");
            }
else {
               $('#divResult').html("No radio button checked");
            }
         });
      });
   </script>
</head>
<body style="font-family:Arial">
Gender :
   <input type="radio" name="gender" value="Male">Male
   <input type="radio" name="gender" value="Female">Female
    <input id="btnSubmit" type="submit" value="submit" />
      <div id="divResult">
   </div>
</body>
</html>
```

- The each() method in jQuery is used to execute a function for each matched element.

```
<html>
```

```
<head>
   <title></title>
   <script src="jquery-1.11.2.js"></script>
   <script type="text/javascript">
      $(document).ready(function () {
$('#btnSubmit').click(function () {
            var result = $('input[type="checkbox"]:checked');
if (result.length > 0) {
               var resultString = result.length + " checkboxe(s) checked<br/>";
result.each(function () {
                  resultString += $(this).val() + "<br/>";
               });
               $('#divResult').html(resultString);
            }
```

```
            else {
               $('#divResult').html("No checkbox checked");
            }
         });
      });
   </script>
</head>
<body style="font-family:Arial">
   Skills :
   <input type="checkbox" name="skills" value="JavaScript" />JavaScript
   <input type="checkbox" name="skills" value="jQuery" />jQuery
   <input type="checkbox" name="skills" value="C#" />C#
   <input type="checkbox" name="skills" value="VB" />VB
<br /><br />
   <input id="btnSubmit" type="submit" value="submit" />
   <br /><br />
   <div id="divResult">
   </div>
</body>
</html>
```

The animate() Method

The jQuery animate() method is used to create custom animations.
$(*selector*).animate({*params*},*speed*,*callback*);
The required params parameter defines the CSS properties to be animated.
The optional speed parameter specifies the duration of the effect. It can take the following values: "slow", "fast", or milliseconds.
The optional callback parameter is a function to be executed after the animation completes.

```
$("button").click(function(){
$("div").animate({left:'250px'});
});
```

LAB ASSIGNMENTS:

1. Write a web page which contains table with 3 X 3 dimensions (fill some data) and one image. Style the rows with alternate color. Move the table and image together from right to left when button is clicked.
2. Design a calculator to perform basic arithmetic operations. Use textboxes and buttons to design web page.
3. Create a web page to design a birthday card shown below.

HOME ASSIGNMENTS:

1. Design a webpage. The page contains:
    a. Dropdown list with HP, Nokia, Samsung, Motorola, Apple as items.
    b. Checkbox with Mobile and Laptop as items. Textbox where you enter quantity.
    c. There is a button with text as ‘Produce Bill’.

On Clicking Produce Bill button, alert should be displayed with total amount.

2. Implement the bouncing ball using animate() function.
3. Write a web page which displays image and show the sliding text on the image.

Lab No:3 BOOTSTRAP

Objectives:

In this lab, student will be able to:

1. Develop web pages using design templates
2. Learn how to use bootstrap elements ***What is Bootstrap?***

1. Bootstrap is a free front-end framework for faster and easier web development
2. Bootstrap includes HTML and CSS based design templates for typography, forms, buttons, tables, navigation, modals, image carousels and many other, as well as optional JavaScript plugins
3. Bootstrap also gives you the ability to easily create responsive designs(automatically adjust themselves to look good on all devices)

Bootstrap Containers are used to pad the content inside of them, and there are two container classes available:

- The .container class provides a responsive fixed width container
- The .container-fluid class provides a full width container, spanning the entire width of the viewport Example:

```
<!DOCTYPE html>

<html lang="en">

<head>

  <title>Bootstrap Example</title>

  <meta charset="utf-8">
```

```
  <meta name="viewport" content="width=device-width, initial-scale=1">

  <link rel="stylesheet"
href="https://maxcdn.bootstrapcdn.com/bootstrap/4.4.1/css/bootstrap.min.css">

  <script
src="https://ajax.googleapis.com/ajax/libs/jquery/3.4.1/jquery.min.js"></script>

  <script
src="https://cdnjs.cloudflare.com/ajax/libs/popper.js/1.16.0/umd/popper.min.js"
></script>

  <script
src="https://maxcdn.bootstrapcdn.com/bootstrap/4.4.1/js/bootstrap.min.js"></scr
ipt>

</head>

<body>

<div class="container">

  <h1>My First Bootstrap Page</h1>

  <p>This part is inside a .container class.</p>

  <p>The .container class provides a responsive fixed width container.</p>

  <p>Resize the browser window to see that its width (max-width) will change at
different breakpoints.</p>

</div>

</body></html>
```

Bootstrap Tables

The .table-striped class adds zebra-stripes to a table.

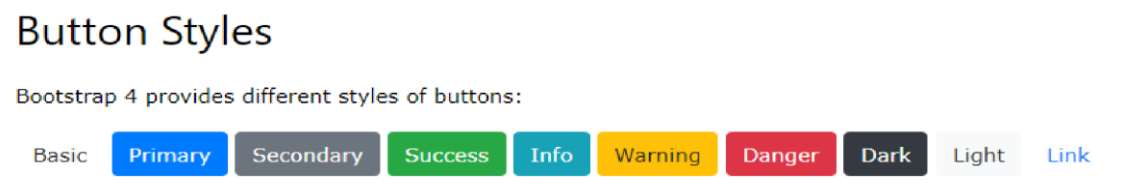
```
<!DOCTYPE html>
<html lang="en">
<head>
  <title>Bootstrap Example</title>
  <meta charset="utf-8">
```

Firstname	Lastname	Email
John	Doe	john@example.com
Mary	Moe	mary@example.com
July	Dooley	july@example.com

```
  <meta name="viewport" content="width=device-width, initial-scale=1">
  <link rel="stylesheet"
href="https://maxcdn.bootstrapcdn.com/bootstrap/4.4.1/css/bootstrap.min.css">
  <script
src="https://ajax.googleapis.com/ajax/libs/jquery/3.4.1/jquery.min.js"></script>
  <script
src="https://cdnjs.cloudflare.com/ajax/libs/popper.js/1.16.0/umd/popper.min.js"></scrip
t>   <script
src="https://maxcdn.bootstrapcdn.com/bootstrap/4.4.1/js/bootstrap.min.js"></script>
</head>
<body>

<div class="container">
  <h2>Dark Striped Table</h2>
  <p>Combine .table-dark and .table-striped to create a dark, striped table:</p>
<table class="table table-dark table-striped">
    <thead>
      <tr>
        <th>Firstname</th>
        <th>Lastname</th>
        <th>Email</th>
      </tr>
    </thead>
    <tbody>
      <tr>
        <td>John</td>
        <td>Doe</td>
        <td>john@example.com</td>
      </tr>
    </tbody>
  </table>
</div>
```

```
</body>
</html>
<button type="button" class="btn btn-outline-primary">Primary</button>
<button type="button" class="btn btn-outline-secondary">Secondary</button>
<button type="button" class="btn btn-outline-success">Success</button>
<button type="button" class="btn btn-outline-info">Info</button>
<button type="button" class="btn btn-outline-warning">Warning</button>
<button type="button" class="btn btn-outline-danger">Danger</button>
<button type="button" class="btn btn-outline-dark">Dark</button>
<button type="button" class="btn btn-outline-light text-dark">Light</button>
```



LAB ASSIGNMENTS:

1. Design the student bio-data form using button, label, textbox, radio button, table and checkbox.
2. Design a web page which shows the database-oriented CRUD operation. Consider Employee data.
3. Create a web page using bootstrap as mentioned. Divide the page into 2 parts top and bottom, then divide the bottom into 3 parts and design each top and bottom part using different input groups, input, badges, buttons and button groups. Make the design more attractive.
4. Design your class timetable using bootstrap table and carousel.

HOME ASSIGNMENTS:

1. Design an attractive ‘train ticket booking form’ using different bootstrap elements.
2. Design an attractive ‘magazine cover page’ using different bootstrap elements.

Lab No:4 Python Basics

Objectives:

In this lab, student will be able to

1. Familiarize with the python programming language
2. Understand the usage of python primitives, data structures and functions

Guido van Rossum created Python in the early 90s. It is now one of the most popular languages in existence.

Single line comments start with a number symbol.

""" Multiline strings can be written
using three "s, and are often used as
documentation.
"""

1. Primitive Datatypes and Operators

You have numbers
3 # => 3

Math is what you would expect
1 + 1 # => 2
8 - 1 # => 7
10 * 2 # => 20
35 / 5 # => 7.0

Integer division rounds down for both positive and negative numbers. 5
// 3 # => 1
-5 // 3 # => -2
5.0 // 3.0 # => 1.0 # works on floats too
-5.0 // 3.0 # => -2.0

```
# The result of division is always a float
10.0 / 3  # => 3.3333333333333335

# Modulo operation
7 % 3  # => 1

# Exponentiation (x**y, x to the yth power)
2**3  # => 8

# Enforce precedence with parentheses
1 + 3 * 2  # => 7
(1 + 3) * 2  # => 8

# Boolean values are primitives (Note: the capitalization)
True  # => True
False  # => False

# negate with not not
True   # => False
not False  # => True

# Boolean Operators
# Note "and" and "or" are case-sensitive
True and False  # => False
False or True   # => True

# True and False are actually 1 and 0 but with different keywords
True + True # => 2
True * 8    # => 8
False - 5   # => -5

# Comparison operators look at the numerical value of True and False
0 == False  # => True 1
== True   # => True
2 == True   # => False
-5 != False # => True
```

```
# Using boolean logical operators on ints casts them to booleans for evaluation, but their non-cast value is returned
# Don't mix up with bool(ints) and bitwise and/or (&,|) bool(0)
# => False
bool(4)     # => True
bool(-6)    # => True 0
and 2      # => 0
-5 or 0     # => -5

# Equality is ==
1 == 1  # => True
2 == 1  # => False

# Inequality is !=
1 != 1  # => False
2 != 1  # => True

# More comparisons
1 < 10  # => True
1 > 10  # => False
2 <= 2  # => True
2 >= 2  # => True

# Seeing whether a value is in a range
1 < 2 and 2 < 3  # => True
2 < 3 and 3 < 2  # => False
# Chaining makes this look nicer
1 < 2 < 3  # => True
2 < 3 < 2  # => False

# (is vs. ==) is checks if two variables refer to the same object, but == checks
# if the objects pointed to have the same values. a = [1, 2, 3, 4]  # Point a at a new list, [1, 2, 3, 4] b = a             # Point b at what a is pointing to b is a
# => True, a and b refer to the same object b == a            # => True, a's and b's objects are equal b = [1, 2, 3, 4]  # Point b at a new list, [1, 2, 3, 4]
b is a            # => False, a and b do not refer to the same object b
== a           # => True, a's and b's objects are equal

# Strings are created with " or '
```

```
"This is a string."
'This is also a string.'

# Strings can be added too! But try not to do this.
"Hello " + "world!"  # => "Hello world!"
# String literals (but not variables) can be concatenated without using '+'
"Hello " "world!"    # => "Hello world!"

# A string can be treated like a list of characters
"This is a string"[0]  # => 'T'

# You can find the length of a string
len("This is a string")  # => 16

# You can also format using f-strings or formatted string literals (in Python 3.6+) name
= "Reiko"
f"She said her name is {name}." # => "She said her name is Reiko"
# You can basically put any Python statement inside the braces and it will be output in
the string.
f"{name} is {len(name)} characters long." # => "Reiko is 5 characters long."


# None is an object
None  # => None

# Don't use the equality "==" symbol to compare objects to None #
Use "is" instead. This checks for equality of object identity.
"etc" is None  # => False
None is None   # => True

# None, 0, and empty strings/lists/dicts/tuples all evaluate to False.
# All other values are True
bool(0)   # => False
bool("")  # => False bool([])
# => False bool({})  # =>
False
bool(())  # => False
```

2. Variables and Collections

Python has a print function print("I'm Python. Nice to meet you!") # =>
I'm Python. Nice to meet you!

By default the print function also prints out a newline at the end.
Use the optional argument end to change the end string.
print("Hello, World", end="!") # => Hello, World!

Simple way to get input data from console input_string_var = input("Enter
some data: ") # Returns the data as a string # Note: In earlier versions of
Python, input() method was named as raw_input()

There are no declarations, only assignments.
Convention is to use lower_case_with_underscores
some_var = 5 some_var # => 5

Accessing a previously unassigned variable is an exception.
See Control Flow to learn more about exception handling.
some_unknown_var # Raises a NameError

if can be used as an expression
Equivalent of C's '?:' ternary operator
"yahoo!" if 3 > 2 else 2 # => "yahoo!"

Lists store sequences li
= []
You can start with a prefilled list other_li
= [4, 5, 6]

# Add stuff to the end of a list with append
li.append(1)   # li is now [1] li.append(2)
# li is now [1, 2] li.append(4)   # li is now
[1, 2, 4] li.append(3)   # li is now [1, 2, 4,
3] # Remove from the end with pop
li.pop()   # => 3 and li is now [1, 2, 4]
Let's put it back li.append(3)   # li is
now [1, 2, 4, 3] again.

```
# Access a list like you would any array
li[0]   # => 1
# Look at the last element
li[-1]  # => 3

# Looking out of bounds is an IndexError li[4]
# Raises an IndexError
# You can look at ranges with slice syntax.
# The start index is included, the end index is not # (It's a
closed/open range for you mathy types.) li[1:3]   # Return list
from index 1 to 3 => [2, 4] li[2:]    # Return list starting from
index 2 => [4, 3] li[:3]    # Return list from beginning until
index 3  => [1, 2, 4] li[::2]   # Return list selecting every
second entry => [1, 4] li[::-1]  # Return list in reverse order
=> [3, 4, 2, 1]
# Use any combination of these to make advanced slices
# li[start:end:step]

# Make a one layer deep copy using slices li2 = li[:]  # => li2 =
[1, 2, 4, 3] but (li2 is li) will result in false.

# Remove arbitrary elements from a list with "del"
del li[2]  # li is now [1, 2, 3]

# Remove first occurrence of a value li.remove(2)
# li is now [1, 3]
li.remove(2)  # Raises a ValueError as 2 is not in the list

# Insert an element at a specific index
li.insert(1, 2)  # li is now [1, 2, 3] again

# Get the index of the first item found matching the argument li.index(2)
# => 1
li.index(4)  # Raises a ValueError as 4 is not in the list

# You can add lists
# Note: values for li and for other_li are not modified. li
+ other_li  # => [1, 2, 3, 4, 5, 6]
```

```
# Concatenate lists with "extend()" li.extend(other_li)
# Now li is [1, 2, 3, 4, 5, 6]

# Check for existence in a list with "in"
1 in li  # => True

# Examine the length with "len()"
len(li)  # => 6

# Tuples are like lists but are immutable.
tup = (1, 2, 3) tup[0]      # => 1
tup[0] = 3  # Raises a TypeError

# Note that a tuple of length one has to have a comma after the last element but
# tuples of other lengths, even zero, do not. type((1))   # => <class 'int'>
type((1,))  # => <class 'tuple'> type(())    # => <class 'tuple'>

# You can do most of the list operations on tuples too len(tup)
# => 3
tup + (4, 5, 6)  # => (1, 2, 3, 4, 5, 6) tup[:2]
# => (1, 2)
2 in tup         # => True

# You can unpack tuples (or lists) into variables a, b, c =
(1, 2, 3)  # a is now 1, b is now 2 and c is now 3
# You can also do extended unpacking
a, *b, c = (1, 2, 3, 4)  # a is now 1, b is now [2, 3] and c is now 4
# Tuples are created by default if you leave out the parentheses d,
e, f = 4, 5, 6  # tuple 4, 5, 6 is unpacked into variables d, e and f
# respectively such that d = 4, e = 5 and f = 6 #
Now look how easy it is to swap two values e,
d = d, e  # d is now 5 and e is now 4


# Dictionaries store mappings from keys to values empty_dict
= {}
# Here is a prefilled dictionary
filled_dict = {"one": 1, "two": 2, "three": 3}
```

```
# Note keys for dictionaries have to be immutable types. This is to ensure that #
the key can be converted to a constant hash value for quick look-ups.
# Immutable types include ints, floats, strings, tuples.
invalid_dict = {[1,2,3]: "123"}  # => Raises a TypeError: unhashable type: 'list'
valid_dict = {(1,2,3):[1,2,3]}   # Values can be of any type, however.

# Look up values with [] filled_dict["one"]
# => 1 # Get all keys as an iterable with
"keys()". We need to wrap the call in list()
# to turn it into a list. We'll talk about those later.  Note - for Python
# versions <3.7, dictionary key ordering is not guaranteed. Your results might #
not match the example below exactly. However, as of Python 3.7, dictionary #
items maintain the order at which they are inserted into the dictionary.
list(filled_dict.keys())  # => ["three", "two", "one"] in Python <3.7
list(filled_dict.keys())  # => ["one", "two", "three"] in Python 3.7+


# Get all values as an iterable with "values()". Once again we need to wrap it
# in list() to get it out of the iterable. Note - Same as above regarding key #
ordering. list(filled_dict.values())  # => [3, 2, 1]  in Python <3.7
list(filled_dict.values())  # => [1, 2, 3] in Python 3.7+

# Check for existence of keys in a dictionary with "in"
"one" in filled_dict  # => True
1 in filled_dict      # => False

# Looking up a non-existing key is a KeyError filled_dict["four"]
# KeyError

# Use "get()" method to avoid the KeyError
filled_dict.get("one")      # => 1 filled_dict.get("four")
# => None
# The get method supports a default argument when the value is missing
filled_dict.get("one", 4)   # => 1
filled_dict.get("four", 4)  # => 4

# "setdefault()" inserts into a dictionary only if the given key isn't present
filled_dict.setdefault("five", 5)  # filled_dict["five"] is set to 5
filled_dict.setdefault("five", 6)  # filled_dict["five"] is still 5
```

```
# Adding to a dictionary
filled_dict.update({"four":4})  # => {"one": 1, "two": 2, "three": 3, "four": 4}
filled_dict["four"] = 4         # another way to add to dict

# Remove keys from a dictionary with del
del filled_dict["one"]  # Removes the key "one" from filled dict

# From Python 3.5 you can also use the additional unpacking options {'a':
1, **{'b': 2}}  # => {'a': 1, 'b': 2}
{'a': 1, **{'a': 2}}  # => {'a': 2}

# Sets store ... well sets empty_set
= set()
# Initialize a set with a bunch of values. Yeah, it looks a bit like a dict. Sorry. some_set
= {1, 1, 2, 2, 3, 4}  # some_set is now {1, 2, 3, 4}

# Similar to keys of a dictionary, elements of a set have to be immutable.
invalid_set = {[1], 1}  # => Raises a TypeError: unhashable type: 'list' valid_set
= {(1,), 1}

# Add one more item to the set filled_set
= some_set
filled_set.add(5)  # filled_set is now {1, 2, 3, 4, 5}
# Sets do not have duplicate elements
filled_set.add(5)  # it remains as before {1, 2, 3, 4, 5}

# Do set intersection with & other_set
= {3, 4, 5, 6}
filled_set & other_set  # => {3, 4, 5}

# Do set union with |
filled_set | other_set  # => {1, 2, 3, 4, 5, 6}

# Do set difference with - {1, 2, 3,
4} - {2, 3, 5}  # => {1, 4}

# Do set symmetric difference with ^
{1, 2, 3, 4} ^ {2, 3, 5}  # => {1, 4, 5}
```

```
# Check if set on the left is a superset of set on the right
{1, 2} >= {1, 2, 3} # => False

# Check if set on the left is a subset of set on the right
{1, 2} <= {1, 2, 3} # => True

# Check for existence in a set with in
2 in filled_set   # => True
10 in filled_set # => False

# Make a one-layer deep copy
filled_set = some_set.copy()  # filled_set is {1, 2, 3, 4, 5} filled_set
is some_set        # => False
```

3. Control Flow and Iterables

```
# Let's just make a variable
some_var = 5

# Here is an if statement. Indentation is significant in Python!
# Convention is to use four spaces, not tabs. # This prints
"some_var is smaller than 10" if some_var > 10:
print("some_var is totally bigger than 10.") elif some_var <
10:    # This elif clause is optional.     print("some_var is
smaller than 10.") else:                # This is optional too.
print("some_var is indeed 10.")

"""
For loops iterate over lists prints:
    dog is a mammal
cat is a mammal
mouse is a mammal
""" for animal in ["dog", "cat",
"mouse"]:
    # You can use format() to interpolate formatted strings
print("{} is a mammal".format(animal))
```

"""
"range(number)" returns an iterable of numbers
from zero to the given number prints:
   0
   1
   2
   3
""" for i in
range(4):
   print(i)

"""
"range(lower, upper)" returns an iterable of numbers
from the lower number to the upper number prints:
   4
   5
   6
   7 """ for i in
range(4, 8):
   print(i)

"""
"range(lower, upper, step)" returns an iterable of numbers from
the lower number to the upper number, while incrementing by
step. If step is not indicated, the default value is 1. prints:
   4
   6 """ for i in
range(4, 8, 2):
   print(i)

"""
To loop over a list, and retrieve both the index and the value of each item in the list
prints: 0 dog
1 cat
2 mouse """ animals = ["dog",
   "cat", "mouse"] for i, value in
   enumerate(animals):
    print(i, value)

"""
While loops go until a condition is no longer met.
prints:
    0
    1
    2
3 """ x = 0 while x < 4:   print(x)
    x += 1 # Shorthand for x = x + 1

Handle exceptions with a try/except block try:
    # Use "raise" to raise an error   raise IndexError("This is an index error") except
IndexError as e: pass   # Pass is just a no-op. Usually you would do recovery
here. except (TypeError, NameError):   pass   # Multiple exceptions can be
handled together, if required. else: # Optional clause to the try/except block.
Must follow all except blocks   print("All good!")   # Runs only if the code in try raises
no exceptions
finally: # Execute under all circumstances
print("We can clean up resources here")

Instead of try/finally to cleanup resources you can use a with statement
with open("myfile.txt") as f: for line in f: print(line)

Writing to a file contents = {"aa":
12, "bb": 21} with open("myfile1.txt",
"w+") as file:
    file.write(str(contents))   # writes a string to a file

with open("myfile2.txt", "w+") as file:
file.write(json.dumps(contents)) # writes an object to a file

Reading from a file with open('myfile1.txt', "r+") as
file: contents = file.read()   # reads a string from
a file print(contents)
print: {"aa": 12, "bb": 21}

with open('myfile2.txt', "r+") as file:
    contents = json.load(file)   # reads a json object from a file print(contents)
# print: {"aa": 12, "bb": 21}

Python offers a fundamental abstraction called the Iterable.
An iterable is an object that can be treated as a sequence.
The object returned by the range function, is an iterable.

filled_dict = {"one": 1, "two": 2, "three": 3} our_iterable = filled_dict.keys() print(our_iterable) # => dict_keys(['one', 'two', 'three']). This is an object that implements our Iterable interface.

We can loop over it. for i in
our_iterable: print(i) # Prints
one, two, three

However we cannot address elements by index. our_iterable[1]
Raises a TypeError

An iterable is an object that knows how to create an iterator. our_iterator
= iter(our_iterable)

Our iterator is an object that can remember the state as we traverse through it.
We get the next object with "next()". next(our_iterator)
=> "one"

It maintains state as we iterate. next(our_iterator)
=> "two"
next(our_iterator) # => "three"

After the iterator has returned all of its data, it raises a StopIteration exception
next(our_iterator) # Raises StopIteration

# We can also loop over it, in fact, "for" does this implicitly!
our_iterator = iter(our_iterable)
for i in our_iterator: print(i) #
Prints one, two, three

You can grab all the elements of an iterable or iterator by calling list() on it.
list(our_iterable) # => Returns ["one", "two", "three"]
list(our_iterator) # => Returns [] because state is saved

The indention of each line controls whether it is within a loop, if statement, etc. -- there are no { } to define blocks of code. This use of indentation in Python is unusual, but it's logical and you get used to it.

4. Functions

```
# Use "def" to create new functions def
add(x, y):     print("x is {} and y is
{}".format(x, y))
   return x + y  # Return values with a return statement

# Calling functions with parameters
add(5, 6)  # => prints out "x is 5 and y is 6" and returns 11

# Another way to call functions is with keyword arguments add(y=6,
x=5)  # Keyword arguments can arrive in any order.

# You can define functions that take a variable number of
# positional arguments def
varargs(*args):
   return args

varargs(1, 2, 3)  # => (1, 2, 3)

# You can define functions that take a variable number of
# keyword arguments, as well def
keyword_args(**kwargs):
   return kwargs

# Let's call it to see what happens
keyword_args(big="foot", loch="ness")  # => {"big": "foot", "loch": "ness"}


# You can do both at once, if you like def
all_the_args(*args, **kwargs):
   print(args)
print(kwargs)
"""
all_the_args(1, 2, a=3, b=4) prints:
   (1, 2)
```

```
    {"a": 3, "b": 4}
"""

# When calling functions, you can do the opposite of args/kwargs!
# Use * to expand tuples and use ** to expand kwargs.
args = (1, 2, 3, 4) kwargs = {"a": 3, "b": 4} all_the_args(*args)
# equivalent to all_the_args(1, 2, 3, 4) all_the_args(**kwargs)
# equivalent to all_the_args(a=3, b=4)
all_the_args(*args, **kwargs)  # equivalent to all_the_args(1, 2, 3, 4, a=3, b=4)

# Returning multiple values (with tuple assignments) def swap(x, y):
return y, x  # Return multiple values as a tuple without the parenthesis.
# (Note: parenthesis have been excluded but can be included)

x = 1 y = 2 x, y = swap(x, y)     # =>
x = 2, y = 1
# (x, y) = swap(x,y)  # Again parenthesis have been excluded but can be included.

# Function Scope
x = 5

def set_x(num):
    # Local var x not the same as global variable x
x = num    # => 43
    print(x)   # => 43

def set_global_x(num):
    global x
print(x)   # => 5
    x = num    # global var x is now set to 6
    print(x)   # => 6

set_x(43)
set_global_x(6)


# Python has first class functions
```

```
def create_adder(x):
def adder(y):
return x + y
   return adder

add_10 = create_adder(10)
add_10(3)   # => 13

# There are also anonymous functions
(lambda x: x > 2)(3)                # => True
(lambda x, y: x ** 2 + y ** 2)(2, 1)  # => 5

# There are built-in higher order functions list(map(add_10,
[1, 2, 3]))         # => [11, 12, 13] list(map(max, [1, 2, 3], [4,
2, 1]))  # => [4, 2, 3]

list(filter(lambda x: x > 5, [3, 4, 5, 6, 7]))  # => [6, 7]

# We can use list comprehensions for nice maps and filters
# List comprehension stores the output as a list which can itself be a nested list
[add_10(i) for i in [1, 2, 3]]         # => [11, 12, 13]
[x for x in [3, 4, 5, 6, 7] if x > 5]  # => [6, 7]

# You can construct set and dict comprehensions as well.
{x for x in 'abcddeef' if x not in 'abc'}  # => {'d', 'e', 'f'}
{x: x**2 for x in range(5)}  # => {0: 0, 1: 1, 2: 4, 3: 9, 4: 16}
```

5. Modules

```
# You can import modules import
math
print(math.sqrt(16))  # => 4.0

# You can get specific functions from a module
from math import ceil, floor print(ceil(3.7))   #
=> 4.0
print(floor(3.7))  # => 3.0
```

```
# You can import all functions from a module.
# Warning: this is not recommended from
math import *

# You can shorten module names import
math as m
math.sqrt(16) == m.sqrt(16)  # => True

# Python modules are just ordinary Python files. You #
can write your own, and import them. The name of the #
module is the same as the name of the file.

# You can find out which functions and attributes
# are defined in a module. import math
dir(math)

# If you have a Python script named math.py in the same
# folder as your current script, the file math.py will # be
loaded instead of the built-in Python module. # This
happens because the local folder has priority # over
Python's built-in libraries.
```

Example:

Write a python program to display content of a file.

```
#!/usr/bin/python -tt

"""
-tt flag above detects space/tab indent problems
"""

# sys is one of many available modules of library code, import to use.
# sys.argv is the list of command line arguments.
import sys

# defines a global variable a
= 123
```

```
# defines a 'cat' function which takes a filename def
cat(filename):
  """Given filename, print its text contents."""
  print  filename,  '======='
f = open(filename, 'r')
  for line in f:  # goes through a text file line by line     print line,
# trailing comma inhibits the ending print-newline   #
alternative, read the whole file into a single string:   # text =
f.read()   f.close()

def main():
  # sys.argv contains command line arguments.
  # This assigns a list of all but the first arg into a local 'args' var.   args
= sys.argv[1:]

  # important syntax -- loop of variable 'filename' over the args list.   for
filename in args:
    # detect scary filenames: if/else and/or/not       if
filename == 'voldemort' or filename == 'vader':
      print     'this     file     is     very     worrying'
cat(filemane, 123, bad_variable)
      # important point: errors in above line only caught if it is run     else:
      #           regular           case
cat(filename)
  print 'all done'  # this print is outside the loop, due to its indentation


# Standard boilerplate at end of file to call main() function. if
__name__ == '__main__':
  main()
```

Defining a Class in Python

Like function definitions begin with the def keyword in Python, class definitions begin with a class keyword.

The first string inside the class is called docstring and has a brief description about the class. Although not mandatory, this is highly recommended.

Here is a simple class definition.

```
class MyNewClass:
    '''This is a docstring. I have created a new class'''
pass
```

A class creates a new local namespace where all its attributes are defined. Attributes may be data or functions.

There are also special attributes in it that begins with double underscores __. For example, __doc__ gives us the docstring of that class.

As soon as we define a class, a new class object is created with the same name. This class object allows us to access the different attributes as well as to instantiate new of class.

```
class Person:
    "This is a person
class"     age = 10

    def greet(self):
print('Hello')


# Output: 10
print(Person.age)

# Output: <function Person.greet>
print(Person.greet)
```

```
# Output: 'This is my second class'
print(Person.__doc__)
```

Output

```
10
<function Person.greet at 0x7fc78c6e8160>
This is a person class
```

Creating an Object in Python

We saw that the class object could be used to access different attributes.

It can also be used to create new object instances instantiation) of that class. The procedure to create an object is similar to a function call

```
>>> harry = Person()
```

This will create a new object instance named `harry`. We can access the attributes of objects using the object name prefix.

Attributes may be data or method. Methods of an object are corresponding functions of that class.

This means to say, since `Person.greet` is a function object (attribute of class), `Person.greet` will be a method object.

```
class Person:
    "This is a person class"
age = 10

    def greet(self):
print('Hello')


# create a new object of Person class
harry = Person()

# Output: <function Person.greet>
print(Person.greet)

# Output: <bound method Person.greet of <__main__.Person object>>
print(harry.greet)

# Calling object's greet() method
# Output: Hello
harry.greet()
```

Output

```
<function Person.greet at 0x7fd288e4e160>
<bound method Person.greet of <__main__.Person object at 0x7fd288e9fa30>>
Hello
```

You may have noticed the `self` parameter in function definition inside the class but we called the method simply as `harry.greet()` without any arguments. It still worked.

This is because, wh`harry.greet()` translates into `Person.greet(harry)`. lf is passed as the first argument. So, .

In general, calling a method with a list of n arguments is equivalent to calling the corresponding function with an argument list that is created by inserting the method's object before the first argument.

For these reasons, the first arg`self`nt of the function in class must be the object itself. This is conventionally called . It can be named otherwise but highly recommend to follow the convention.

Another Example:

```
# We use the "class" statement to create a class
class Human:
    # A class attribute. It is shared by all instances of this class
species = "H. sapiens"
    # Basic initializer, this is called when this class is instantiated.
    # Note that the double leading and trailing underscores denote objects
    # or attributes that are used by Python but that live in user-controlled
    # namespaces. Methods(or objects or attributes) like: __init__, __str__,
    # __repr__ etc. are called special methods (or sometimes called dunder methods)
# You should not invent such names on your own.     def __init__(self, name):

        # Assign the argument to the instance's name attribute
self.name = name
```

```
        # Initialize property
    self._age = 0

    # An instance method. All methods take "self" as the first argument
    def say(self, msg):
        print("{name}: {message}".format(name=self.name, message=msg))

    # Another instance method
    def sing(self):
        return 'yo... yo... microphone check... one two... one two...'

    # A class method is shared among all instances
    # They are called with the calling class as the first argument
    @classmethod
    def get_species(cls):
        return cls.species

    # A static method is called without a class or instance reference
    @staticmethod
    def grunt():
        return "*grunt*"

    # A property is just like a getter.
    # It turns the method age() into an read-only attribute of the same name.
    # There's no need to write trivial getters and setters in Python, though.
    @property
    def age(self):
```

```
        return self._age
    # This allows the property to be set
    @age.setter
def age(self, age):
self._age = age
    # This allows the property to be deleted
    @age.deleter
def age(self):
del self._age
# When a Python interpreter reads a source file it executes all its code. # This
__name__ check makes sure this code block is only executed when this #
module is the main program.

if __name__ == '__main__':
    # Instantiate a class
i = Human(name="Ian")
    i.say("hi")                 # "Ian: hi"
j = Human("Joel")
    j.say("hello")              # "Joel: hello"
    # i and j are instances of type Human, or in other words: they are Human objects


    # Call our class method
    i.say(i.get_species())      # "Ian: H. sapiens"
```

```
    # Change the shared attribute
    Human.species = "H. neanderthalensis"
    i.say(i.get_species())        # => "Ian: H. neanderthalensis"
    j.say(j.get_species())        # => "Joel: H. neanderthalensis"
    # Call the static method
print(Human.grunt())          # => "*grunt*"
    # Cannot call static method with instance of object
    # because i.grunt() will automatically put "self" (the object i) as an argument
    print(i.grunt())              # => TypeError: grunt() takes 0 positional arguments but 1
was given


    # Update the property for this instance
    i.age = 42    #
Get the property
    i.say(i.age)                  # => "Ian: 42"
    j.say(j.age)                  # => "Joel: 0"
# Delete the property     del i.age
    # i.age                       # => this would raise an AttributeError
```

Example: Write a Python program to convert an integer to a roman numeral.

```
class py_solution:     def
int_to_Roman(self, num):
        val = [
            1000, 900, 500, 400,
            100, 90, 50, 40,
            10, 9, 5, 4,
            1
```

```
        ]
    syb = [
        "M", "CM", "D", "CD",
        "C", "XC", "L", "XL",
        "X", "IX", "V", "IV",
        "I"
        ]
    roman_num = ''
    i = 0        while  num > 0:
for _ in range(num // val[i]):
            roman_num += syb[i]
            num -= val[i]
i += 1
    return roman_num

print(py_solution().int_to_Roman(1)) print(py_solution().int_to_Roman(4000)).
```

LAB ASSIGNMENTS:

1. Write a python program to reverse a content a file and store it in another file.
2. Write a python program to implement binary search with recursion.
3. Write a python program to sort words in alphabetical order.
4. Write a Python class to get all possible unique subsets from a set of distinct integers Input:[4,5,6]
   Output : [[], [6], [5], [5, 6], [4], [4, 6], [4, 5], [4, 5, 6]]
5. Write a Python class to find a pair of elements (indices of the two numbers) from a given array whose sum equals a specific target number.
   Input: numbers= [10,20,10,40,50,60,70], target=50
   Output: 3, 4.
6. Write a Python class to implement pow(x, n).
7. Write a Python class which has two methods get_String and print_String. The get_String accept a string from the user and print_String print the string in upper case.

HOME ASSIGNMENTS:

1. Write a python program to select smallest element from a list in an expected linear time.
2. Write a python program to implement bubble sort.
3. Write a python program to multiply two matrices
4. Write a Python class to find validity of a string of parentheses, '(', ')', '{', '}', '[' and ']. These brackets must be close in the correct order, for example "()" and "()[]{}" are valid but "[)", "({[)]" and "{{{" are invalid.
5. Write a Python class to reverse a string word by word.
6. Write a Python class named Circle constructed by a radius and two methods which will compute the area and the perimeter of a circle.