

Department of Mathematics, IIT Madras
MA-5105-Scientific Computing & Advanced Programming Lab
Practice Problems 1

August 5, 2026

Lecturer: Saurav Samantaray

TA: Rohit Kumar Mani

Q. 1 Initialise the string "Barking up the wrong tree", preferably with some variable name of your choice

- access the element number 15
- concatenate it with "in futility"
- display the concatenated string
- print its length using the `len()` function.
- what happens when you try to access the element no 54.
- eventually consolidate all the above in a single script and run.

Q. 2 try negative indices lets say [-9:-6] for a string.

Q. 3 Write a script that assigns the floating-point literal 175000.0 to the variable `num` using exponential notation, and then prints `num` in the interactive window.

Q. 4 Now use concatenation to create a new string from an old string by changing only a few letters.

Q. 5 Try `name = "Jean-luc Picard"`
`>>> name.lower()`.

Q. 6 `.upper()` method.

Q. 7 Try `len()` function

Q. 8 Use IDLE to Discover Additional String Methods
`>>> starship = "Enterprise"`

Q. 9 Try
`>>> num = "2"`
`>>> num + num`

Q. 10 Strings can be “multiplied” by a number as long as that number is an integer, or whole number. Try:

```
>>> num = "12"
>>> num * 3
>>> "12" * "3"
>>> "3" + 3
```

Q. 11 Try `int("12")`

Q. 12 `str()` can even handle arithmetic expressions: Try

```
>>> total_pancakes = 10
>>> pancakes_eaten = 5
>>> "Only " + str(total_pancakes - pancakes_eaten) + " pancakes
left."
```

Q. 13 Find a String in a String:

```
>>> phrase = "the surprise is in here somewhere"
>>> phrase.find("surprise")
```

Q. 14 check with a different string that’s not present and what is the result.

Q. 15 Try `>>> "My number is 555-555-5555".find(5)`
and `>>> "My number is 555-555-5555".find("5")`

Q. 16 Just like `.find()`, you tack `.replace()` on to the end of a variable or string literal.

```
>>> my_story = "I’m telling you the truth; nothing but the truth!"
>>> my_story.replace("the truth", "lies")
```

Q. 17 strings are immutable objects right!!!

Q. 18 Write a script called `temperature.py` that defines two functions:

- `convert_cel_to_far()` which takes one float parameter representing degrees Celsius and returns a float representing the same temperature in degrees Fahrenheit using the following formula:

$$F = C * 9/5 + 32$$

- `convert_far_to_cel()` which take one float parameter representing degrees Fahrenheit and returns a float representing the same temperature in degrees Celsius using the following formula:

$$C = (F - 32) * 5/9$$

- The script should first prompt the user to enter a temperature in degrees Fahrenheit and then display the temperature converted to Celsius.
- Then prompt the user to enter a temperature in degrees Celsius and display the temperature converted to Fahrenheit.

- All converted temperatures should be rounded to 2 decimal places.

- Q. 19** Write a function called `doubles()` that takes one number as its input and doubles that number. Then use the `doubles()` function in a loop to double the number 2 three times, displaying each result on a separate line.
- Q. 20** A projectile is launched vertically from the top of a 20 m building with an initial velocity of 25 m/s. The height of the projectile at time t seconds is

$$h(t) = 20 + 25t - 4.9t^2.$$

Tasks

- (a) Write a Python function

`height(t)`

that returns the height of the projectile at time t .

- (b) Determine the time at which the projectile first reaches the ground.
 (c) Your program should compute the answer to an accuracy of

10^{-6} seconds.

- (d) Verify that the required time lies between 5 and 10 seconds.

Hint: Think carefully about what mathematical equation must be solved to determine when the projectile reaches the ground.

- Q. 21** A spherical balloon is being inflated with helium. At a certain instant, the balloon contains

500 m^3

of gas.

Tasks

- (a) Develop a mathematical model relating the volume of the balloon to its radius.
 (b) Write a Python function that computes the volume of the balloon for a given radius.
 (c) Using your program, determine the radius of the balloon to an accuracy of

10^{-6} m .

- (d) Verify that the radius lies between 4 m and 6 m.