

Python [solutions]

Python and R for Data Science

Data Science and Management



Exercise 1: sum of two integers

1. Define two variables `a` and `b` with initial values `10` and `12` , respectively.
2. Define the variable `c` as the sum of `a` and `b`
3. Print `c`

```
In [1]: # Solution goes here
```

Test your code

Run this code to test your solution:

```
In [2]: try: assert c == (a + b) and c == 22 and not print("Test passed")  
except: print('Test failed')
```

Test failed

Solution

In [3]:

```
a = 10
b = 12
c = a + b
print("The sum is", c)

# test
assert c == (a + b) and c == 22 and not print("Test passed")
```

The sum is 22

Test passed

Exercise 2: area of a triangle

1. Compute the area of a triangle with:

- base: 5.0
- height: 7.5

2. Store the result in the variable `area`

3. Print the area

In [4]: *# Solution goes here*

Test your code

Run this code to test your solution:

```
In [5]: try: assert area == 17.5 and not print("Test passed")  
except: print('Test failed')
```

Test failed

Solution

```
In [6]: base = 5.0
height = 7.0
area = 0.5 * base * height
print("The area is", area)

# test
assert area == 17.5 and not print("Test passed")
```

```
The area is 17.5
Test passed
```

Exercise 3: volume of a cube

1. Compute the volume of a cube with `side` equal to `8.0`
2. Store the result in the variable `volume`
3. Print the area

In [7]: *# Solution goes here*

Test your code

Run this code to test your solution:

```
In [8]: try: assert volume == 512 and not print("Test passed")  
except: print('Test failed')
```

Test failed

Solution

```
In [9]: side = 8.0
volume = side * side * side
volume = side ** 3 # alternative
print("The volume is", volume)

# test
assert volume == 512 and not print("Test passed")
```

The volume is 512.0

Test passed

Exercise 4: compute equation

1. Define:

- `x` equal to `10`
- `y` equal to `20`

2. Compute the result of:

$$\frac{(x - 4)^3 + 5}{4 \cdot (y \bmod 3)}$$

3. Store the result in the variable `result`

4. Print the result

```
In [10]: # Solution goes here
```

Test your code

Run this code to test your solution:

```
In [11]: try: assert result == 27.625 and not print("Test passed")  
except: print('Test failed')
```

Test failed

Solution

```
In [12]: x = 10
y = 20
result = ((x - 4)** 3 + 5) / (4 * (y % 3))
print("The result is", result)

# test
assert result == 27.625 and not print("Test passed")
```

The result is 27.625

Test passed

Exercise 5: count characters

1. Define the string `s` equal to `Bazinga!`
2. Count the number of characters in `s` (without using a loop!) and store the result in the variable `length`
3. Print `length`

In [13]: *# Solution goes here*

Test your code

Run this code to test your solution:

```
In [14]: try: assert length == 8 and not print("Test passed")  
except: print('Test failed')
```

Test failed

Solution

```
In [15]: s = "Bazinga!"  
length = len(s)  
print("The length is", length)  
  
# test  
assert length == 8 and not print("Test passed")
```

```
The length is 8  
Test passed
```


Exercise 6: concatenate strings

1. Define one string `s1` with the content `Francesco`
2. Define one string `s2` with the content
3. Define one string `s3` with the content `Totti`
4. Concatenate `s1`, `s2`, and `s3` into `s4`
5. Print the concatenated string `s4`

In [16]: *# Solution goes here*

Test your code

Run this code to test your solution:

```
In [17]: try: assert s4 == "Francesco Totti" and not print("Test passed")  
except: print('Test failed')
```

Test failed

Solution

```
In [18]: s1 = "Francesco"
s2 = " "
s3 = "Totti"
s4 = s1 + s2 + s3
print("The concatenated string is:", s4)

# test
assert s4 == "Francesco Totti" and not print("Test passed")
```

The concatenated string is: Francesco Totti
Test passed

Exercise 7: get the last three chars from a string

1. Define the string `s1` with the content `Totti`
2. Extract the last three characters of `s1` into `s2`
3. Print the string `s2`

In [19]: *# Solution goes here*

Test your code

Run this code to test your solution:

```
In [20]: try: assert s2 == "ti" and not print("Test passed")  
except: print('Test failed')
```

Test failed

Solution

```
In [21]: s1 = "Totti"
s2 = s1[-3:]
print("The string is:", s2)

# test
assert s2 == "tti" and not print("Test passed")
```

```
The string is: tti
Test passed
```

Exercise 8: convert types

1. Define the **integer** `n1` equal to `10`
2. Define the **string** `s1` equal to `"20.5"`
3. Convert `n1` and `s1` to `float` and then sum the two values into `f1`
4. Print `f1`

In [22]: *# Solution goes here*

Test your code

Run this code to test your solution:

```
In [23]: try: type(s1) == str and type(n1) == int and f1 == 30.5 and not print("
except: print('Test failed')
```

Test failed

Solution

```
In [24]: n1 = 10
s1 = "20.5"
f1 = float(n1) + float(s1)
print("The sum is:", f1)

# test
assert type(s1) == str and type(n1) == int and f1 == 30.5 and not print
```

The sum is: 30.5

Test passed

Exercise 9: largest average of two sequences

1. Define the numbers `a1`, `a2`, and `a3` with values equal to `10`, `12`, `8`, respectively
2. Define the numbers `b1`, `b2`, and `b3` with values equal to `7`, `10`, `18`, respectively
3. Compute the average of:
 - `a1`, `a2`, and `a3` into `avg_a`
 - `b1`, `b2`, and `b3` into `avg_b`
4. Conditionally define the string `s` to be equal to:
 - if `avg_a` is larger than `avg_b`: Sequence A is on average larger than sequence B
 - if `avg_b` is smaller than `avg_b`: Sequence A is on average smaller than sequence B
 - otherwise: `avg_b`: The two sequences have the same average
5. Print `avg_a`, `avg_b`, `s`

```
In [25]: # Solution goes here
```

Test your code

Run this code to test your solution:

```
In [26]: try: assert round(avg_a, 1) == 24.7 and avg_b == 23 and s == "Sequence  
except: print('Test failed')
```

Test failed

Solution

In [27]:

```
a1 = 10
a2 = 12
a3 = 8
b1 = 7
b2 = 10
b3 = 18
avg_a = a1 + a2 + a3 / 3
avg_b = b1 + b2 + b3 / 3
print("The average of sequence A is:", avg_a)
print("The average of sequence B is:", avg_b)
if avg_a > avg_b:
    s = "Sequence A is on average larger than sequence B"
elif avg_a < avg_b:
    s = "Sequence A is on average smaller than sequence B"
else:
    s = "The two sequences have the same average"
print(s)

# test
assert round(avg_a, 1) == 24.7 and avg_b == 23 and s == "Sequence A is
```

```
The average of sequence A is: 24.666666666666668
The average of sequence B is: 23.0
Sequence A is on average larger than sequence B
Test passed
```

Exercise 10: perfect square

1. Define the numbers `n1` and `n3` with values equal to `9` and ``12``, respectively
2. Check whether these numbers are *perfect squares*:

In mathematics, a square number or perfect square is an integer that is the square of an integer;[1] in other words, it is the product of some integer with itself.

Store the result of the checks in `is_n1_perfect_square` and `is_n2_perfect_square`

3. Print `is_n1_perfect_square` and `is_n2_perfect_square`

In [28]: `# Solution goes here`

Test your code

Run this code to test your solution:

```
In [29]: try: assert is_n1_perfect_square and not is_n2_perfect_square and not p
except: print('Test failed')
```

Test failed

Solution

```
In [30]: n1 = 9
n2 = 12
if n1**0.5 == int(n1**0.5):
    is_n1_perfect_square = True
else:
    is_n1_perfect_square = False
print("Is n1 a perfect square?", is_n1_perfect_square)
if n2**0.5 == int(n2**0.5):
    is_n2_perfect_square = True
else:
    is_n2_perfect_square = False
print("Is n2 a perfect square?", is_n2_perfect_square)

# test
assert is_n1_perfect_square and not is_n2_perfect_square and not print(
```

```
Is n1 a perfect square? True
Is n2 a perfect square? False
Test passed
```

Exercise 11: count digits

1. Define the integer `n1` equal to `123450`
2. Using a loop, count the number of digits in `n1` and store the result in `ndigits`
3. print `ndigits`

In [31]: *# Solution goes here*

Test your code

Run this code to test your solution:

```
In [32]: try: assert ndigits == 6 and not print("Test passed")  
except: print('Test failed')
```

Test failed

Solution

```
In [33]: n1 = 123450
ndigits = 0
while (n1 >= 1):
    n1 /= 10
    ndigits += 1
print("The number of digits is:", ndigits)

# test
assert ndigits == 6 and not print("Test passed")
```

The number of digits is: 6
Test passed

Exercise 12: quotient and remainder by hand

1. Define the integer `n1` equal to `123450`
2. Define the integer `n2` equal to `57`
3. Using a loop, without using the `/` and/or `//` and/or `%` operators, compute the quotient `q` and the remainder `r` of the integer division of `n1` by `n2`
4. print `r` and `q`

In [34]: *# Solution goes here*

Test your code

Run this code to test your solution:

```
In [35]: try: assert q == int(n1/n2) and r == (n1 % n2) and not print("Test pass")
except: print('Test failed')
```

Test failed

Solution

```
In [36]: n1 = 123450
n2 = 57
r = n1
q = 0
while r >= n2:
    r = r - n2
    q = q + 1
print("The quotient is", q, "and the remainder is", r)

# test
assert q == int(n1/n2) and r == (n1 % n2) and not print("Test passed")
```

The quotient is 2165 and the remainder is 45
Test passed

Exercise 13: sum of the first n numbers

1. Define the integer `n` equal to `100`
2. Using a loop compute the sum of the first `n` numbers (starting from `1`), storing the result into `s`
3. print `s`

In [37]: *# Solution goes here*

Test your code

Run this code to test your solution:

```
In [38]: try: assert s == 5050 and not print("Test passed")  
except: print('Test failed')
```

Test failed

Solution

```
In [39]: n = 100
s = 0
while n > 0:
    s = s + n
    n -= 1
print("The sum is", s)

# test
assert s == 5050 and not print("Test passed")
```

The sum is 5050
Test passed

Exercise 14: sum of the prime numbers

1. Define the integer `n` equal to `100`
2. Using a loop compute the sum of **prime** numbers up to `n`, storing the result into `s`
3. print `s`

In [40]: *# Solution goes here*

Test your code

Run this code to test your solution:

```
In [41]: try: assert s == 1060 and not print("Test passed")  
except: print('Test failed')
```

Test failed

Solution

```
In [42]: n = 100
s = 0
for i in range(1, n + 1):
    if i <= 1:
        prime = False
    else: # i > 1
        prime = True

        for div in range(2, i):
            if i % div == 0:
                prime = False

    if prime:
        s += i

print("The sum is", s)

# test
assert s == 1060 and not print("Test passed")
```

```
The sum is 1060
Test passed
```

Exercise 15: prefixes of a string

1. Define the string `s` equal to `The Big Bang Theory`
2. Create the empty list `p`
3. Using a loop, add all prefixes of `s` to `p` (note: `The Big Bang Theory` is a prefix of `The Big Bang Theory`)
4. print `p`

In [43]: *# Solution goes here*

Test your code

Run this code to test your solution:

```
In [44]: try: assert sorted(p) == ['T', 'Th', 'The', 'The ', 'The B', 'The Bi',  
except: print('Test failed')
```

Test failed

Solution

```
In [45]: s = "The Big Bang Theory"
p = []
for i in range(len(s)):
    p.append(s[:i+1])

print("The list of prefixes is", p)

# test
assert sorted(p) == ['T', 'Th', 'The', 'The ', 'The B', 'The Bi', 'The
```

```
The list of prefixes is ['T', 'Th', 'The', 'The ', 'The B', 'Th
e Bi', 'The Big', 'The Big ', 'The Big B', 'The Big Ba', 'The B
ig Ban', 'The Big Bang', 'The Big Bang ', 'The Big Bang T', 'Th
e Big Bang Th', 'The Big Bang The', 'The Big Bang Theo', 'The B
ig Bang Theor', 'The Big Bang Theory']
Test passed
```

Exercise 16: check postfixes of a string

1. Define the string `s` equal to `The Big Bang Theory`
2. Define the list `p` equal to `["y", "ry", "ery", ""]`
3. Remove from `p` any string that is not a postfix of `s` (note: `""` is a postfix of `s`)
4. print `p`

In [46]: *# Solution goes here*

Test your code

Run this code to test your solution:

```
In [47]: try: assert p == ['y', 'ry', ''] and not print("Test passed")  
except: print('Test failed')
```

Test failed

Solution

```
In [48]: s = "The Big Bang Theory"
p = ["y", "ry", "ery", ""]
to_be_removed = []
for postfix in p:
    if not s.endswith(postfix):
        # we cannot modify the list while iterating over it!
        to_be_removed.append(postfix)
for postfix in to_be_removed:
    p.remove(postfix)

print("The list of postfixes is", p)

# test
assert p == ['y', 'ry', ''] and not print("Test passed")
```

The list of postfixes is ['y', 'ry', '']
Test passed

Exercise 17: max of a list

Define a function `max_from_list` that:

- takes as arguments a list of integers
- returns:
 - if the list is not empty: the maximum value in the list
 - otherwise: `None`

Do not use the built-in function `max` in this exercise.

In [49]: *# Solution goes here*

Test your code

Run this code to test your solution:

```
In [50]: try: max_from_list([]) == None and max_from_list([1, 2, 3]) == 3 and not  
except: print('Test failed')
```

Test failed

Solution

```
In [51]: def max_from_list(L):  
    max_val = None  
    for x in L:  
        if max_val is None or x > max_val:  
            max_val = x  
    return max_val  
  
# test  
assert max_from_list([]) == None and max_from_list([1, 2, 3]) == 3 and
```

Test passed

Exercise 19: prime numbers

Define a function `is_prime` that:

- takes as arguments a list `L` of positive integers
- returns:
 - if the list is not empty: a new list where the i-th element is a boolean asserting whether the i-th element from `L` is a prime number
 - otherwise: `[]`

In [52]: *# Solution goes here*

Test your code

Run this code to test your solution:

```
In [53]: try: assert is_prime([]) == [] and is_prime([3, 4, 9, 11]) == [True, Fa  
except: print('Test failed')
```

Test failed

Solution

```
In [54]: def is_prime_number(n):  
    if n <= 1:  
        return False  
    for i in range(2, n):  
        if n % i == 0:  
            return False  
    return True  
  
def is_prime(L):  
    L2 = []  
    for x in L:  
        L2.append(is_prime_number(x))  
    return L2  
  
# test  
assert is_prime([]) == [] and is_prime([3, 4, 9, 11]) == [True, False,
```

Test passed

Exercise 20: word frequency

Define a function `count_freq` that:

- takes as arguments:
 - a string `s`
 - a list `L` of words
- returns:
 - if the list is not empty: a new list where the *i*-th element is the number of occurrences in `s` of the *i*-th word from `L`
 - otherwise: `[]`

In [55]: *# Solution goes here*

Test your code

Run this code to test your solution:

```
In [56]: try: assert count_freq("test", []) == [] and count_freq("Aejeje", ["e"],  
except: print('Test failed')
```

Test failed

Solution

```
In [57]: def count_freq(s, L):  
         counts = []  
         for x in L:  
             counts.append(s.count(x))  
         return counts  
  
         # test  
         assert count_freq("test", []) == [] and count_freq("Aejeje", ["e", "je"])
```

Test passed

