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NPTEL (https://swayam.gov.in/explorer?ncCode=NPTEL) » Programming, Data Structures And Algorithms Using Python (course)

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Course outline

How does an NPTEL online course work?

Week 1 : Introduction

Week 1 Quiz

🔵 **Quiz: Week 1 Quiz (assessment? name=104)**

Week 2: Basics of Python

Week 2 Quiz

Week 2 Programming Assignment

Week 3: Lists, inductive function definitions, sorting

Week 1 Quiz

The due date for submitting this assignment has passed.

Due on 2020-09-30, 23:59 IST.

Score: 4/4=100%

Assignment submitted on 2020-09-14, 17:34 IST

All questions carry equal weightage. All Python code is assumed to be executed using Python3. You may submit as many times as you like within the deadline. Your final submission will be graded.

1) What does h(19685) return for the following function definition?

```
def h(x):
    (d,n) = (1,0)
    while d <= x:
        (d,n) = (d*3,n+1)
    return(n)
```

```
10
```

Yes, the answer is correct.
Score: 1
Accepted Answers:
(Type: Numeric) 10

1 point

2) What is g(36) - g(35), given the definition of g below?

```
def g(n):
    s=0
    for i in range(2,n):
        if n%i == 0:
            s = s+1
    return(s)
```

```
5
```

Yes, the answer is correct.
Score: 1
Accepted Answers:
(Type: Numeric) 5

1 point

3) Consider the following function f.   *1 point*

```
def f(n):
    s=0
    for i in range(1,n+1):
        if n//i == i and n%i == 0:
            s = 1
    return(s%2 == 1)
```

The function f(n) given above returns True for a positive number n if and only if:

- ○ n is an odd number.
- ○ n is a prime number.
- ● n is a perfect square.
- ○ n is a composite number.

Yes, the answer is correct.
Score: 1
Feedback:
*f(n) sets s to 1 if there is a number i such that i*i == n.*

Accepted Answers:
n is a perfect square.

4) Consider the following function fpp.   *1 point*

```
def foo(m):
    if m == 0:
        return(0)
    else:
        return(m+foo(m-1))
```

Which of the following is correct?

- ○ The function always terminates with f(n) = factorial of n
- ○ The function always terminates with f(n) = n(n+1)/2
- ○ The function terminates for nonnegative n with f(n) = factorial of n
- ● The function terminates for nonnegative n with f(n) = n(n+1)/2

Yes, the answer is correct.
Score: 1

Feedback:
If m is negative, the function does not terminate. Otherwise, it computes 1+2+..+m = m(m+1)/2.

Accepted Answers:
The function terminates for nonnegative n with f(n) = n(n+1)/2

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Week 2 Quiz

The due date for submitting this assignment has passed.

Due on 2020-09-30, 23:59 IST.

Score: 10/10=100%

Assignment submitted on 2020-09-25, 18:35 IST

All questions carry equal weightage. All Python code is assumed to be executed using Python3. You may submit as many times as you like within the deadline. Your final submission will be graded.
Note:

- If the question asks about a value of type `string`, remember to enclose your answer in single or double quotes.
- If the question asks about a value of type `list`, remember to enclose your answer in square brackets and use commas to separate list items.

1) One of the following 10 statements generates an error. Which one? (Your answer should be a number between 1 and 10.)

```
x = ["slithy",[7,10,12],2,"tove",1]  # Statement 1
y = x[0:50]                          # Statement 2
z = y                                # Statement 3
w = x                                # Statement 4
x[0] = x[0][:5] + 'ery'              # Statement 5
y[2] = 4                             # Statement 6
z[4] = 42                            # Statement 7
w[0][:3] = 'fea'                     # Statement 8
x[1][0] = 5555                       # Statement 9
a = (x[4][1] == 1)                   # Statement 10
```

```
8
```

Yes, the answer is correct.
Score: 2.5

Accepted Answers:
(Type: Numeric) 8

2.5 points

2) Consider the following lines of Python code.   **2.5 points**

```
b = [23,44,87,100]
a = b[1:]
d = b[2:]
c = b
d[0] = 97
c[2] = 77
```

Which of the following holds at the end of this code?

- ⚪ `a[1] == 77, b[2] == 77, c[2] == 77, d[0] == 97`
- ⚪ `a[1] == 87, b[2] == 87, c[2] == 77, d[0] == 97`
- 🔘 `a[1] == 87, b[2] == 77, c[2] == 77, d[0] == 97`
- ⚪ `a[1] == 97, b[2] == 77, c[2] == 77, d[0] == 97`

Yes, the answer is correct.
Score: 2.5

Feedback:
a[1] == 87, b[2] == 77, c[2] == 77, d[0] == 97
b and c refer to the same list, while a and d are two independent slices. The update to d[0] does not affect any of the other lists, but the update to c[2] is also reflected in b[2].

Accepted Answers:
a[1] == 87, b[2] == 77, c[2] == 77, d[0] == 97

3) What is the value of `endmsg` after executing the following lines?

```
startmsg = "python"
endmsg = ""
for i in range(1,1+len(startmsg)):
  endmsg = startmsg[-i] + endmsg
```

```
'python'
```

Yes, the answer is correct.
Score: 2.5

Accepted Answers:
(Type: Regex Match) \s\'python\'\s**
(Type: Regex Match) \s\"python\"\s**

2.5 points

4) What is the value of `mylist` after the following lines are executed?

```
def mystery(l):
  l = l[1:]
  return()

mylist = [7,11,13]
mystery(mylist)
```

[7, 11, 13]

Yes, the answer is correct.
Score: 2.5

Accepted Answers:
(Type: Regex Match) \s\[\s*7,\s*11,\s*13\s*]\s***

2.5 points

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Week 1 : Introduction

Week 1 Quiz

Week 2: Basics of Python

Week 2 Quiz

Week 2 Programming Assignment

Week 3: Lists, inductive function definitions, sorting

Week 3 Programming Assignment

Week 4 Quiz

The due date for submitting this assignment has passed.

Due on 2020-10-14, 23:59 IST.

Score: 10/10=100%

Assignment submitted on 2020-10-05, 13:35 IST

All questions carry equal weightage. All Python code is assumed to be executed using Python3. You may submit as many times as you like within the deadline. Your final submission will be graded.

Note:

- If the question asks about a value of type `string`, remember to enclose your answer in single or double quotes.
- If the question asks about a value of type `list`, remember to enclose your answer in square brackets and use commas to separate list items.

1) Consider the following Python function.

```
def mystery(l):
    if l == []:
        return(l)
    else:
        return(mystery(l[1:])+l[:1])
```

What does `mystery([22,14,19,65,82,55])` return?

[55, 82, 65, 19, 14, 22]

Yes, the answer is correct.
Score: 2.5
Accepted Answers:
(Type: Regex Match) [ ]*[[ ]*55[ ]*,[ ]*82[ ]*,[ ]*65[ ]*,[ ]*19[ ]*,[ ]*14[ ]*,[ ]*22[ ]*][ ]*

Week 4:
Sorting, Tuples,
Dictionaries,
Passing
Functions, List
Comprehension

Week 4 Quiz

- **Quiz: Week 4**
  Quiz
  (assessment?
  name=108)

Week 4
Programming
Assignment

Week 5:
Exception
handling,
input/output,
file handling,
string
processing

Week 5
Programming
Assignment

Week 6:
Backtracking,
scope, data
structures;
stacks, queues
and heaps

Week 6 Quiz

Week 7:
Classes,
objects and
user defined
datatypes

Week 7 Quiz

Week 8:
Dynamic
programming,
wrap-up

Week 8
Programming
Assignment

2.5 points

2) What is the value of `pairs` after the following assignment?

```
pairs = [ (x,y) for x in range(4,1,-1) for y in range(5,1,-1) if (x+y)%3
== 0 ]
```

[(4, 5), (4, 2), (3, 3), (2, 4)]

Yes, the answer is correct.
Score: 2.5
Accepted Answers:
(Type: Regex Match) [ ]*[[ ]*\([ ]*4[ ]*,[ ]*5[ ]*\)[ ]*,[ ]*\([ ]*4[ ]*,[ ]*2[ ]*\)[ ]*,[ ]*\([ ]*3[ ]*,[ ]*3[ ]*\)[ ]*,
[ ]*\([ ]*2[ ]*,[ ]*4[ ]*\)[ ]*][ ]*

2.5 points

3) Consider the following dictionary.   *2.5 points*

```
wickets = {"Tests":{"Kumble":[3,5,2,3],"Srinath":[4,4,1,0],"Prasad":[2,
1,7,4]},"ODI":{"Kumble":[2,0],"Srinath":[1,2]}}
```

Which of the following statements does not generate an error?

○ `wickets["ODI"]["Prasad"][0:] = [4,4]`

○ `wickets["ODI"]["Prasad"].extend([4,4])`

⦿ `wickets["ODI"]["Prasad"] = [4,4]`

○ `wickets["ODI"]["Prasad"] = wickets["ODI"]["Prasad"] + [4,4]`

Yes, the answer is correct.
Score: 2.5
Feedback:
Direct assignment to a new key adds a value. All other updates result in KeyError.

Accepted Answers:
wickets["ODI"]["Prasad"] = [4,4]

4) Assume that hundreds has been initialized as an empty dictionary: *2.5 points*

```
hundreds = {}
```

Which of the following generates an error?

○ `hundreds["Tendulkar, international"] = 100`

○ `hundreds["Tendulkar"] = {"international":100}`

○ `hundreds[("Tendulkar","international")] = 100`

⦿ `hundreds[["Tendulkar","international"]] = 100`

Yes, the answer is correct.
Score: 2.5
Feedback:
Dictionary keys must be immutable values.

Accepted Answers:
hundreds[["Tendulkar","international"]] = 100

Text Transcripts

Books

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Online Programming Test - Sample

Online Programming Test 1, 01 Dec 2020, 10:00-12:00

Online Programming Test 2, 01 Dec 2020, 20:00-22:00

Online Programming Test 1, 09 Mar 2021, 10:00-12:00

Online Programming Test 2, 09 Mar 2021, 20:00-22:00

Online Programming Test 1, 19 Sep 2021, 10:00-12:00

Online Programming Test 2, 19 Sep 2021, 20:00-22:00

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Week 6 Quiz

The due date for submitting this assignment has passed.

Due on 2020-10-28, 23:59 IST.

Score: 7.5/10=75%

Assignment submitted on 2020-10-25, 13:03 IST

All questions carry equal weightage. All Python code is assumed to be executed using Python3. You may submit as many times as you like within the deadline. Your final submission will be graded.

Note:

- If the question asks about a value of type `string`, remember to enclose your answer in single or double quotes.
- If the question asks about a value of type `list`, remember to enclose your answer in square brackets and use commas to separate list items.

1) Suppose u and v both denote sets in Python. What is the most general condition **2.5 points** that guarantees that u - (v - u) == u?

○ The sets u and v should be disjoint.

○ The set v should be a subset of the set u.

○ The set u should be a subset of the set v.

◉ This is true for any u and v.

Yes, the answer is correct.
Score: 2.5

Feedback:
v - u, by definition, has no elements from u. Hence u - (v - u) does not remove any elements from u.

Accepted Answers:
This is true for any u and v.

2) Suppose u and v both denote sets in Python. What is the most general condition **2.5 points** that guarantees that u|v == u^v?

◉ The sets u and v should be disjoint.

○ The set u should be a subset of the set v.

○ The set v should be a subset of the set u.

○ This is true for any u and v.

Yes, the answer is correct.
Score: 2.5
Feedback:
u^v has all elements that are in exactly one of u or v. This is the same as u|v - u&v. Since u^v = u|v, we have u&v is empty, so u and v are disjoint.

Accepted Answers:
The sets u and v should be disjoint.

3) Suppose we insert 19 into the min heap [17,25,42,67,38,89,54,98,89]. What is the resulting heap?

[17,19,42,67,25,89,54,98,8

Yes, the answer is correct.
Score: 2.5
Accepted Answers:
(Type: Regex Match) [ ]*[[ ]*17[ ]*,[ ]*19[ ]*,[ ]*42[ ]*,[ ]*67[ ]*,[ ]*25[ ]*,[ ]*89[ ]*,[ ]*54[ ]*,[ ]*98[ ]*, [ ]*89[ ]*,[ ]*38[ ]*][ ]*

2.5 points

4) Suppose we execute delete-min twice on the min-heap [13,29,24,67,52,89,45,98.79,58]. What is the resulting heap?
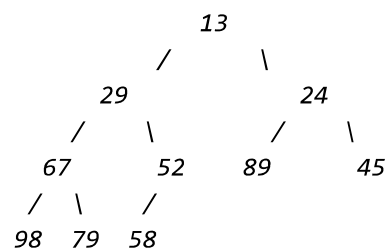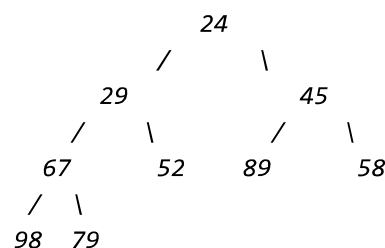
[29,52,45,67,98.79,89,58]

No, the answer is incorrect.
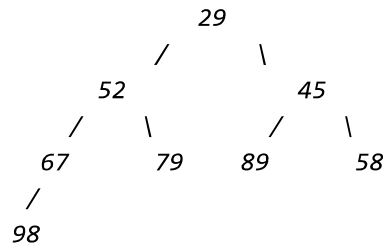Score: 0
Feedback:
The original heap is:

```
              13
           /      \
        29          24
      /     \      /     \
    67       52   89       45
   /  \     /
  98   79  58
```

After one delete-min, we have:

```
              24
           /      \
        29          45
      /     \      /     \
    67       52   89       58
   /  \
  98   79
```

After the second delete-min, we have:

```
                29
              /      \
          52           45
         /   \        /    \
      67       79   89       58
     /
   98
```

Accepted Answers:
(Type: Regex Match) [ ]*[29[ ]*,[ ]*52[ ]*,[ ]*45[ ]*,[ ]*67[ ]*,[ ]*79[ ]*,[ ]*89[ ]*,[ ]*58[ ]*,[ ]*98[ ]*][ ]*

2.5 points

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Week 3 Programming Assignment

Week 7 Quiz

The due date for submitting this assignment has passed.

Due on 2020-11-04, 23:59 IST.

Score: 7.5/10=75%

Assignment submitted on 2020-10-31, 16:02 IST

All questions carry equal weightage. All Python code is assumed to be executed using Python3. You may submit as many times as you like within the deadline. Your final submission will be graded.
Note:

- If the question asks about a value of type `string`, remember to enclose your answer in single or double quotes.
- If the question asks about a value of type `list`, remember to enclose your answer in square brackets and use commas to separate list items.

1) Given the following permutation of `a,b,c,d,e,f,g,h,i,j`, what is the next permutation in lexicographic (dictionary) order? Write your answer without any blank spaces between letters.

```
    fjadbihgec
```

'fjadcbeghi'

Yes, the answer is correct.
Score: 2.5
Accepted Answers:
*(Type: Regex Match) [ ]*fjadcbeghi[ ]**
(Type: Regex Match) [ ]\"fjadcbeghi\"[ ]**
(Type: Regex Match) [ ]\'fjadcbeghi\'[ ]**

2.5 points

2) We want to add a function `length()` to the class `Node` that implements user   **2.5 points**
defined lists which will compute the length of a list. An incomplete implementation of `length()`
given below. You have to provide expressions to put in place of XXX, YYY. and ZZZ.

```
def length(self):
  if self.value == None:
    return(XXX)
  elif self.next == None:
    return(YYY)
  else:
    return(ZZZ)
```

○ XXX: 0, YYY: 0, ZZZ: self.next.length()

◉ XXX: 0, YYY: 0, ZZZ: 1 + self.next.length()

○ XXX: 0, YYY: 1, ZZZ: self.next.length()

○ XXX: 0, YYY: 1, ZZZ: 1 + self.next.length()

No, the answer is incorrect.
Score: 0
Feedback:
*Inductive definition: if empty, return 0, if singleton return 1, else add 1 to the length of the list
starting at self.next.*

Accepted Answers:
XXX: 0, YYY: 1, ZZZ: 1 + self.next.length()

3) Suppose we add this function `foo()` to the class `Tree` that implements search   **2.5 points**
trees. For a name `mytree` with a value of type `Tree`, what would `mytree.foo()` compute?

```
def foo(self):
    if self.isempty():
        return(0)
    elif self.isleaf():
        return(1)
    else:
        return(1 + max(self.left.foo(),self.right.foo()))
```

○ The number of nodes in `mytree`

○ The largest value in `mytree`.

◉ The length of the longest path from root to leaf in `mytree`.

○ The number of paths in `mytree`.

Yes, the answer is correct.
Score: 2.5
Feedback:
This computes the height of the tree, which is the length of the longest root to leaf path.

Accepted Answers:
The length of the longest path from root to leaf in `mytree`.

4) Inorder traversal of a binary tree has been defined in the lectures. A preorder traversal lists
the vertices of a binary tree (not necessarily a search tree) as follows:
- Print the root.
- Print the left subtree in preorder.
- Print the right subtree in preorder.

Suppose we have a binary tree with 10 nodes labelled a, b, c, d, e, f, g, h, i, j, with preorder traversal gbhecidajf and inorder traversal ehbicgjafd. What is the right child of the root node?

'd'

Hint

Yes, the answer is correct.
Score: 2.5
Accepted Answers:
(Type: Regex Match) [ ]*d[ ]*
(Type: Regex Match) [ ]*"d"[ ]*
(Type: Regex Match) [ ]*'d'[ ]*

2.5 points