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## Course outline

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Introduction

Week 1 Quiz

● **Quiz : Week 1 Quiz**  
(assessment? name=87)

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 2019-08-14, 23:59 IST.

## Assignment submitted on 2019-08-13, 09:33 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(3231)` return for the following function definition?

```
def h(x):  
    (m,a) = (1,0)  
    while m <= x:  
        (m,a) = (m*2,a+1)  
    return(a)
```

Yes, the answer is correct.  
Score: 2.5

Accepted Answers:  
(Type: Regex Match) [ ]\*12[ ]

2.5 points

2) What is `g(24) - g(23)`, given the definition of `g` below?

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Tuples,  
Dictionaries,  
Passing  
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Week 7: Classes,  
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Week 7 Quiz

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Week 8  
Programming

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

Yes, the answer is correct.  
Score: 2.5

Accepted Answers:  
(Type: Regex Match) [ ]\*6[ ]

2.5 points

3) Consider the following function f.

2.5 points

```
def f(n):
    s=0
    for i in range(1,n+1):
        if n%i == 0:
            s = 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 composite number.
- ☒  $n$  is a perfect square.

Yes, the answer is correct.  
Score: 2.5

Feedback:

$f(n)$  computes whether the number of factors of  $n$  is odd. Factors occur in pairs, except for perfect squares. So the number of factors is odd only for perfect squares.

Accepted Answers:  
 $n$  is a perfect square.

4) Consider the following function f.

2.5 points

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

Which of the following is correct?

- ☐ The function always terminates with  $f(n)$  = factorial of  $n$
- ☐ The function always terminates with  $f(n)$  =  $n(n+1)/2$

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- ☐ The function terminates for nonnegative  $n$  with  $f(n) = \text{factorial of } n$
- ☒ The function terminates for nonnegative  $n$  with  $f(n) = n(n+1)/2$

Yes, the answer is correct.

Score: 2.5

Feedback:

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

Accepted Answers:

The function terminates for nonnegative  $n$  with  $f(n) = n(n+1)/2$


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**Quiz : Week 2 Quiz (assessment? name=89)**

Week 2 Programming Assignment

Week 3: Lists, inductive function definitions, sorting

Week 3 Programming

# Week 2 Quiz

The due date for submitting this assignment has passed.

Due on 2019-08-21, 23:59 IST.

## Assignment submitted on 2019-08-20, 09:36 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 = [1,"abcd",2,"efgh",[3,4]] # Statement 1
y = x[0:50] # Statement 2
z = y # Statement 3
w = x # Statement 4
x[1] = x[1] + 'd' # Statement 5
y[2] = 4 # Statement 6
x[1][1] = 'y' # Statement 7
z[0] = 0 # Statement 8
w[4][0] = 1000 # Statement 9
a = (x[4][1] == 4) # Statement 10
```

## Assignment

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

## Week 4 Quiz

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## Week 7 Quiz

Week 8:  
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No, the answer is incorrect.  
Score: 0

Accepted Answers:  
(Type: Regex Match) [ ]\*7[ ]

2.5 points

2) Consider the following lines of Python code.

2.5 points

```
x = [13,4,17,1000]
w = x[1:]
u = x[1:]
y = x
u[0] = 50
y[1] = 40
```

Which of the following is correct?

- ☒ x[1] == 40, y[1] == 40, w[0] == 4, u[0] == 50
- ☐ x[1] == 50, y[1] == 40, w[0] == 50, u[0] == 50
- ☐ x[1] == 4, y[1] == 40, w[0] == 4, u[0] == 50
- ☐ x[1] == 40, y[1] == 40, w[0] == 50, u[0] == 50

Yes, the answer is correct.

Score: 2.5

Feedback:

(d) x[1] == 40, y[1] == 40, w[0] == 4, u[0] == 50

x and y refer to the same list, while w and u are two independent slices. The update to u[0] does not affect any of the other names. The update to y[1] is also reflected in x[1].

Accepted Answers:

x[1] == 40, y[1] == 40, w[0] == 4, u[0] == 50

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

```
startmsg = "hello"
endmsg = ""
for i in range(0, len(startmsg)):
    endmsg = startmsg[i] + endmsg
```

'olleh'

Yes, the answer is correct.

Score: 2.5

Accepted Answers:

(Type: Regex Match) \s\*\'olleh\' \s\*

(Type: Regex Match) \s\*"olleh" \s\*

2.5 points

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

```
def mystery(l):
    l = l + l
    return()

mylist = [22,34,57]
mystery(mylist)
```

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[22,34,57]

Yes, the answer is correct.

Score: 2.5

Accepted Answers:

(Type: Regex Match) `\s*\[s*22,s*34,s*57\s*\]\s*`

2.5 points

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Week 4: Sorting, Tuples,

# Week 4 Quiz

The due date for submitting this assignment has passed.

Due on 2019-08-28, 23:59 IST.

## Assignment submitted on 2019-08-28, 22:01 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 (l[-1:] + mystery(l[:-1]))
```

What does `mystery([31,32,71,18,51])` return?

[51, 18, 71, 32, 31]

Yes, the answer is correct.  
Score: 2.5

Accepted Answers:

(Type: Regex Match) `[ ]*[[ ]*51[ ]*,[ ]*18[ ]*,[ ]*71[ ]*,[ ]*32[ ]*,[ ]*31[ ]*][ ]*`

2.5 points

Dictionaries,  
Passing  
Functions, List  
Comprehension

#### Week 4 Quiz

#### Quiz : Week 4 Quiz (assessment? name=94)

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#### Week 7 Quiz

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

```
pairs = [ (x,y) for x in range(3,0,-1) for y in range(2,0,-1) if
(x+y)%3 == 0 ]
```

[(2, 1), (1, 2)]

Yes, the answer is correct.

Score: 2.5

Accepted Answers:

(Type: Regex Match) [ ]\*[[ ]\*\([ ]\*2[ ]\*,[ ]\*1[ ]\*\)\([ ]\*,[ ]\*\([ ]\*1[ ]\*,[ ]\*2[ ]\*\)\([ ]\*\)[ ]\*

2.5 points

3) Consider the following dictionary.

2.5 points

```
marks = {"Quizzes":{"Mahesh": [3,5,7,8], "Suresh": [9,4,8,8], "Uma": [9,9,7,6]}, "Exams":{"Mahesh": [37], "Uma": [36]}}
```

Which of the following statements does not generate an error?

- ☐ marks["Exams"]["Suresh"][0:] = [44]
- ☐ marks["Exams"]["Suresh"].append(44)
- ☒ marks["Exams"]["Suresh"] = [44]
- ☐ marks["Exams"]["Suresh"].extend([44])

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:

marks["Exams"]["Suresh"] = [44]

4) Assume that d has been initialized as an empty dictionary:

2.5 points

d = {}

Which of the following generates an error?

- ☐ d[12] = 5
- ☐ d["1,2"] = 5
- ☐ d[(1,2)] = 5
- ☒ d[[1,2]] = 5

Yes, the answer is correct.

Score: 2.5

Feedback:

Key must be an immutable value. List is not OK. Tuple, string and integer are OK.

Accepted Answers:

d[[1,2]] = 5



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# Week 6 Quiz

The due date for submitting this assignment has passed.

Due on 2019-09-11, 23:59 IST.

## Assignment submitted on 2019-09-11, 18:07 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. Under what condition can we guarantee that  $u - (u - v) == v$ ? 2.5 points

- ☐ 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:

From  $u$  you take away all elements that are not in  $v$  and you are left with  $u \cap v$ . Since  $u \cap v = v$ , we have  $v$  is a subset of  $u$ .

Accepted Answers:

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

Dictionaries,  
Passing  
Functions, List  
Comprehension

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Week 6 Quiz

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2) Suppose  $u$  and  $v$  both denote sets in Python. Under what condition can we guarantee that  $u \cap v == u \cap v$ ?

2.5 points

- ☒ 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:

$u \cap v$  has all elements that are in exactly one of  $u$  or  $v$ . This is the same as  $u \cap v = u \cap v$ . Since  $u \cap v = u \cap v$ , we have  $u \cap v$  is empty, so  $u$  and  $v$  are disjoint.

Accepted Answers:

The sets  $u$  and  $v$  should be disjoint.

3) Suppose we insert 97 into the max heap [98,67,89,38,42,54,89,17,25]. What is the resulting heap?

[98,97,89,38,67,54,89,17,25]

Yes, the answer is correct.

Score: 2.5

Accepted Answers:

(Type: Regex Match) `[ ]*[[ ]*98[ ],[ ]*97[ ],[ ]*89[ ],[ ]*38[ ],[ ]*67[ ],[ ]*54[ ],[ ]*89[ ],[ ]*17[ ],[ ]*25[ ],[ ]*42[ ]][ ]*`

2.5 points

4) Suppose we we apply delete\_max() twice to the heap [100,97,93,38,67,54,93,17,25,42]. What is the resulting heap?

[93,67,93,38,42,54,25,17]

Yes, the answer is correct.

Score: 2.5

Accepted Answers:

(Type: Regex Match) `[ ]*93[ ],[ ]*67[ ],[ ]*93[ ],[ ]*38[ ],[ ]*42[ ],[ ]*54[ ],[ ]*25[ ],[ ]*17[ ]][ ]*`

2.5 points

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# Week 7 Quiz

The due date for submitting this assignment has passed.

Due on 2019-09-18, 23:59 IST.

## Assignment submitted on 2019-09-18, 18:22 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.

eibjdhgfc

[e,i,b,j,f,a,c,d,g,h]

No, the answer is incorrect.

Score: 0

Feedback:

The suffix to change is *dhgfc*. This becomes *facdgh*

Accepted Answers:

(Type: Regex Match) [ ]\*eibjfacdgh[ ]\*

(Type: Regex Match) [ ]\*\eibjfacdgh\[ ]\*

(Type: Regex Match) [ ]\*"eibjfacdgh"[ ]\*

2.5 points

Dictionaries,  
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Week 7 Quiz

● **Quiz : Week 7  
Quiz  
(assessment?  
name=97)**

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2) We want to add a function `listmax()` to the class `Node` that implements user defined lists such that `listmax()` computes the maximum value in a list where values are of type `int`.

An incomplete implementation of `listmax()` given below. You have to provide expressions to put in place of `AAA`, `BBB` and `CCC`.

```
def listmax(self):
    if self.value == None:
        return(AAA)
    elif self.next == None:
        return(BBB)
    else:
        return(CCC)
```

- ☐ AAA: 0, BBB: `self.value`, CCC: `max(self.value, self.next.listmax())`
- ☐ AAA: 0, BBB: `self.value`, CCC: `max(self.value, self.next.value)`
- ☒ AAA: `None`, BBB: `self.value`, CCC: `max(self.value, self.next.listmax())`
- ☐ AAA: `None`, BBB: `self.value`, CCC: `max(self.value, self.next.value)`

Yes, the answer is correct.

Score: 2.5

Feedback:

- `listmax` is not defined for the empty list, so `AAA` is `None`.
- If the list has only one value, that value is the maximum, so `BBB` is `self.value`.
- If there are two or more elements, inductively compute the maximum of the rest of the list and take the max with respect to the current values, so `CCC` is `max(self.value, self.next.listmax())`

Accepted Answers:

AAA: `None`, BBB: `self.value`, CCC: `max(self.value, self.next.listmax())`

3) Suppose we add this function `foo()` to the class `Tree` that implements search 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(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 leaves in `mytree`.

Yes, the answer is correct.

Score: 2.5

Feedback:

This computes the number of leaves in the tree. An empty tree has no leaves. A tree with just one node has a single leaf. Otherwise, compute the number of leaves in left and right subtrees and add them.

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This does not compute the number of nodes in the tree. For that, we need to add 1 in the inductive case, to account for the current node. So the *else*: expression would be `return(1 + self.left.foo() + self.right.foo())`.

Accepted Answers:

The number of leaves in *mytree*.

4) Inorder traversal of a binary tree has been defined in the lectures. A postorder traversal lists the vertices of a binary tree (not necessarily a search tree) as follows:

- Print the left subtree in postorder.
- Print the right subtree in postorder.
- Print the root.

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

Hint

No, the answer is incorrect.

Score: 0

Feedback:

From the post traversal, *g* is the root. The inorder traversal tells us that *ehbic* lie to the left of the root. The postorder traversal of this segment says *b* is the root of this subtree, so *b* is the left child of the root.

Accepted Answers:

(Type: Regex Match) [ ]\*b[ ]\*

(Type: Regex Match) [ ]\*\b\[ ]\*

(Type: Regex Match) [ ]\*"b"[ ]\*

2.5 points