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Week 1 Quiz

The due date for submitting this assignment has passed.

Due on 2021-08-18, 23:59 IST.

Score: 10/10=100%

Assignment submitted on 2021-07-15, 20:07 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.

1) What is the value of `g(728)` for the function below?

```
def g(y):
    b = 0
    while y >= 3:
        (y,b) = (y/3,b+1)
    return(b)
```

5

Yes, the answer is correct.
Score: 2.5

Feedback:
The function computes the largest power of 3 that is less than or equal to n – i.e., the integer part of $log_3(n)$

Accepted Answers:
(Type: Numeric) 5

2.5 points

2) What is `f(90)-f(89)`, given the definition of `f` below?

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

5

Yes, the answer is correct.
Score: 2.5

Feedback:
f(n) counts the number of proper factors of n (factors excluding 1 and n) that are odd. 90 has 5 odd factors: 3,5,9,15,45. 89 is a prime number, so it has 0 odd factors.

Accepted Answers:
(Type: Numeric) 5

2.5 points

3) Consider the following function `h`. ***2.5 points***

```
def h(n):
    s = True
    for i in range(1,n+1):
        if i*i == n:
            s = False
    return(s)
```

The function `h(n)` given above returns `False` 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: 2.5

Feedback:
`h(n)` sets `s` to `False` if there is a number `i` such that `i*i == n`.

Accepted Answers:
n is a perfect square.

4) Consider the following function `fpp`. ***2.5 points***

```
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: 2.5

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 2021-08-18, 23:59 IST.

Score: 10/10=100%

Assignment submitted on 2021-08-03, 16:42 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

Feedback:
At statement 8, w[0] is the string "slithy", which cannot be updated in place.

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` (selected)
- `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

Feedback:
`"python"`
The loop copies each letter in `startmsg` from right to left to the beginning of `endmsg`, so the resulting string is the same as the original string.

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

Feedback:
[7,11,13]
The update `l = l[1:]` inside the function creates a new list, so the list passed as the argument is not changed.

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

2.5 points

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Week 4 Quiz

The due date for submitting this assignment has passed.

Due on 2021-09-01, 23:59 IST.

Score: 10/10=100%

Assignment submitted on 2021-08-17, 08:57 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([22,34,18,57,92,45])` return?

[45, 92, 57, 18, 34, 22]

Yes, the answer is correct.
Score: 2.5

Feedback:
Elements are moved from the beginning of the list to the end, so the list gets reversed.

Accepted Answers:
(Type: Regex Match) [ ][[ ]*45[ ]*,[ ]*92[ ]*,[ ]*57[ ]*,[ ]*18[ ]*,[ ]*34[ ]*,[ ]*22[ ]*][ ]**

2.5 points

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

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

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

Yes, the answer is correct.
Score: 2.5

Feedback:
All pairs (i,j) with i ∈ {5,4,3,2}, j ∈ {4.3,2} such that i + j is a multiple of 3,

Accepted Answers:
(Type: Regex Match) [ ][[ ]*\([ ]*5[ ]*,[ ]*4[ ]*\)[ ]*,[ ]*\([ ]*4[ ]*,[ ]*2[ ]*\)[ ]*,[ ]*\([ ]*3[ ]*,[ ]*3[ ]*\)[ ]*,[ ]*\([ ]*2[ ]*,[ ]*4[ ]*\)[ ]*][ ]**

2.5 points

3) Consider the following dictionary. ***2.5 points***

```
wickets = {"Tests":{"Ishant":[3,5,2,3],"Shami":[4,4,1,0],"Bumrah":[2,1,7,4]},"ODI":{"Ishant":[2,0],"Shami":[1,2]}}
```

Which of the following statements does not generate an error?

- `wickets["ODI"]["Bumrah"][0:] = [4,4]`
- `wickets["ODI"]["Bumrah"].extend([4,4])`
- `wickets["ODI"]["Bumrah"] = [4,4]` (selected)
- `wickets["ODI"]["Bumrah"] = wickets["ODI"]["Bumrah"] + [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"]["Bumrah"] = [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` (selected)

Yes, the answer is correct.
Score: 2.5

Feedback:
Dictionary keys must be immutable values.

Accepted Answers:

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

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Week 6 Quiz

The due date for submitting this assignment has passed.

Due on 2021-09-08, 23:59 IST.

Score: 10/10=100%

Assignment submitted on 2021-09-02, 15:22 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) Suppose u and v both have values of type set and are disjoint. Which of the following expressions evaluates to `True`? ***2.5 points***

- u == v | (u^v)
- u == (v^u)
- u == v^(u | v)
- u == u^(v | u)

Yes, the answer is correct.
Score: 2.5

Feedback:
Check set theoretically.

Accepted Answers:
u == v^(u | v)

2) Suppose u and v both denote sets in Python. What is the most general condition that guarantees that `u|v == u^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^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) Consider the min-heap [15, 27, 33, 39, 66, 39, 47, 58, 51]. built by repeatedly inserting values into an empty heap. Which of the following *could not* have been the last element inserted into this heap? ***2.5 points***

- ( ) 27
- ( ) 15
- (•) 58
- ( ) 51

Yes, the answer is correct.
Score: 2.5
Feedback:
The last position added was the one containing 51. The last element added must lie on the path from 51 to the root: {15, 27, 39, 51}.
Accepted Answers:
58

4) Consider the min-heap [13, 24, 32, 32, 41, 38, 50, 48, 40] built by repeatedly inserting values into an empty heap. Suppose the last value inserted was 24. What was the heap structure before this value was inserted? ***2.5 points***

- ( ) [13, 32, 32, 41, 40, 38, 50, 48]
- ( ) [13, 41, 32, 40, 32, 38, 50, 48]
- ( ) [13, 32, 32, 48, 41, 38, 50, 40]
- (•) [13, 32, 32, 40, 41, 38, 50, 48]

Yes, the answer is correct.
Score: 2.5
Feedback:
Push 24 down the path towards the last leaf 40. Swap 24 with 32 and then with 40.
Accepted Answers:
[13, 32, 32, 40, 41, 38, 50, 48]

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Week 7 Quiz

The due date for submitting this assignment has passed.

Due on 2021-09-15, 23:59 IST.

Score: 10/10=100%

Assignment submitted on 2021-09-08, 07:56 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 as a sequence of letters without quotes and without any blank spaces between letters.

```
eibjdhgfca
```

eibjfacdgh

Yes, the answer is correct.
Score: 2.5

Feedback:

The suffix to change is `dhgfca`. This becomes `facdgh`

Accepted Answers:

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

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

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

2.5 points

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`. ***2.5 points***

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? ***2.5 points***

```
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.

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? (Write your answer as a single letter, without quotes.)

b

Hint

Yes, the answer is correct.
Score: 2.5

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

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