data-flow.md

Data Flow

array_merger.py

```
__author__ = "Zelin Cai, Patrick Silvestre"
__version__ = "0.1.0"
__license__ = "MIT"

def array_merger(list1, list2):
    """ Variables to iterate through the lists """
    i = j = 0
    merged_list = []
    while i < len(list1) and j < len(list2):
        if list1[i] <= list2[j]:
            merged_list.append(list1[i])
            i += 1
        else:
            merged_list.append(list2[j])
            j += 1

    """ Checks if there are any index values remaining in list1 and appends them """
    while i < len(list1):
        merged_list.append(list1[i])
        i += 1

    """ Has the same purpose as the previous while loop but for list2 instead """
    while j < len(list2):
        merged_list.append(list2[j])
        j += 1

    return merged_list
```

test_array_merger.py

```
__author__ = "Zelin Cai, Patrick Silvestre"
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from array_merger import *
import unittest


class TestTwoEmptyLists(unittest.TestCase):
    def test_01_two_empty_lists(self):
        """
        Nodes:
        1-2-3-8-10-12
        """
        list1 = []
        list2 = []
        expected_output = []
```
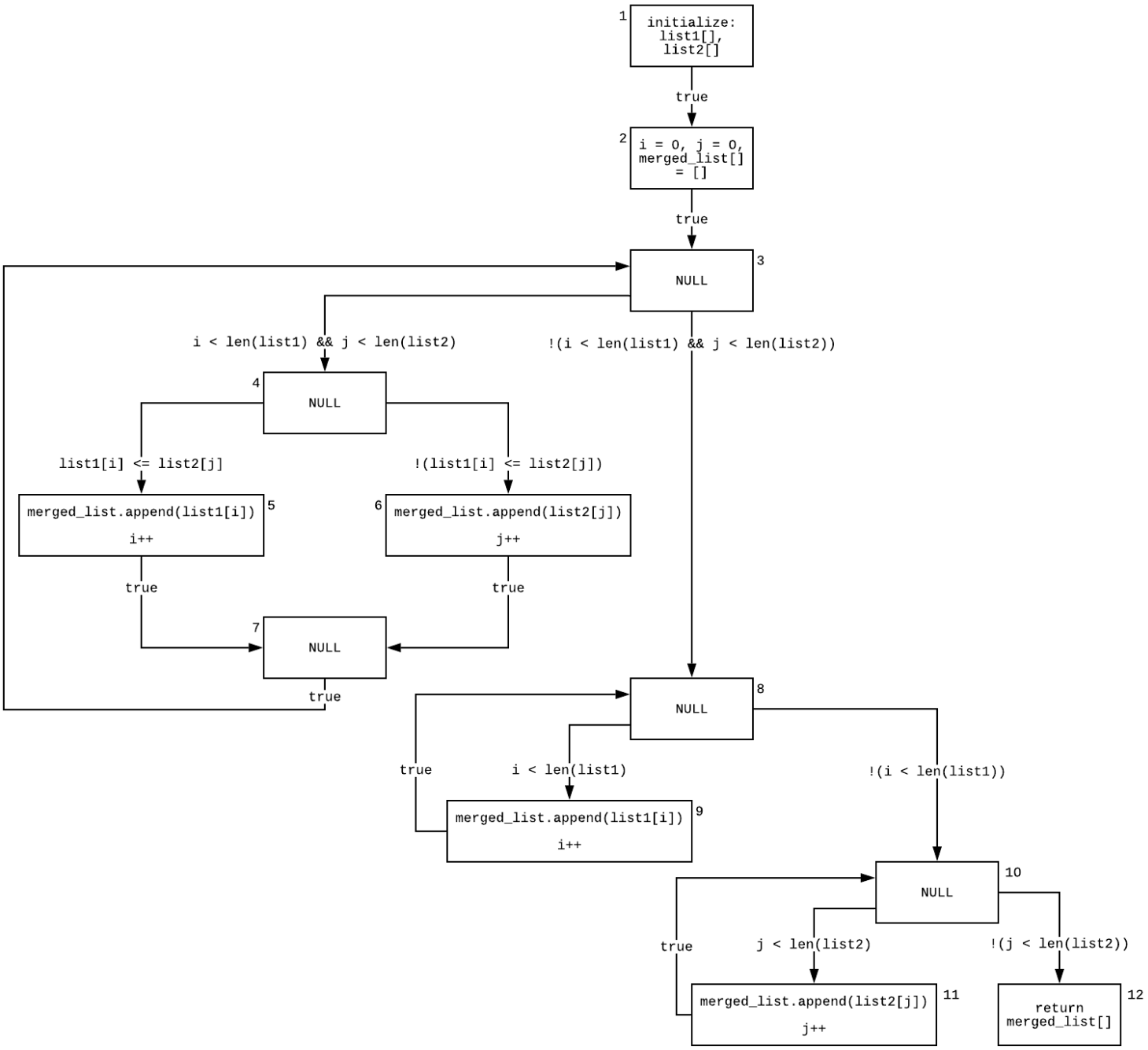

```
        actual_output = array_merger(list1, list2)
        self.assertEqual(expected_output, actual_output)


class TestOneEmptyList(unittest.TestCase):
    def test_02_first_list_empty(self):
        """
        Nodes:
        1-2-3-8-
            10-11-
            10-12
        """
        list1 = []
        list2 = [0]
        expected_output = [0]
        actual_output = array_merger(list1, list2)
        self.assertEqual(expected_output, actual_output)

    def test_03_second_list_empty(self):
        """
        Nodes:
        1-2-3-
            8-9-
            8-10-12
        """
        list1 = [0]
        list2 = []
        expected_output = [0]
        actual_output = array_merger(list1, list2)
        self.assertEqual(expected_output, actual_output)


class TestFullLists(unittest.TestCase):
    def test_04_list1_with_leftover_values(self):
        """
        Nodes:
        1-2-
            3-4-6-7-
            3-4-6-7-
            3-4-6-7-
            3-
                8-9-
                8-9-
                8-9-
                8-9-
                8-10-12
        """
        list1 = [3, 4, 5, 6]
        list2 = [0, 1, 2]
        expected_output = [0, 1, 2, 3, 4, 5, 6]
        actual_output = array_merger(list1, list2)
        self.assertEqual(expected_output, actual_output)

    def test_05_list2_with_leftover_values(self):
        """
        Nodes:
        1-2-
            3-4-5-7-
            3-4-5-7-
            3-4-5-7-
            3-8-
                10-11-
```

```
                10-11-
                10-11-
                10-11-
                10-12
        """
        list1 = [0, 1, 2]
        list2 = [3, 4, 5, 6]
        expected_output = array_merger(list1, list2)
        actual_output = array_merger(list1, list2)
        self.assertEqual(expected_output, actual_output)

    def test_06_same_sized_lists(self):
        """
        Nodes:
        1-2-3-4-5-7-
            3-4-6-7-
            3-4-5-7-
            3-4-6-7-
            3-4-5-7-
            3-4-6-7-8-10-12
        """
        list1 = [0, 2, 4]
        list2 = [1, 3, 5]
        expected_output = [0, 1, 2, 3, 4, 5]
        actual_output = array_merger(list1, list2)
        self.assertEqual(expected_output, actual_output)
```

Data Flow Graph



Independent Paths

- Path 1: 1 - 2 - 3 - 8 - 10 - 12
- Path 2: 10 - 11 - 10
- Path 3: 8 - 9 - 8
- Path 4: 2 - 3 - 4 - 5 - 7
- Path 5: 3 - 4 - 6 - 7 - 3

Simple Paths

Paths 1, 2, 3, 4 and 5 are all simple paths since all of the nodes are distinct aside from the first and last nodes in paths 2, 3 and 5.

Loop-Free Paths

Paths 1 and 4 are loop-free paths since every node is distinct.

def(), c-use(), p-use()

Nodes `i`	`def(i)`	`c-use(i)`
1	{ `list1[]` , `list2[]` }	{}
2	{ `i` , `j` , `merged_list[]` }	{}
3	{}	{}
4	{}	{}
5	{ `merged_list[]` , `i` }	{ `i` , `list1[i]` }
6	{ `merged_list[]` , `j` }	{ `j` , `list2[j]` }
7	{}	{}
8	{}	{}
9	{ `merged_list[]` , `i` }	{ `i` , `list1[i]` }
10	{}	{}
11	{ `merged_list[]` , `j` }	{ `j` , `list2[j]` }
12	{}	{ `merged_list[]` }

Edges (i, j)	predicate(i, j)	p-use(i, j)
(1, 2)	`true`	{}
(2, 3)	`true`	{}
(3, 4)	`i < len(list1) && j < len(list2)`	{ `i` , `list1` , `j` , `list2` }
(4, 5)	`list1[i] <= list2[j]`	{ `list1[i]` , `list2[j]` }
(4, 6)	`!(list1[i] <= list2[j])`	{ `list1[i]` , `list2[j]` }
(5, 7)	`true`	{}
(6, 7)	`true`	{}
(7, 3)	`true`	{}
(3, 8)	`!(i < len(list1) && j < len(list2))`	{ `i` , `list1` , `j` , `list2` }
(8, 9)	`i < len(list1)`	{ `i` , `list1` }
(9, 8)	`true`	{}
(8, 10)	`!(i < len(list1))`	{ `i` , `list1` }
(10, 11)	`j < len(list2)`	{ `j` , `list2` }

(11, 10)	`true`	{}
(10, 12)	`!(j < len(list2))`	{ `j` , `list2` }

Def-Use Associations and Associated Test Cases

(When creating test cases, we attempted to follow the *All du Paths Strategy*.)

Variable `i`

du path	Test Case(s)	(path)
(i, 2, (3, T))	4, 5, 6	2-3-4
(i, 2, (3, F))	1, 2, 3	2-3-8
(i, 2, (4, T))	5, 6	2-3-4-5
(i, 2, (4, F))	4, 6	2-3-4-6
(i, 2, 5)	5, 6	2-3-4-5
(i, 2, (8, T))	3, 4	2-3-...-8-9
(i, 2, (8, F))	1, 2, 3, 4, 5, 6	2-3-...-8-10
(i, 2, 9)	3, 4	2-3-...-8-9

Variable `j`

du path	Test Case(s)	(path)
(j, 2, (3, T))	4, 5, 6	2-3-4
(j, 2, (3, F))	1, 2, 3	2-3-8
(j, 2, (4, T))	5, 6	2-3-4-5
(j, 2, (4, F))	4, 6	2-3-4-6
(j, 2, 6)	4, 6	2-3-4-6
(j, 2, (10, T))	2, 5	2-3-...-10-11
(j, 2, (10, F))	1, 2, 3, 4, 5, 6	2-3-...-10-12
(j, 2, 11)	2, 5	2-3-...-11