Data Flow

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1 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
```

2 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)

```

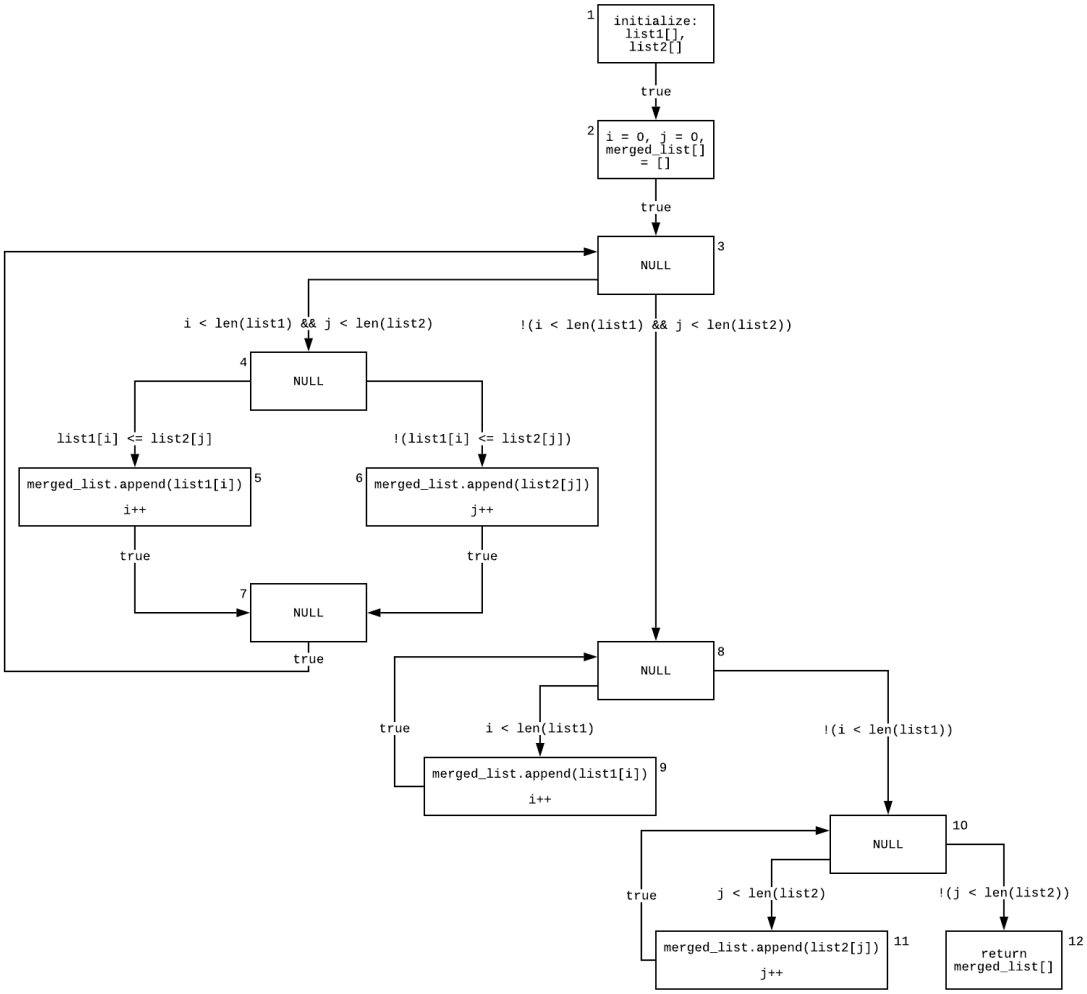
```

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)
```

3 Data Flow Graph



4 Independent Paths

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

4.1 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.

4.2 Loop-Free Paths

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

5 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}

6 Def-Use Associations and Associated Test Cases

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

6.1 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

6.2 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