

# Data Flow

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## 1 array\_merger.py

```
1  __author__ = "Zelin Cai, Patrick Silvestre"
2  __version__ = "0.1.0"
3  __license__ = "MIT"
4
5  def array_merger(list1, list2):
6      """ Variables to iterate through the lists """
7      i = j = 0
8      merged_list = []
9      while i < len(list1) and j < len(list2):
10         if list1[i] <= list2[j]:
11             merged_list.append(list1[i])
12             i += 1
13         else:
14             merged_list.append(list2[j])
15             j += 1
16
17     """ Checks if there are any index values remaining in list1 and appends
18         them """
19     while i < len(list1):
20         merged_list.append(list1[i])
21         i += 1
22
23     """ Has the same purpose as the previous while loop but for list2 instead
24         """
25     while j < len(list2):
26         merged_list.append(list2[j])
27         j += 1
28
29     return merged_list
```

## 2 test\_array\_merger.py

```
1 __author__ = "Zelin Cai, Patrick Silvestre"
2 __version__ = "0.1.0"
3 __license__ = "MIT"
4
5 from array_merger import *
6 import unittest
7
8
9 class TestTwoEmptyLists(unittest.TestCase):
10     def test_01_two_empty_lists(self):
11         """
12         Nodes:
13         1-2-3-8-10-12
14         """
15         list1 = []
16         list2 = []
17         expected_output = []
18         actual_output = array_merger(list1, list2)
19         self.assertEqual(expected_output, actual_output)
20
21
22 class TestOneEmptyList(unittest.TestCase):
23     def test_02_first_list_empty(self):
24         """
25         Nodes:
26         1-2-3-8-
27             10-11-
28             10-12
29         """
30         list1 = []
31         list2 = [0]
32         expected_output = [0]
33         actual_output = array_merger(list1, list2)
34         self.assertEqual(expected_output, actual_output)
35
36     def test_03_second_list_empty(self):
37         """
38         Nodes:
39         1-2-3-
40             8-9-
41             8-10-12
42         """
43         list1 = [0]
44         list2 = []
45         expected_output = [0]
46         actual_output = array_merger(list1, list2)
47         self.assertEqual(expected_output, actual_output)
48
```

```

49
50 class TestFullLists(unittest.TestCase):
51     def test_04_list1_with_leftover_values(self):
52         """
53         Nodes:
54         1-2-
55             3-4-6-7-
56             3-4-6-7-
57             3-4-6-7-
58             3-
59             8-9-
60             8-9-
61             8-9-
62             8-9-
63             8-10-12
64         """
65         list1 = [3, 4, 5, 6]
66         list2 = [0, 1, 2]
67         expected_output = [0, 1, 2, 3, 4, 5, 6]
68         actual_output = array_merger(list1, list2)
69         self.assertEqual(expected_output, actual_output)
70
71     def test_05_list2_with_leftover_values(self):
72         """
73         Nodes:
74         1-2-
75             3-4-5-7-
76             3-4-5-7-
77             3-4-5-7-
78             3-8-
79             10-11-
80             10-11-
81             10-11-
82             10-11-
83             10-12
84         """
85         list1 = [0, 1, 2]
86         list2 = [3, 4, 5, 6]
87         expected_output = array_merger(list1, list2)
88         actual_output = array_merger(list1, list2)
89         self.assertEqual(expected_output, actual_output)

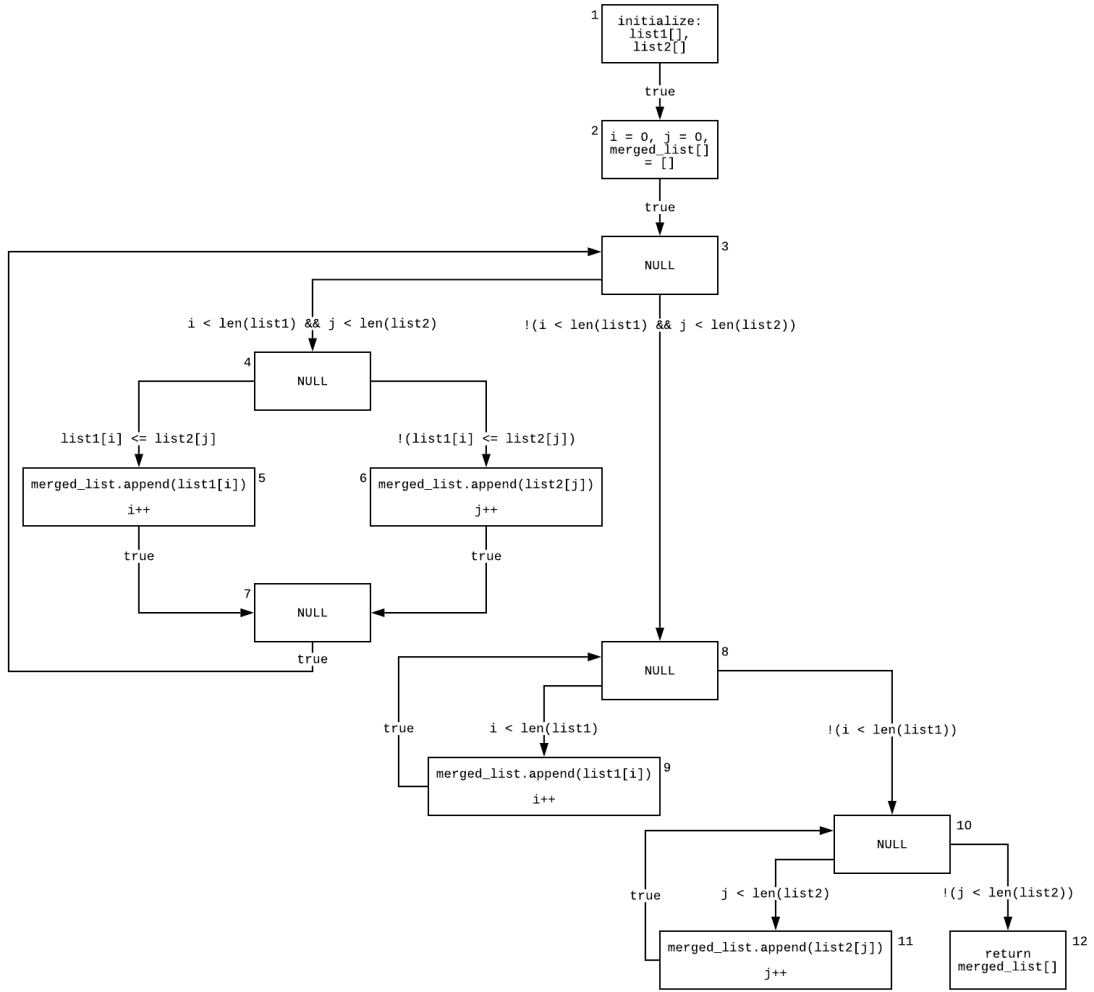
```

```

1  def test_06_same_sized_lists(self):
2      """
3      Nodes:
4      1-2-3-4-5-7-
5          3-4-6-7-
6          3-4-5-7-
7          3-4-6-7-
8          3-4-5-7-
9          3-4-6-7-8-10-12
10     """
11     list1 = [0, 2, 4]
12     list2 = [1, 3, 5]
13     expected_output = [0, 1, 2, 3, 4, 5]
14     actual_output = array_merger(list1, list2)
15     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