Software Testing: Tutorial 3
Data Flow Testing

Consider the following program,

```
 static int find (int list[], int n, int key)
{
    // binary search of ordered list
    int lo = 0, mid;
    int hi = n - 1;
    int result = -1;
    while ((hi >= lo) && (result == -1)) {
      mid = (lo + hi) / 2;
      if (list[mid] == key)
          result = mid;
      else if (list[mid] > key)
          hi = mid - 1;
      else // list[mid] < key
          lo = mid + 1;
    }
    return result;
}
```

This is not a particularly good example of programming but it is useful for the purposes of this tutorial.

Preparation: Review the code above; please try to ensure you understand the method and the particular implementation. It is an implementation of binary search of an ordered array.

Pre-Tutorial Requirement: Complete the activities marked as **<pre-tutorial>** on the next page and submit them on Learn *before* your tutorial session.

Activity

<pre-tutorial>

1. Construct the control flow graph corresponding to this program.

<during-tutorial>

2. In breakout rooms with 3 – 4 students, share your control flow graphs, discuss and resolve any differences.

<pre-tutorial>

3. For each variable, write down the $< D,U >$ pairs
4. Write down tests that satisfy one of the following coverage criteria:
   (a) All $< D,U >$ pairs
   (b) All $< D,U >$ paths

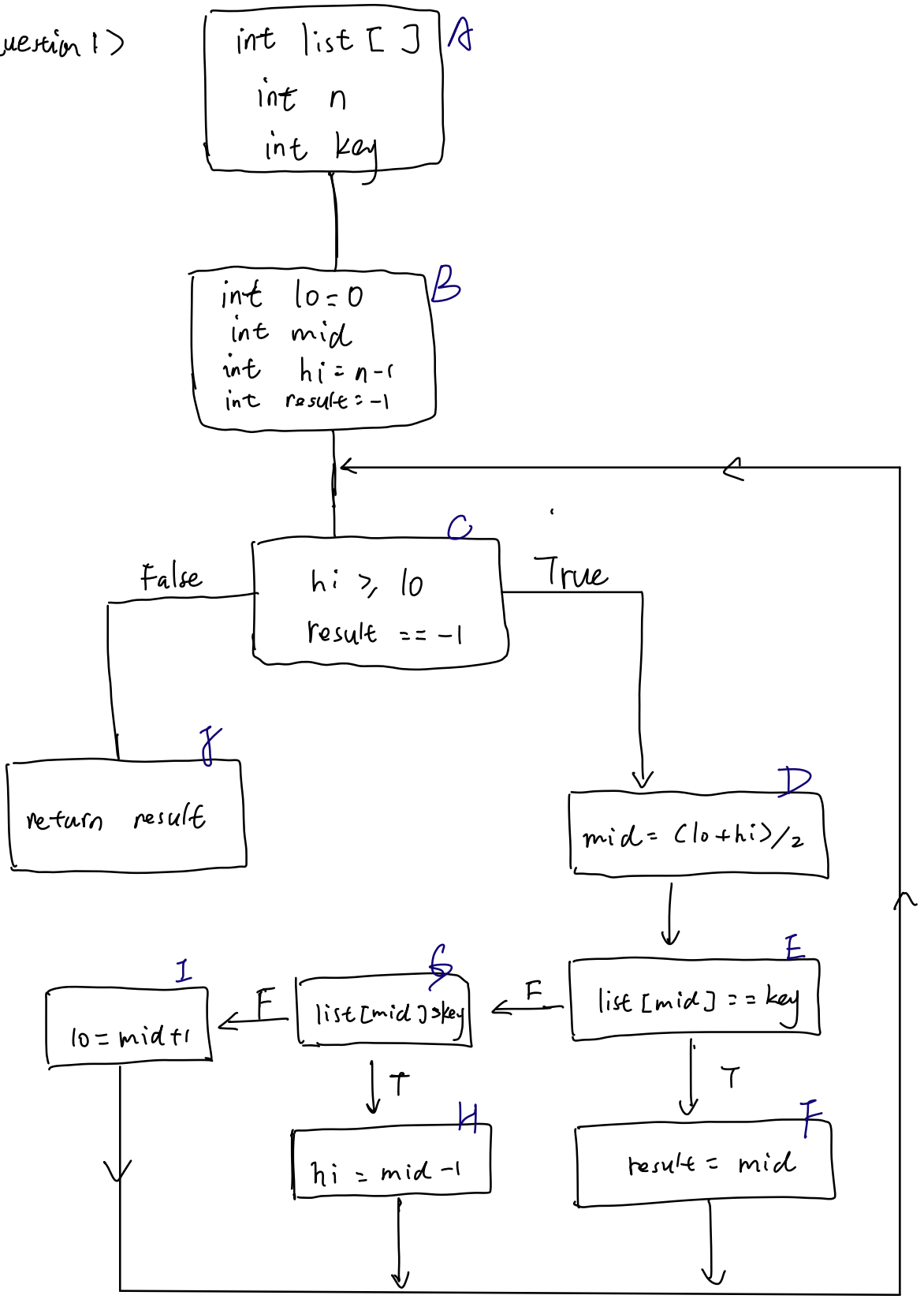
<**during-tutorial>**

5. In breakout rooms with 3 – 4 students, share and discuss your test sets for the different coverage metrics.

<during-tutorial>

6. As a whole group, compare the tests sets devised for the two coverage criteria and discuss which is stronger. Can you think of a test that passes one of the two criteria but fails the other?

Question 1>


int list[ ]
int n
int key
A
int lo=0
int mid
int hi=n-1
int result=-1
B
hi >= lo
result == -1
C
False
True
return result
J
mid=(lo+hi)/2
D
list[mid]==key
E
T
list[mid]>key
F
F
lo=mid+1
I
T
hi=mid-1
H
result=mid
F

Question 3)

Variable	Definition	Use	<D - U> pairs
list[ ]	A	E, G	AE, AG
n	A	B	AB
key	A	E, G	AE, AG
lo	B, I	C, D	BC, BD, IC, ID
mid	D	E, G, I, F, H	DE, DG, DI, DF, DH
hi	B, H	C, D	BC, BD, HC, HD
result	B, F	C, J	BC, BJ, FC, FJ

Question 4(a)

All <D, U> pairs.

	list[ ]	n	key
Test 1	[1, 3, 5, 7, 9, 11]	6	9
Test 2	[1, 3, 5, 7, 9, 11]	6	3
Test 3	[ ]	0	1

Question 4 (b)

Satisfy all <D,U> pairs, but fails all Du Paths

	list [ ]	n	key
Test 1	[1, 3, 5, 7, 9, 11]	6	9
Test 2	[1, 3, 5, 7, 9, 11]	6	3
Test 3	[1, 3, 5, 7, 9, 11]	6	18
Test 4	[1, 3, 5, 7, 9, 11]	6	-1