Test Report

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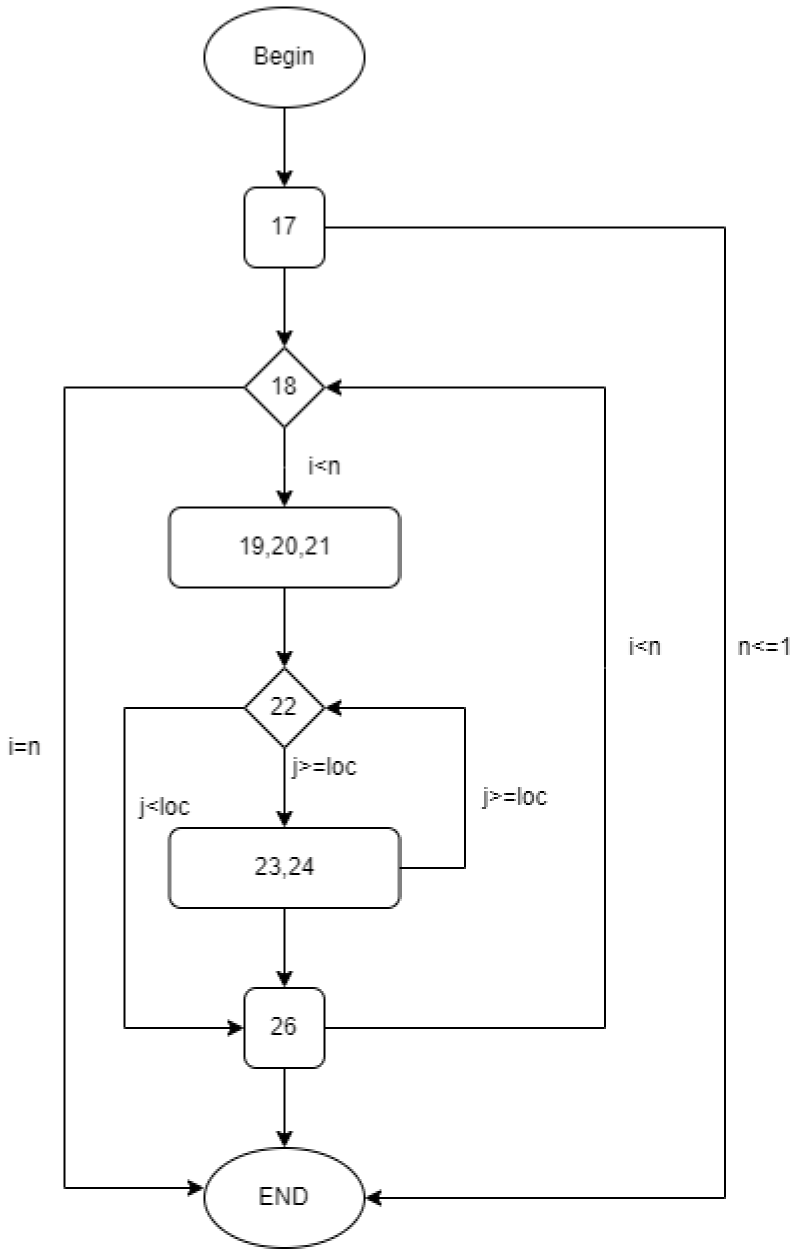
Code: [C-Plus-Plus/binary_insertion_sort.cpp at master · TheAlgorithms/C-Plus-Plus (github.com)]

Function test: insertionSort_binsrch()

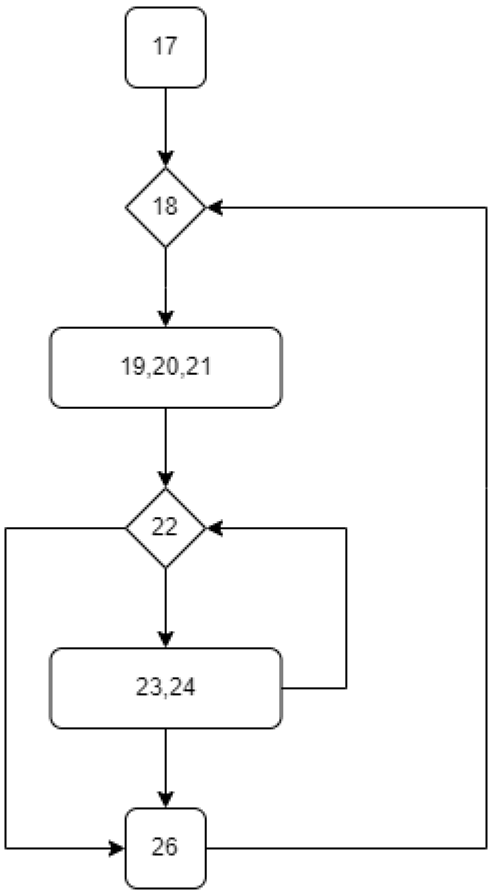
Purpose: Using binary insertion sort to sort an array.

```
LINE  CODE
1     template <class T>
2     int64_t binary_search(std::vector<T> &arr, T val, int64_t low, int64_t high) {
3         if (high <= low) {
4             return (val > arr[low]) ? (low + 1) : low;
5         }
6         int64_t mid = low + (high - low) / 2;
7         if (arr[mid] > val) {
8             return binary_search(arr, val, low, mid - 1);
9         } else if (arr[mid] < val) {
10            return binary_search(arr, val, mid + 1, high);
11        } else {
12            return mid + 1;
13        }
14    }
15    template <typename T>
16    void insertionSort_binsrch(std::vector<T> &arr) {
17        int64_t n = arr.size();
18        for (int64_t i = 1; i < n; i++) {
19            T key = arr[i];
20            int64_t j = i - 1;
21            int64_t loc = sorting::binary_search(arr, key, 0, j);
22            while (j >= loc) {
23                arr[j + 1] = arr[j];
24                j--;
25            }
26            arr[j + 1] = key;
27        }
28    }
```

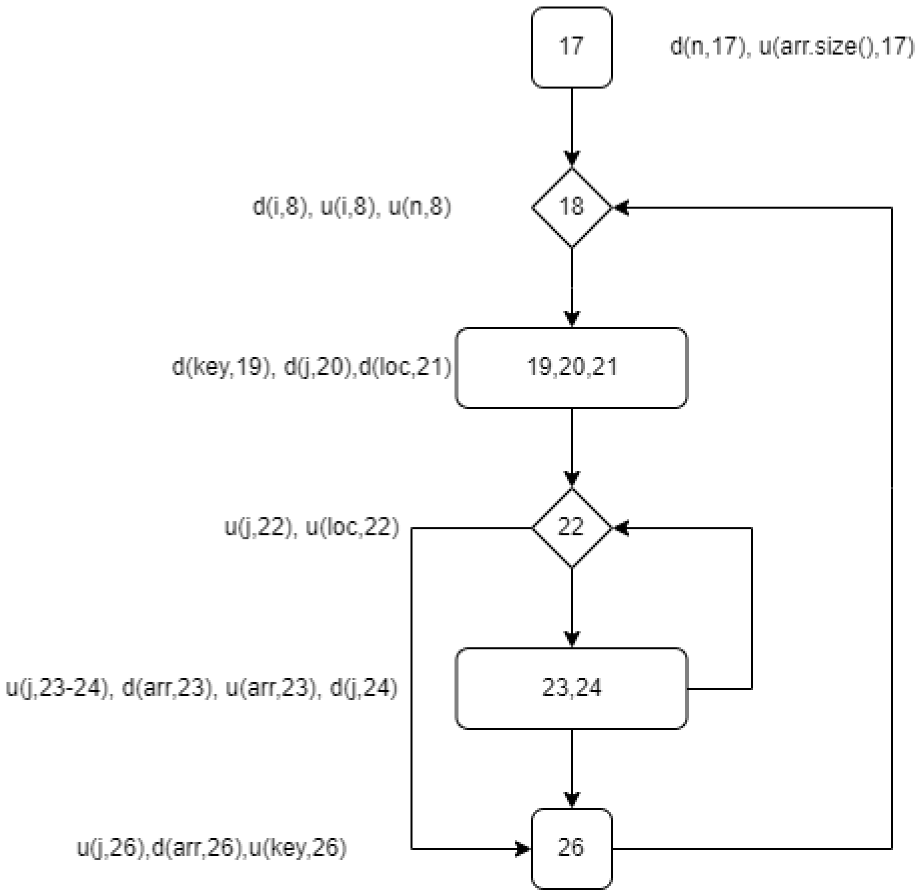
GRAPH



Control Flow Graph:



Data Flow Graph:


17
d(n,17), u(arr.size(),17)
d(i,8), u(i,8), u(n,8)
18
d(key,19), d(j,20),d(loc,21)
19,20,21
u(j,22), u(loc,22)
22
u(j,23-24), d(arr,23), u(arr,23), d(j,24)
23,24
u(j,26),d(arr,26),u(key,26)
26

Find all path and corresponding equation:

ID	Path	Equations	Solution	Test case
1	Begin →17→End	n<=1	n=1	[3]
2	Begin →17→18→ 19,20,21→22→26→End	n=1, j<loc	No solution	No testcase
3	Begin →17→18→ 19,20,21 →22→ 23,24 →26→End	n=1, j = loc	No solution	No testcase
4	Begin →17→18→ 19,20,21 →22→ 23,24→22 →26→End	n=1, j = loc	No solution	No testcase
5	Begin →17→18→ 19,20,21 →22→ 23,24 →22→ 23,24 →26→END	n=1	No solution	No testcase
6	Begin →17→18→ 19,20,21 →22→26→18…..	n>1, j < loc	n=2 or n = 3 and array sorted	[1,2], [1,2,3]
7	Begin →17→18→ 19,20,21 →22→ 23,24 →26→18…..	n>1, j = loc	An array with 2 elements next to each other needs to be swapped	[1,2,4,3], [1,3,2]
8	Begin →17→18→ 19,20,21 →22→ 23,24→22 →26→ 18…..	n>1, j >= loc	Array with 2 unsorted elements	[1,2,5,3,4]
9	Begin →17→18→ 19,20,21 →22→ 23,24 →22→ 23,24 →26→18….	n>1, j >= loc		[5,1,2,4,3,6]

Test cases:

ID	**Input**	**Expected output**	**Actual output**	Result
1	[5]	[5]	[5]	TRUE
2	[1,2]	[1,2]	[1,2]	TRUE
3	[1,3,2,4]	[1,2,3,4]	[1,2,3,4]	TRUE
4	[5,4,3,2,1]	[1,2,3,4,5]	[1,2,3,4,5]	TRUE

5	[-1,-2,1,2]	[-2,-1,1,2]	[-2,-1,1,2]	TRUE
6	[0.2,0.1,0.3]	[0.1,0.2,0.3]	[0.1,0.2,0.3]	TRUE
7	[z,x,c,v]	[c,v,x,z]		TRUE