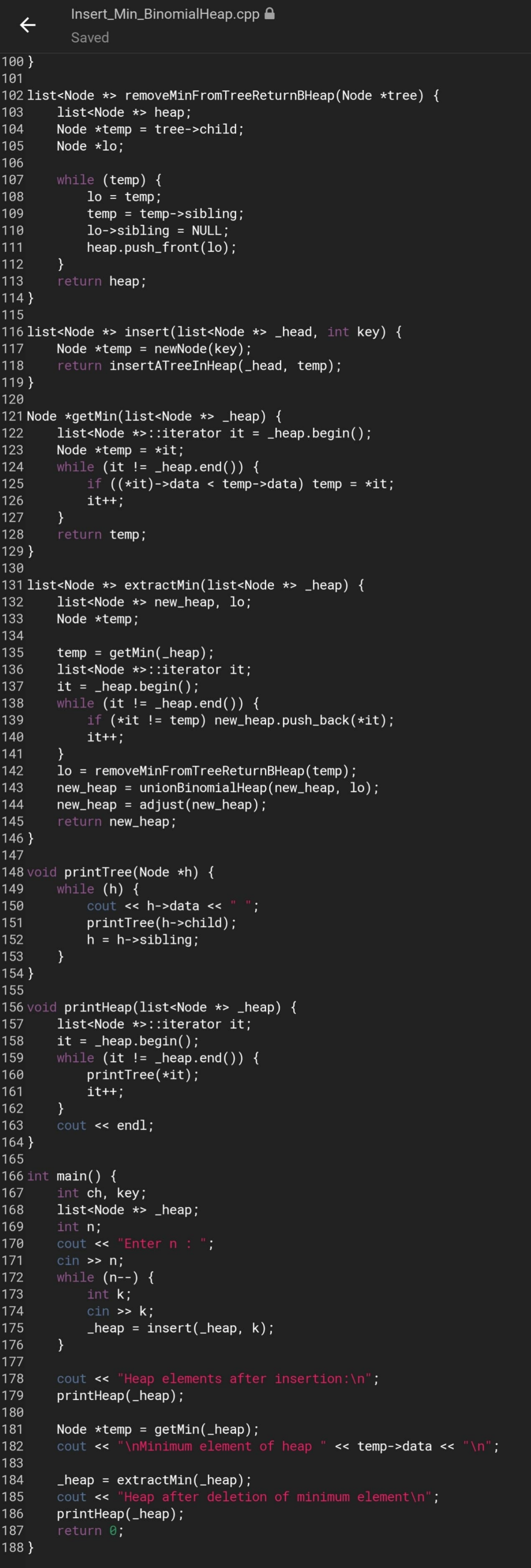
Insert_Min_BinomialHeap.cpp

Saved

```cpp
#include <bits/stdc++.h>

#include <iostream>
using namespace std;

struct Node {
    int data, degree;
    Node *child, *sibling, *parent;
};

Node *newNode(int key) {
    Node *temp = new Node;
    temp->data = key;
    temp->degree = 0;
    temp->child = temp->parent = temp->sibling = NULL;
    return temp;
}

Node *mergeBinomialTrees(Node *b1, Node *b2) {
    if (b1->data > b2->data) swap(b1, b2);

    b2->parent = b1;
    b2->sibling = b1->child;
    b1->child = b2;
    b1->degree++;

    return b1;
}

list<Node *> unionBinomialHeap(list<Node *> l1, list<Node *> l2) {
    list<Node *> _new;
    list<Node *>::iterator it = l1.begin();
    list<Node *>::iterator ot = l2.begin();
    while (it != l1.end() && ot != l2.end()) {
        if ((*it)->degree <= (*ot)->degree) {
            _new.push_back(*it);
            it++;
        } else {
            _new.push_back(*ot);
            ot++;
        }
    }

    while (it != l1.end()) {
        _new.push_back(*it);
        it++;
    }

    while (ot != l2.end()) {
        _new.push_back(*ot);
        ot++;
    }
    return _new;
}

list<Node *> adjust(list<Node *> _heap) {
    if (_heap.size() <= 1) return _heap;
    list<Node *> new_heap;
    list<Node *>::iterator it1, it2, it3;
    it1 = it2 = it3 = _heap.begin();

    if (_heap.size() == 2) {
        it2 = it1;
        it2++;
        it3 = _heap.end();
    } else {
        it2++;
        it3 = it2;
        it3++;
    }
    while (it1 != _heap.end()) {
        if (it2 == _heap.end())
            it1++;

        else if ((*it1)->degree < (*it2)->degree) {
            it1++;
            it2++;
            if (it3 != _heap.end()) it3++;
        } else if (it3 != _heap.end() && (*it1)->degree == (*it2)->degree && (*it1)->degree == (*it3)->degree) {
            it1++;
            it2++;
            it3++;
        }

        else if ((*it1)->degree == (*it2)->degree) {
            Node *temp;
            *it1 = mergeBinomialTrees(*it1, *it2);
            it2 = _heap.erase(it2);
            if (it3 != _heap.end()) it3++;
        }
    }
    return _heap;
}

list<Node *> insertATreeInHeap(list<Node *> _heap, Node *tree) {
    list<Node *> temp;
    temp.push_back(tree);
    temp = unionBinomialHeap(_heap, temp);
    return adjust(temp);
}
```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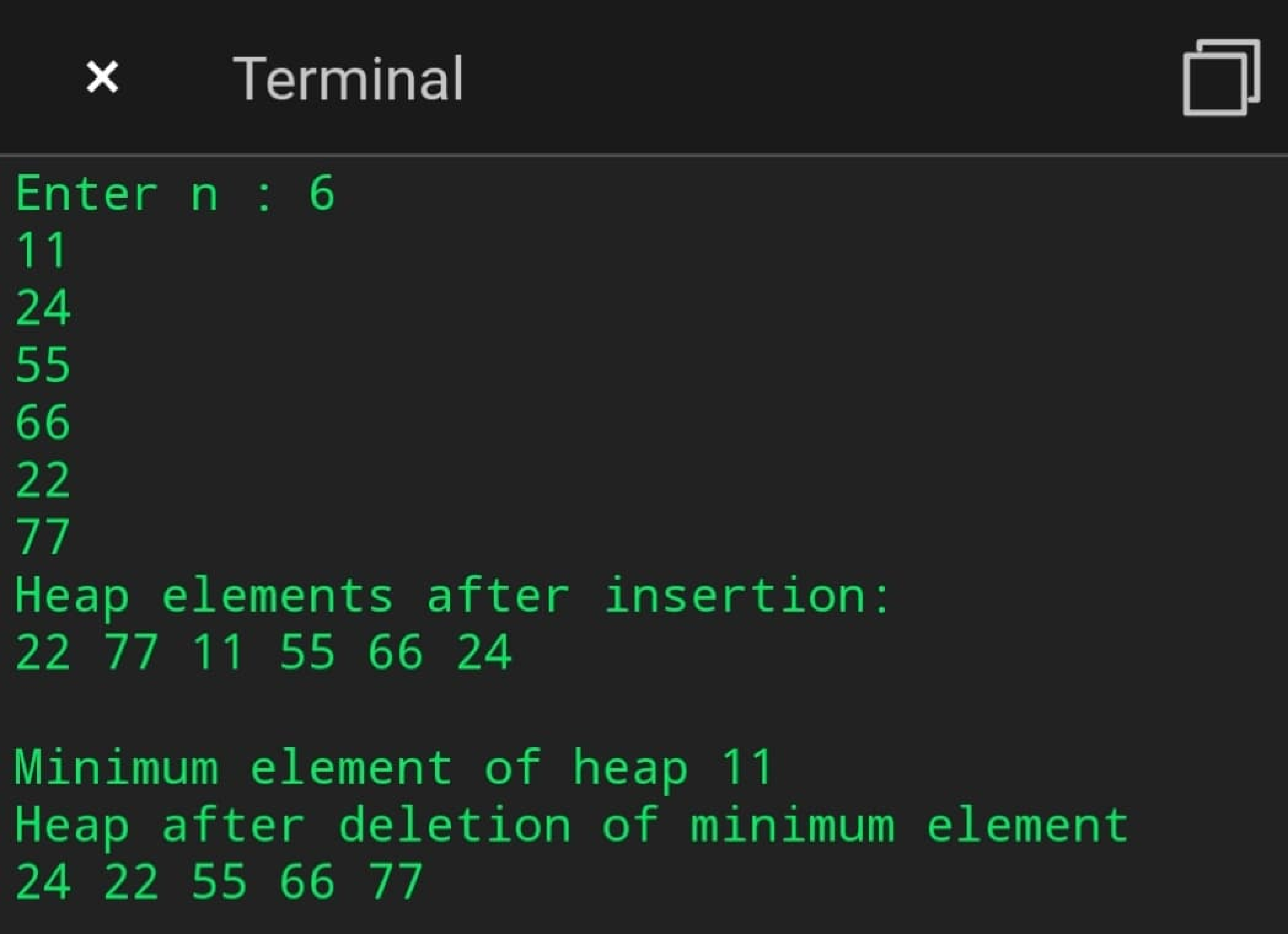
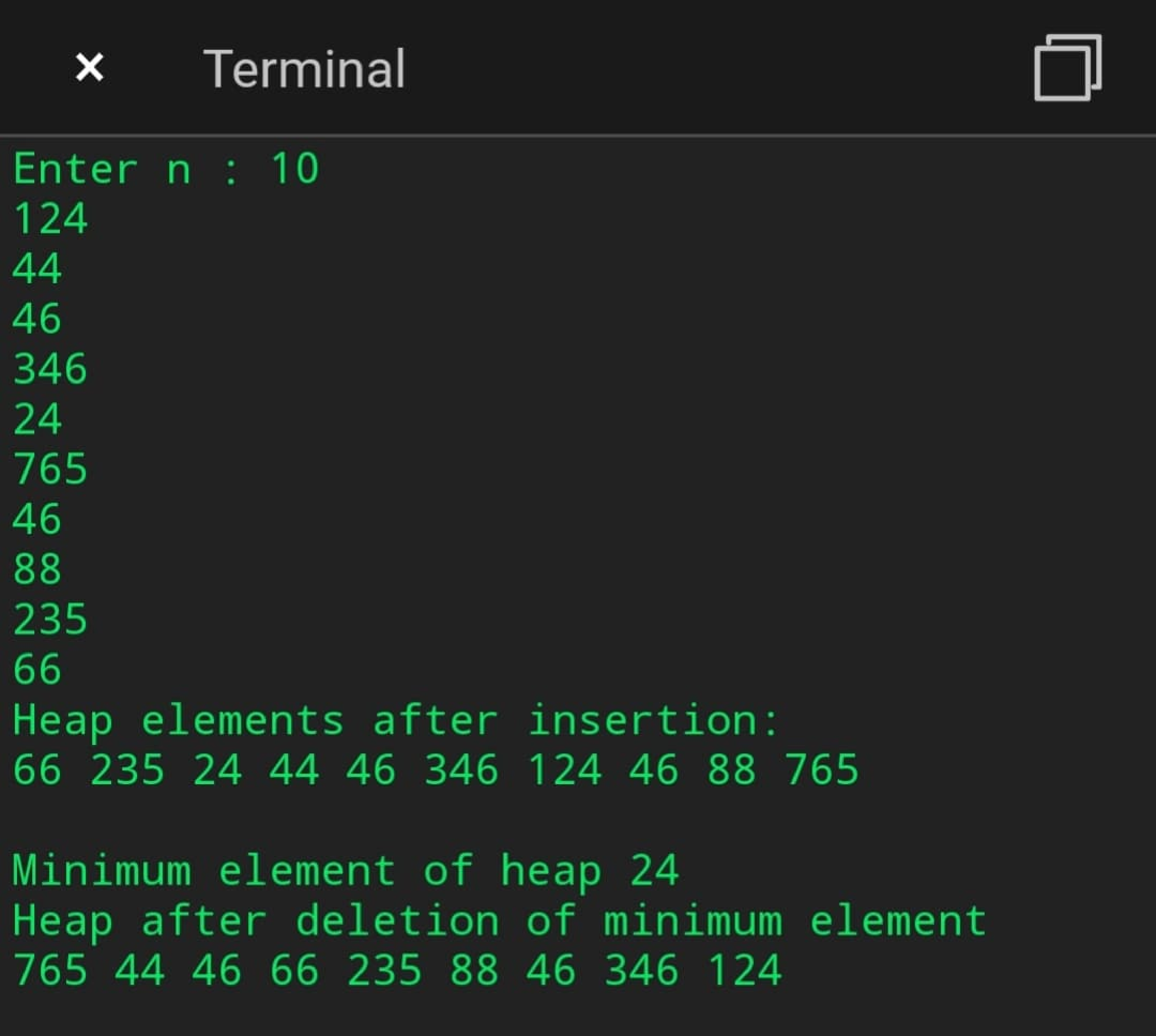
```cpp
}

list<Node *> removeMinFromTreeReturnBHeap(Node *tree) {
    list<Node *> heap;
    Node *temp = tree->child;
    Node *lo;

    while (temp) {
        lo = temp;
        temp = temp->sibling;
        lo->sibling = NULL;
        heap.push_front(lo);
    }
    return heap;
}

list<Node *> insert(list<Node *> _head, int key) {
    Node *temp = newNode(key);
    return insertATreeInHeap(_head, temp);
}

Node *getMin(list<Node *> _heap) {
    list<Node *>::iterator it = _heap.begin();
    Node *temp = *it;
    while (it != _heap.end()) {
        if ((*it)->data < temp->data) temp = *it;
        it++;
    }
    return temp;
}

list<Node *> extractMin(list<Node *> _heap) {
    list<Node *> new_heap, lo;
    Node *temp;

    temp = getMin(_heap);
    list<Node *>::iterator it;
    it = _heap.begin();
    while (it != _heap.end()) {
        if (*it != temp) new_heap.push_back(*it);
        it++;
    }
    lo = removeMinFromTreeReturnBHeap(temp);
    new_heap = unionBinomialHeap(new_heap, lo);
    new_heap = adjust(new_heap);
    return new_heap;
}

void printTree(Node *h) {
    while (h) {
        cout << h->data << " ";
        printTree(h->child);
        h = h->sibling;
    }
}

void printHeap(list<Node *> _heap) {
    list<Node *>::iterator it;
    it = _heap.begin();
    while (it != _heap.end()) {
        printTree(*it);
        it++;
    }
    cout << endl;
}

int main() {
    int ch, key;
    list<Node *> _heap;
    int n;
    cout << "Enter n : ";
    cin >> n;
    while (n--) {
        int k;
        cin >> k;
        _heap = insert(_heap, k);
    }

    cout << "Heap elements after insertion:\n";
    printHeap(_heap);

    Node *temp = getMin(_heap);
    cout << "\nMinimum element of heap " << temp->data << "\n";

    _heap = extractMin(_heap);
    cout << "Heap after deletion of minimum element\n";
    printHeap(_heap);
    return 0;
}
```


Terminal

```
Enter n : 6
11
24
55
66
22
77
Heap elements after insertion:
22 77 11 55 66 24

Minimum element of heap 11
Heap after deletion of minimum element
24 22 55 66 77
```


Terminal

```
Enter n : 10
124
44
46
346
24
765
46
88
235
66
Heap elements after insertion:
66 235 24 44 46 346 124 46 88 765

Minimum element of heap 24
Heap after deletion of minimum element
765 44 46 66 235 88 46 346 124
```