ASSIGNMENT:4.7

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PRACTICAL EXERCISES WITH FENWICK TREES -BINARY INDEXED TREES : PROBLEM:

Hospital Patient Count Monitoring Using Fenwick Tree
A hospital records the number of patients admitted each day in a particular ward. Occasionally, patient counts are updated due to late admissions, discharges, or data corrections.
To efficiently manage daily patient data, the hospital uses a Fenwick Tree (Binary Indexed Tree) that allows:
1.
Updating the patient count for a specific day
2.
Querying the total number of patients admitted from Day 1 to a given day

Task
Write a program using a Fenwick Tree to support:
•
Update operation: Modify the patient count of a given day
•
Query operation: Find cumulative patient count till a given day Example Test Case 1 Input
• Number of days: 7

Daily patient admissions: [18, 22, 20, 25, 19, 23, 21]
Operations:
1.
Find total patient count till Day 5
2.
Update Day 4 patient count from 25 → 27
3.
Find total patient count till Day 5 Output

• Total patients till Day 5 = 104 • After update, total patients till Day 5 = 106
Explanation
Initial patient admission data:
Day: 1 2 3 4 5 6 7
Patients:18 22 20 25 19 23 21
Query 1
18 + 22 + 20 + 25 + 19 = 104

Update
Day 4 patient count corrected from 25 → 27 Increase = +2 patients
Query 2
18 + 22 + 20 + 27 + 19 = 106

CODE:

```
class FenwickTree:
    def __init__(self, n):
        self.n = n
        self.tree = [0] * (n + 1)
    def update(self, i, delta):
        while i <= self.n:
            self.tree[i] += delta
            i += i & (-i)
    def query(self, i):
        s = 0
        while i > 0:
            s += self.tree[i]
            i -= i & (-i)
        return s
n = int(input("Enter number of days: "))
patients = list(map(int, input("Enter daily patient counts: ").split()))
ft = FenwickTree(n)
```

```
# Build Fenwick Tree
for i in range(n):
    ft.update(i + 1, patients[i])
# Query 1
day = int(input("Enter day to find total patients till that day: "))
print("Total patients till Day", day, "=", ft.query(day))
# Update
update_day = int(input("Enter day to update: "))
new_value = int(input("Enter new patient count for that day: "))
old_value = patients[update_day - 1]
delta = new_value - old_value
patients[update_day - 1] = new_value
ft.update(update_day, delta)
# Query 2
day = int(input("Enter day to find total patients till that day after update: "))
print("After update, total patients till Day", day, "=", ft.query(day))
```

OUTPUT:

```
Enter number of days: 7
Enter daily patient counts: 18 22 20 25 19 23 21
Enter day to find total patients till that day: 5
Total patients till Day 5 = 104
Enter day to update: 4
Enter new patient count for that day: 27
Enter day to find total patients till that day after update: 5
After update, total patients till Day 5 = 106
```