DATE:

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EXP 1C

AIM: Perform Amortized Analysis using Potential Method.

THEORY: According to computational complexity theory, the potential method is defined as: A method implemented to analyze the amortized time and space complexity of a data structure, a measure of its performance over sequence of operations that eliminates the cost of infrequent but expensive operations.

→ The potential approach focuses on how the current pontient may be calculated directly from the algorithm's or data structure's present state.

→ The potential technique chooses a function ϕ that changes the data structures states into non-negetive values.

→ At each stage in the computation, the potential function should be able to maintain the track of the precharged time.

→ It calculates the amount of time that can be saved up to cover expensive operation

→ Intriguingly, though it simply depends on the data structure current state, regardless of the history of the computation that led to that state.

→ we then define the amortized time of an operation as:

$$c + \phi(a') \cancel{+} - \phi(a),$$

where c is the original cost of the operation and a and a' are the states of the data structure before and after the operation, respectively.

→ As a result, the amortized time is calculated as the actual time plus the prospective change.

→ The amortized time of each operation should ideally be low when defined.

CONCLUSION: Hence, we studied the potential method.

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Experiment No.:	01-C

AIM: Perform Amortized Analysis of Multipop / Dynamic Tables / Binary Counter using Aggregate, Accounting and Potential method. (Amortized Analysis)

1C) Amortized Analysis (Potential method)

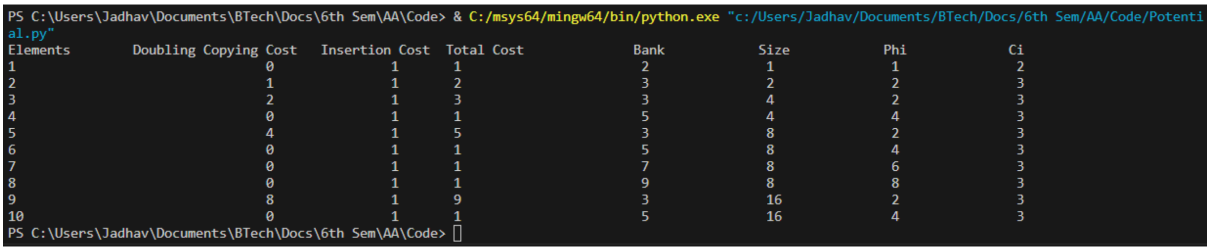
CODE:

```
def potential(n):
    size = 1
    total = 0
    dcost = 0
    icost = 0
    bank = 0
    phi = 0
    ci = 0
    phi_prev = 0

    print("Elements\tDoubling Copying Cost\tInsertion Cost\tTotal
Cost\t\tBank\t\tSize\t\tPhi\t\tCi")
    for i in range(1, n + 1):
        icost = 1
        if i > size:
            size *= 2
            dcost = i - 1
        total = icost + dcost
        phi = 2 * i - size
        ci = total + phi - phi_prev
        bank += (3 - total)
        print(i, "\t\t\t\t", dcost, "\t\t", icost, "\t", total, "\t\t\t",
bank, "\t\t", size, "\t\t", phi, "\t\t", ci)
        icost = 0
        dcost = 0
        phi_prev = phi

potential(10)
```

OUTPUT:



```
PS C:\Users\Jadhav\Documents\BTech\Docs\6th Sem\AA\Code> & C:/msys64/mingw64/bin/python.exe "c:/Users/Jadhav/Documents/BTech/Docs/6th Sem/AA/Code/Potenti
al.py"
Elements        Doubling Copying Cost   Insertion Cost  Total Cost              Bank            Size            Phi             Ci
1                                0               1       1                       2               1               1               2
2                                1               1       2                       3               2               2               3
3                                2               1       3                       3               4               2               3
4                                0               1       1                       5               4               4               3
5                                4               1       5                       3               8               2               3
6                                0               1       1                       5               8               4               3
7                                0               1       1                       7               8               6               3
8                                0               1       1                       9               8               8               3
9                                8               1       9                       3               16              2               3
10                               0               1       1                       5               16              4               3
PS C:\Users\Jadhav\Documents\BTech\Docs\6th Sem\AA\Code> ▯
```

CONCLUSION: Hence we studied amortized analysis-Potential method.