

11th June 2025 :

Page No. _____
Date: _____

Problem 1: longest balanced substring of 0s & 1s
Input

- N (length of binary string)
- S - binary string of length N

N = 10

S = "0100011100"

O/P : 8

Approach :-

- convert 0 to -1, keep 1 as +1
- Now problem becomes: find the longest subarray with sum = 0.
- use a hashmap to track the 1st occurrence of each prefix sum,

pseudo-code:

```
Map<Integer, Integer> map = new HashMap<>();
map.put(0, -1);
int maxlen = 0;
int sum = 0;
for (int i=0 ; i<n; i++) {
    sum += (s.charAt(i) == '1') ? 1 : -1;
    if (map.containsKey(sum)) {
        maxlen = Math.max(maxlen, i - map.get(sum));
    } else {
        map.put(sum, i);
    }
}
return maxlen;
```

My Run:- Input:

$$S = "0100011100"$$

\Rightarrow convert $0 \rightarrow -1$ and $1 \rightarrow +1$

$$S \rightarrow 0 \quad 1 \quad 0 \quad 0 \quad 0 \quad 1 \quad 1 \quad 1 \quad 0 \quad 0$$

$\downarrow \quad \downarrow \quad \downarrow \quad \downarrow \quad \downarrow \quad \downarrow \quad \downarrow$

$$\begin{matrix} -1 \\ \text{runlen} \\ 0 \end{matrix} \quad -1 \quad -1 \quad -1 \quad 1 \quad 1 \quad 1 \quad -1 \quad -1$$

- $\{0 : -1\}$
- $\{0 : -1, -1 : 0\}$
- 0 found before at $-1 \rightarrow$
 $\text{len} = 1 - (-1) = 2 \quad 2$
- -1 found before at 0 \rightarrow
 $\text{len} = 2 - 0 = 2 \quad 2$

• -1 found at 0 $\rightarrow \text{len} = 6 - 0 = 6$

• -1 found at 0 $\rightarrow \text{len} = 8 - 0 = 8$

• -2 found at 3 $\rightarrow \text{len} = 9 - 3 = 6$

ap <?> C:

find Answer = B

Problem 2:

Approach:

1. low = 1
2. high = P[N-1] - P[0]
3. for mid = (low+high)/2

pseudocode:-

```
int low=1  
int high= P.length - 1 - P[0];  
int result = 0;  
while (low <= high) {  
    int mid = low + (high - low)/2;  
    if (canplace (P, k, mid))  
    {  
        result = mid;  
        low = mid + 1;  
    } else {  
        high = mid - 1;  
    }  
}
```

return result;

dry run: binary search range : 1 to 16

try mid = 8 \rightarrow can place 3 station

\rightarrow try bigger \exists

try mid = 12 \rightarrow only 2 station ✓

try mid = 14 \rightarrow .. 2 .. ✓

try mid = 15 \rightarrow .. 2 .. ✓

try mid = 16 \rightarrow .. 2 .. ✓

try mid = 17 \rightarrow .. 2 .. ✓

try mid = 9 \rightarrow can place 2 stations ✓

try mid = 10 \rightarrow cannot \rightarrow 9 is max

answer \rightarrow 9