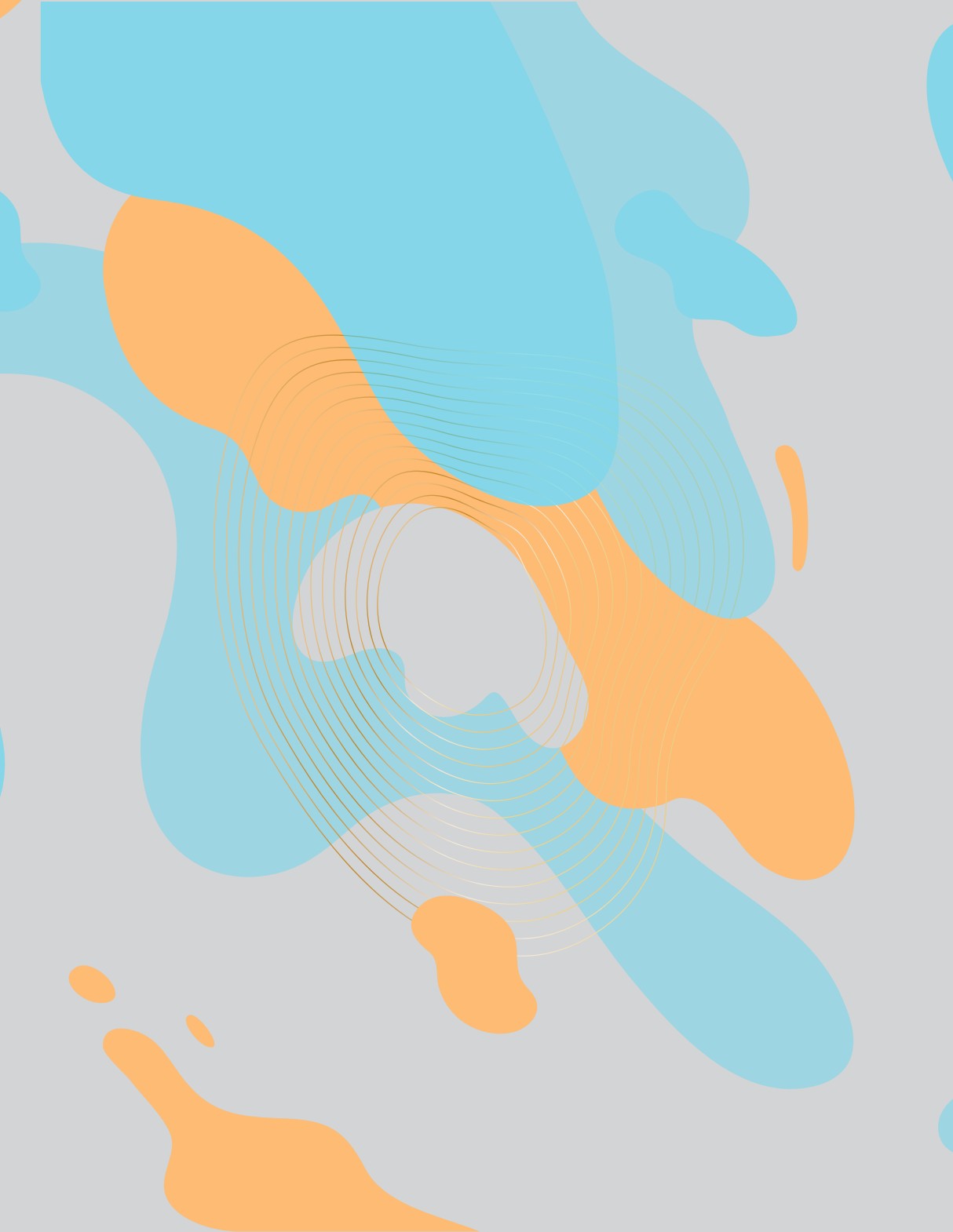

Rough work / Approach

In Class / Sum of all Subarray Sums

(Introduction to Problem Solving - I)

Carry Forward Technique

Observe the below loop

```
for (int i = 0; i < N; i++) {
    for (int j = i; j < N; j++) {
        |
    }
}
```

For any value of (i, j) this is how the loop runs

i = 0

j → 0

j → 0, 1

j → 0, 1, 2

⋮

j → 0, 1, 2, ..., N-1

Observation

→ In essence, these are just each, subarray indices of each subarray for i = 0

→ If we carry forward the sum of each element, for an entire iteration of 'j' we will have the subarray sum till that index

```
for (int i = 0; i < N; i++) {
    int sum = 0;
    for (int j = i; j < N; j++) {
        sum += arr[j];
    }
}
```

Analysing the pattern on the right →

→ After each iteration of j's value, the sum holds the value of subarray sum from 'i' to the current 'j' index

→ So, therefore if we keep on storing and incrementing the value of sum into a variable we can get the cumulative sum of all the subarrays

→ `answer += sum;`

How 'sum' accumulates

i = 0

sum = 0

j = 0

sum = 0 + a[0]

subarray sum of [0] index

j = 1

sum = sum + a[1]

or

sum = a[0] + a[1]

subarray sum of [0, 1] indexes

j = 2

sum = sum + a[2]

OR

sum = a[0] + a[1] + a[2]

subarray sum of [0, 1, 2] indexes

.
.
.

sum = a[0] + a[2] + ... + a[N-1]

sub array sum of (0, 1, 2, ..., N-1) indexes

Putting it all together

```
int answer = 0;
for (int i = 0; i < N; i++) {
    int sum = 0;
    for (int j = i; j < N; j++) {
        sum += arr[j];
        answer += sum;
    }
}
```

After the complete iteration of 'j' ends for $i = 0$,

→ sum resets, i.e sum = 0

→ answer holds the entire subarray sum for $i = 0$

Similarly

for further values of 'j'

$j = 1$ and so on

→ sum will keep on carry forwarding

→ answer will keep on accumulating

How 'answer' accumulates

answer = 0

$i = 0$

sum = 0

$j = 0$

sum = a[0]

ans = a[0]

$j = 1$

sum = a[0] + a[1]

answer = answer + sum

OR

answer = a[0] + {a[0] + a[1]}

$j = 2$

sum = a[0] + a[1] + a[2]

answer = a[0] + {a[0] + a[1]}

+ {a[0] + a[1] + a[2]}

⋮

$j = N-1$

sum = a[0] + a[1] + ... + a[N-1]

answer = a[0] + {a[0] + a[1]} +

...

+

{a[0] + a[1] + ... + a[N-1]}

Hint

$i = 1$

$sum = 0;$

$j = 1$

$sum = a[2]$

$answer = [\ \Sigma sum_i^0 + a[1]]$

$j = 2$

$sum = a[1] + a[2]$

$answer = [\ \Sigma sum_i^0 + a[1] + \{a[1] + a[2]\}$

⋮

This goes until we have the final value of 'answer'

$$answer = [\ \Sigma sum_i^0 + \Sigma sum_i^1 + \dots + \Sigma sum_i^{N-1}\ ]$$

Happy Coding ☺