

* Split Array - Largest Sum

$$\text{arr} = \{7, 2, 5, 10, 8\}, m = 2$$

there are four ways to split nums into sub arrays.

$$\boxed{7, 2, 5, 10} \mid \boxed{8} \quad \text{largest sum} = 24$$

$$\boxed{7, 2, 5} \mid \boxed{10, 8} \Rightarrow \boxed{18} \leftarrow \text{Ans}$$

$$\boxed{7, 2} \mid \boxed{5, 10, 8} \quad \text{sum} = 23$$

$$\boxed{7} \mid \boxed{2, 5, 10, 8} \quad \text{sum} = 25$$

The best way is to split it into $\{7, 2, 5\}$ and $\{10, 8\}$,

where the largest sum among the two subarrays is only $\boxed{18}$.

⇒ Let's check:

Case: I

⇒ minimum num of partitions that we can make $\boxed{= 1}$ ~~1000000~~

$$\{7, 2, 5, 10, 8\}$$

ans will be the ~~max sum~~ ~~arr~~ sum of entire $\boxed{= 32}$

Case: 2

=> Maximum num of partitions
or m that can be = n

$[7, 2, 5, 10, 8]$ $m=5$

⇓

$[7], [2], [5], [10], [8]$

Ans will be the ~~sum~~^{max} of ~~entire~~ arr

= ~~7~~ ~~2~~ ~~5~~ ~~10~~ ~~8~~

= 10

* What will be the ans in Case: 1

when $m=1$

$[7, 2, 5, 10, 8]$

sum of entire arr

⇓
= 32

* What will be the ans in Case: 2

$[7], [2], [5], [10], [8]$

when $m=n$

max num in arr

⇓

= 10

So Hence,

- max value of ans of question = case 1
- min value of ans of question = case 2

↓↓

maxAns = sum of all value in arr
minAns = max value in arr

So, now we have lower and upper bound of an answer. [10, 32] in this case.

Start = minAns = 10

end = maxAns = 32

↓↓

So now we can find middle potential answer that can be split with m

$$\text{mid} = \frac{\text{Start} + \text{end}}{2} = \frac{10 + 32}{2} = \frac{42}{2} = 21$$

We can split arr with 21 of max sum.

[7, 2, 5] | [8, 10]

$14 < 21$

$18 < 21$

Pieces = 2

* Check 1

$\text{if } (\text{Pieces} < m) \Rightarrow \text{end} = \text{mid}$

now,

$\text{start} = 10, \text{end} = 21$

$\text{mid} = \frac{10 + 21}{2} = 15$

$[7, 2, 5], [8], [10]$

\Downarrow

In this case

$\text{Pieces} = 3$

* Check 2

//

$\text{if } (\text{Pieces} > m) \Rightarrow \text{start} = \text{mid} + 1$

now,

$\text{start} = 16$

$\text{end} = 21$

$\text{mid} = \frac{16 + 21}{2} = 18$

$[7, 2, 5], [8, 10]$

\Downarrow

\Downarrow

~~7~~ ~~2~~ ~~5~~

~~8~~ ~~10~~

\Downarrow

$\text{Pieces} = 2$

\Rightarrow start = 16 end = 18

$$\text{mid} = \frac{16+18}{2} = 17$$

[7, 2, 5], [8], [17]

pieces = 3

1. $\text{start} = \text{mid} + 1$

$\text{start} = \text{mid} + 1$

\Rightarrow start = 18 end = 18

$$\text{mid} = \frac{18+18}{2} = 18$$

So, start, end & mid are same
We found our answer. 18

* Let's Code

splitArray (int[] arr, int m) {

int start = 0;

int end = 0;

// Find starting and ending point

for (int num : arr) { // start = max num in arr

start = Math.max (start, num);

// end = sum of arr

end += num;

}

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// loop will break when start and end both are equal

⇓

```
while (start < end) {
```

```
    int mid = (start + (end - start) / 2);
```

```
    int sum = 0;
```

```
    int pieces = 1; // min partition is 1.
```

```
    for (int num : arr) {
```

```
        if (sum + num <= mid) {
```

```
            sum += num;
```

```
        }
```

```
        else {
```

```
            // if sum bigger than mid then new partition
```

```
            sum = num;
```

```
            pieces++;
```

```
        }
```

```
    }
```

```
    if (pieces > m) {
```

```
        start = mid + 1;
```

```
    } else {
```

```
        end = mid;
```

```
    }
```

```
}
```

```
return start;
```

```
}
```