$F(n) = F(n-1) + F(n-2)$

$f(1) = 1$
$f(0) = 0$

$F(n) \longrightarrow 1$

$f(n-1) \quad f(n-2) \longrightarrow 2$

$f(n-2) \quad f(n-3) \quad f(n-3) \quad f(n-4) \longrightarrow 4$

$f(n-3)$

$f(n-4)$

Big-O

Theta $\quad \Theta(n)$

$\Omega \quad O$

$n = 1000$

3

$n^2 \quad n^{\log n}$

$1 < \log n < \underline{n} < \underline{n\log n} < \underline{n^2} - - -$

$\Omega(n) \qquad O(n^2)$

2^{2n} $\quad$ 2^n

4^n $\quad$ 2^n

$2^n \times 2^n \times 2^n$ ---- n times

2^{n+1} $\quad$ 2^{2n+1}

2×2^n $\quad$ 2×2^{2n}

n^2 $\quad$ n^3 $\quad$ $2n$ $\quad$ $3n$

$n^2 \times n$

$$O(f(n) + g(n)) = O(\max(f(n), g(n)))$$

with $f(n) = n$, $g(n) = n^2$:

$$O(n + n^2) = O(n^2)$$

Example 1:

```
Input:
N = 5
arr[] = {1,2,3,4,5}
Output: 6
Explanation: Smallest positive missing
number is 6.
```

Example 2:

```
Input:
N = 5
arr[] = {0,-10,1,3,-20}
Output: 2
Explanation: Smallest positive missing
number is 2.
```

$[0, -10, \underline{\underline{1}}, 3, -20]$

$\underline{\underline{1}}, 2, 3, 4, \text{-----}$ $\quad$ $\underline{\underline{O(n)}}$

$[\underline{1}, \underline{\underline{n+1}}]$

Input:
N = 5
Arr[] = {1,2,3,-2,5}
Output:
9
Explanation:
Max subarray sum is 9
of elements (1, 2, 3, -2, 5) which
is a contiguous subarray.

Example 2:

Input:
N = 4
Arr[] = {-1,-2,-3,-4}
Output:
-1
Explanation:
Max subarray sum is -1
of element (-1)

$[\underbrace{1, 2, 3}_{6}, -2, 5]$

$\boxed{9}$

$[1, 2, -10, \underbrace{1, 5}_{6}]$

1	2	3	......	n
n	n-1	n-2	......	1

$O(n^2)$

	0	1	2	3	4
	1	2	-10	1	5
max_till_here:	1	3	-7	1	$\boxed{6}$

$mth[0] = arr[0]$

$i \geq 1$: $mth[i] = mth[i-1] + arr[i]$ if $mth[i-1] > 0$

$mth[i] = arr[i]$ otherwise

$mth[i]$ = maximum sum of any subarray ending EXACTLY at index i.

TC: $O(n)$ Aux space = $O(n)$

	0	1	2	3	4	5
arr:	1	2	-1	1	3	-2
mth:	1	3	2	3	$\boxed{6}$	4

```
Input : arr[] = {1, 3, 5, 5, 5, 5, 67, 123, 125}
        x = 5
Output : First Occurrence = 2
         Last Occurrence = 5

Input : arr[] = {1, 3, 5, 5, 5, 5, 7, 123, 125 }
        x = 7
Output : First Occurrence = 6
         Last Occurrence = 6
```

0	1	2	3	4	5	6	7
1	3	5	5	5	5	67	123

x = 5

low = 0 high = 7

$mid = \frac{0+7}{2} = 3$ first_occ = 3

arr[mid] == x

low = 0 high = 2

$mid = \frac{0+2}{2} = 1$ (arr[mid] < x)

low = 2 high = 2

$mid = \frac{2+2}{2} = 2$ first_occ = 2

arr[mid] == x

(low = 2 high = 1) STOP!