Exercise

The Fibonacci numbers are the numbers in the following integer sequence.

0, 1, 1, 2, 3, 5, 8, 13, 21, 34, 55, 89, 144, ……..

In mathematical terms, the sequence F_n of Fibonacci numbers is defined by the recurrence relation: $F_n = F_{n-1} + F_{n-2}$ with seed values: $F_0 = 0$ and $F_1 = 1$.

Write an algorithm to get the n-th Fibonacci number (n > 0).

Option 1 - Use Loops

```
function fibonacci(n)
     input - n: integer
     output - n: integer

     int arr[n+1];
     arr[0] = 0;
     arr[1] = 1;
     for (i = 2; i <= n; i++)
          arr[i] = arr[i-1] + arr[i-2];
     return arr[n];
```

Option 2 - Use Recursion

```
function fibonacci(n)
     input - n: integer
     output - n: integer

     if (n < 2)
          return n;
     else
          return fibonacci(n-1) + fibonacci(n-2);
```

Use RAM Model on Two Algorithms (1st)

```
function fibonacci(n)
     input - n: integer
     output - n: integer

     int arr[n+1];
     arr[0] = 0;
     arr[1] = 1;
     for (i = 2; i <= n; i++)
          arr[i] = arr[i-1] + arr[i-2];
     return arr[n];
```

Use RAM Model on Two Algorithms (1st)

```
function fibonacci(n)
     input - n: integer
     output - n: integer

     int arr[n+1];                          1
     arr[0] = 0;                            1
     arr[1] = 1;                            1
     for (i = 2; i <= n; i++)               1 (assign)
          arr[i] = arr[i-1] + arr[i-2];     1(<=) 1 (i-1) 1(i-2) 1(+) 1(=) 1(++)
                                            1 (last comparison when i = n + 1)
     return arr[n];                         1
```

Use RAM Model on Two Algorithms (1st)

```
function fibonacci(n)
     input - n: integer
     output - n: integer

     int arr[n+1];                          1
     arr[0] = 0;                            1
     arr[1] = 1;                            1
     for (i = 2; i <= n; i++)               1
          arr[i] = arr[i-1] + arr[i-2];     6(n-1)
                                            1
     return arr[n];                         1
```

6(n-1) + 6 = 6n

Use RAM Model on Two Algorithms (2nd)

```
function fibonacci(n)
     input - n: integer
     output - n: integer

     if (n < 2)
          return n;
     else
          return fibonacci(n-1) + fibonacci(n-2);
```

Use RAM Model on Two Algorithms (2nd)

```
function fibonacci(n)
     input - n: integer
     output - n: integer

     if (n < 2)                                          1
          return n;                                      1
     else
          return fibonacci(n-1) + fibonacci(n-2);        1 1 1 1
```

T(n) = T(n-1) + T(n-2) + 4

Announcement

- Office Hours:
  - Guoxi Liu (guoxil@clemson.edu)
    - Monday 11 - 12 AM, Tuesday 2 - 3 PM
  - Xueyi Bao (xueyib@clemson.edu)
    - Wednesday 11 - 12 AM, Thursday 1 - 2 PM
  - Or schedule an appointment with Zoom
- Join the slack channel!