CS330

Fibonacci numbers

Dr. Eva Iwer

DigiPen Institute of Technology

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Fibo who?

What are the fibonacci numbers?

- Were introduced in The Book of Calculating
- Series begins with 0 and 1
- Next number is found by adding the last two numbers together
- Number obtained is the next number in the series
- Pattern is repeated over and over

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Mathematical Description

- $F(n) = F(n-1) + F(n-2)$ for $n > 1$
- $F(0) = 0$
- $F(1) = 1$

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Iterative

Iterative

Implementation

```
static int fib(int n)
 {
    int fib0 = 0, fib1 = 1;
    for (int i = 2; i <= n; i++)
    {
        int tmp = fib0;
        fib0 = fib1;
        fib1 = tmp + fib1;
    }
    return (n > 0 ? fib1 : 0);
 }
```

Recursive

Recursive

Implementation

```
unsigned int fib(unsigned int n){
    if (n < 2)
      return n;
    else
      return fib(n - 1) + fib(n - 2);
 }
```

Recursive - Tail

Recursive - Tail

Implementation

```
unsigned int fib(unsigned int n, unsigned int a = 0,
unsigned int b = 1) {
      if(n < 1) return a;
      else return fib(n - 1, a + b, a);
}
```

Iterative - Dynamic Programming

Iterative - Dynamic Programming

```
int fib(int n)
{
  /* Declare an array to store Fibonacci numbers. */
  int f[n+1];
  int i;
  /* 0th and 1st number of the series are 0 and 1*/
  f[0] = 0;
  f[1] = 1;
  for (i = 2; i <= n; i++)
  {
      /* Add the previous 2 numbers in the series
         and store it */
      f[i] = f[i-1] + f[i-2];
  }
  return f[n];
}
```

Recursive - Dynamic Programming

Recursive - Dynamic Programming

```
int fib(int n)
{
    if (lookup[n] == NIL)
    {
        if (n <= 1)
            lookup[n] = n;
        else
            lookup[n] = fib(n-1) + fib(n-2);
    }

    return lookup[n];
}
```