Dynamic Programming

Maximum Sum Sub-Array

Given an array

Each sub-array has a sum. What is the maximum such sum possible.

Maximum Sum for any sub Array ending at i^{th} location

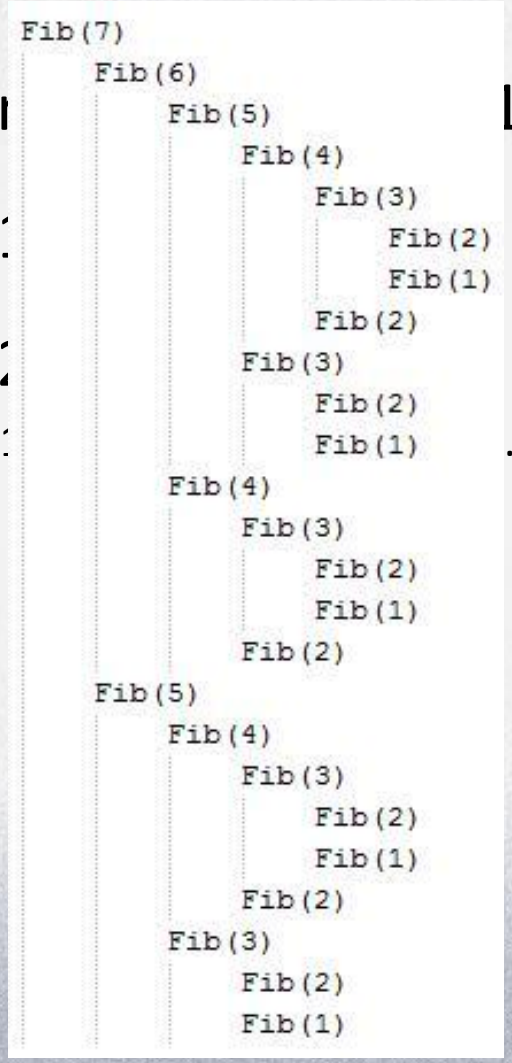
31	0	59	85	32	90	187	94	71	155

Maximum so far

31	31	59	85	85	90	187	187	187	187

Fibonacci Sequence

Execution Trace:

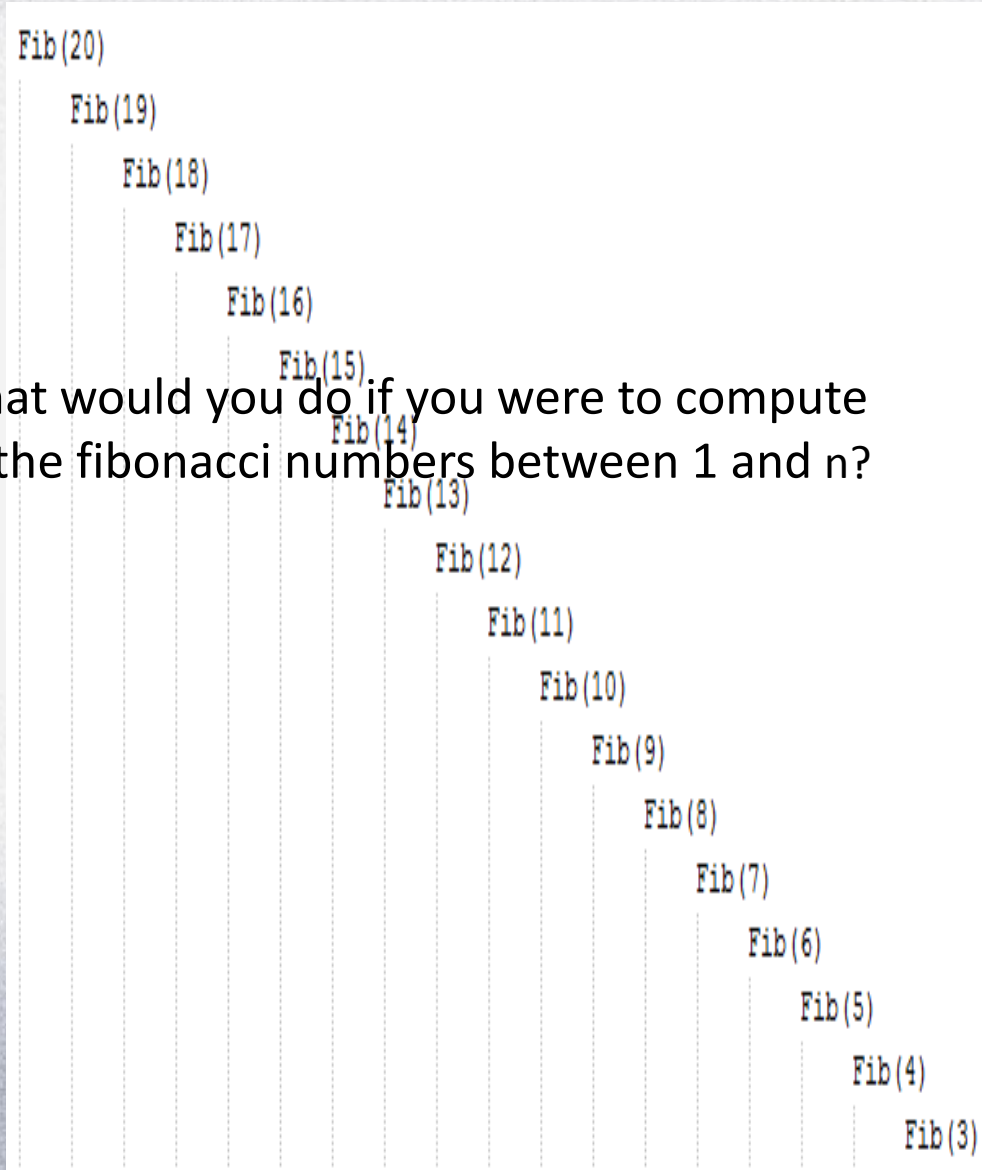


Naïve Recursive Function

```
int Fib(int n){
        if(n==1 || n==2)
                return 1;
        return Fib(n-1)+Fib(n-2);
}
```

Fibonacci Sequence (Doing it Cleverly)

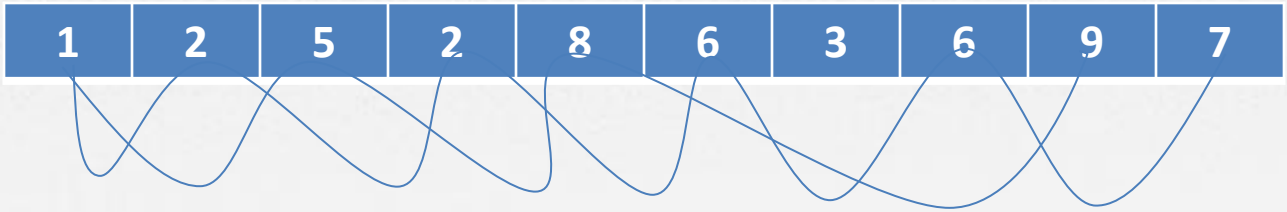
```
int fib[100];
memset(fib,0,sizeof(fib));
fib[1]=fib[2]=1;

int Fib(int n){
        int x,y;
        if(n==1 || n==2)
                return 1;
        if(fib[n-1])
                x = fib[n-1];
        else
                x = fib[n-1] = Fib(n-1);
        if(fib[n-2])
                y = fib[n-2];
        else
                y = fib[n-2] = Fib(n-2);
        return x+y;
}
```



What would you do if you were to compute all the fibonacci numbers between 1 and n?

Longest Non Decreasing Subsequence

Given an array



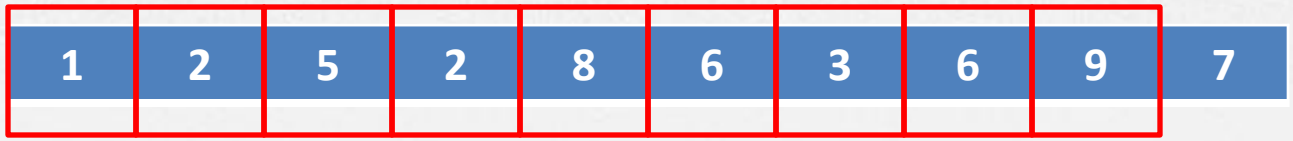
Find a subsequence which is non decreasing and of maximum length

1-5-8-9 Forms a non decreasing subsequence

So does 1-2-2-6-6-7 but it is longer

Our aim is to find the longest such subsequence

Longest Non Decreasing Subsequence



Length of LNDS ending at i^{th} Loc

1	2	3	3	4	4	4	5	6	6

```
for(i=0;i<100;i++){
        max= 0;
        for(j=0;j<i;j++){
                if(A[i] >= A[j] && L[j] > max)
                        max = L[j];
        }
        L[i] = max+1;
}
```

Longest Common Subsequence

A	B	C	B	D	A	B
B	D	C	A	B	A	

Find a string such that it is a subsequence in both of the arrays and its length is longest

CAB is a subsequence of both the arrays

BDAB is also a subsequence of both the arrays, but is longer

Practice Problems

http://www.spoj.pl/problems/COINS/

http://www.spoj.pl/problems/AIBOHP/

http://www.spoj.pl/problems/IOIPALIN/

http://www.spoj.pl/problems/ADFRUITS/

http://www.spoj.pl/problems/NY10E/

http://www.spoj.pl/problems/EDIST/

http://www.spoj.pl/problems/RENT/

http://www.spoj.pl/problems/BABTWR/