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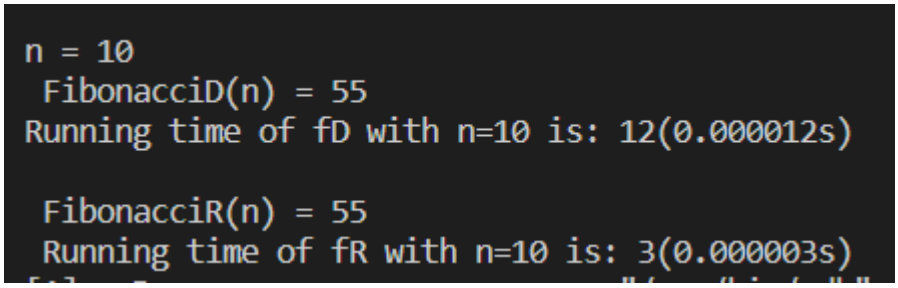
Problem 1

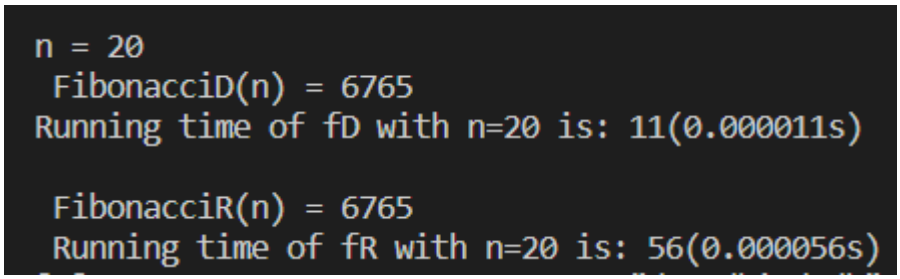
a) Comment on the running time of each function

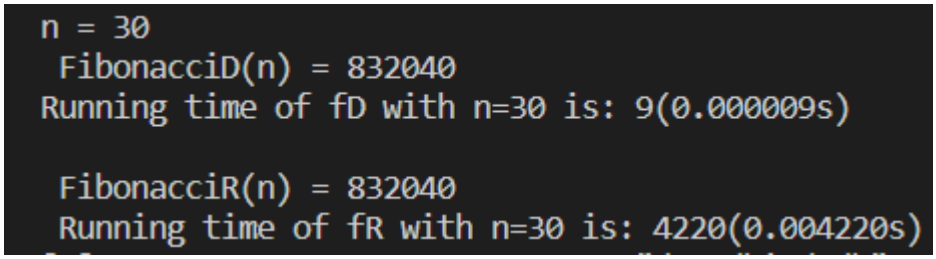
n	FibonacciD	FibonacciR
5	0.000013s	0.000029s
10	0.000012s	0.000003s
20	0.000011s	0.000056s
30	0.000009s	0.004220s
40	0.000010s	0.478264s

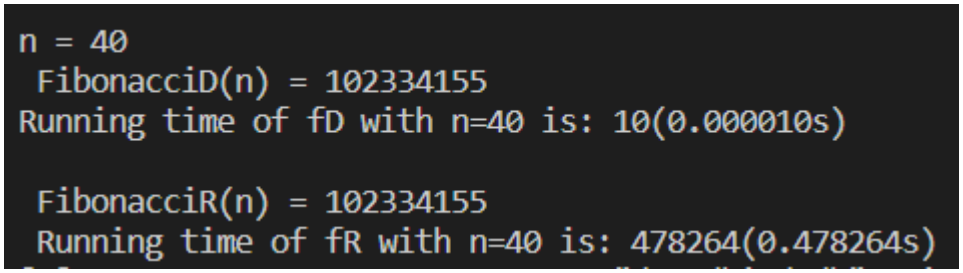
Sample run

```
n = 5
 FibonacciD(n) = 5
Running time of fD with n=5 is: 13(0.000013s)

 FibonacciR(n) = 5
 Running time of fR with n=5 is: 29(0.000029s)
```









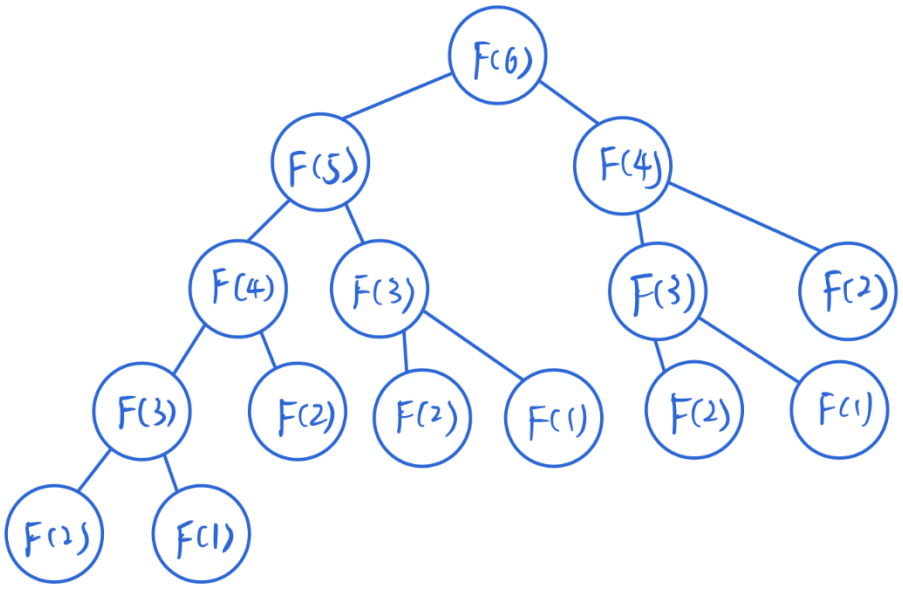
b) The big O asymptotic notation of each function

Fibonacci D

The time complexity is O(n). Each loop the function stores the result with adding, and the result could be directly used by the next loop. Therefore, the total time is O(n)

Fibonacci R

The time complexity is O(2^n). Each loop the function is divided by 2, hence there will be a binary tress. The total running time equals to the number of nodes in the tree. Therefore, the total time is O(2^n).



Problem 2

Running table

Rod Size	Recursive Time	Recursive Max Revenue	Dynamic Time	Dynamic Max Revenue
5	1	12	7	12
10	5	25	8	25
15	133	37	9	37
20	4726	50	9	50
25	135544	62	9	62
30	4389127	75	10	75
35	No solution	No solution	10	87
40	No solution	No solution	12	100
45	No solution	No solution	12	112
50	No solution	No solution	13	125

Sample run.

```
Input the length of the rod: 5
 CutRodD with n = 5 is 12
 Running time is 7

 cutRodR with n = 5 is 12
 Running time is 1
[1] + Done                    "/usr
```

```
Input the length of the rod: 10
 CutRodD with n = 10 is 25
 Running time is 8

 cutRodR with n = 10 is 25
 Running time is 5
```

```
Input the length of the rod: 15
 CutRodD with n = 15 is 37
 Running time is 9

 cutRodR with n = 15 is 37
 Running time is 125
```

```
Input the length of the rod: 20
 CutRodD with n = 20 is 50
 Running time is 9

 cutRodR with n = 20 is 50
 Running time is 4726
```

```
Input the length of the rod: 25
 CutRodD with n = 25 is 62
 Running time is 9

 cutRodR with n = 25 is 62
 Running time is 135544
```

```
Input the length of the rod: 30
 CutRodD with n = 30 is 75
 Running time is 10

 cutRodR with n = 30 is 75
 Running time is 4389127
```

```
Input the length of the rod: 35
 CutRodD with n = 35 is 87
 Running time is 10

 cutRodR with n = 35
 No result in 2 mins
```

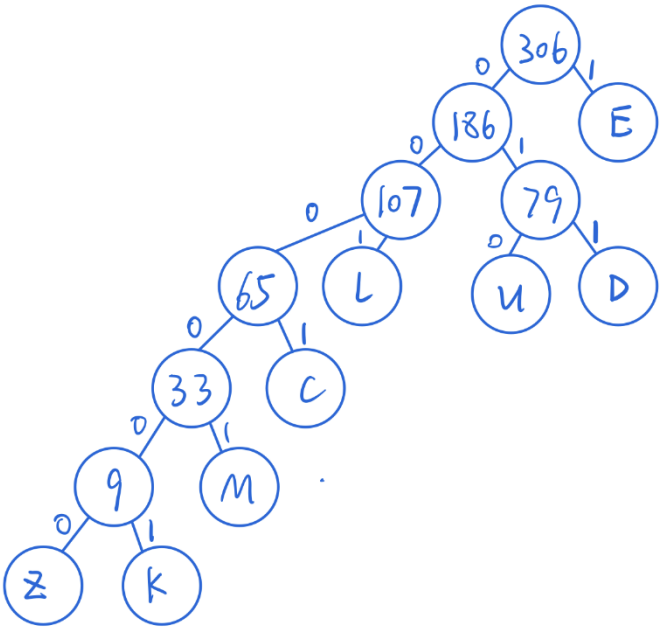
```
Input the length of the rod: 40
 CutRodD with n = 40 is 100
 Running time is 12

 cutRodR with n = 40
 No result in 2 mins
```

```
Input the length of the rod: 45
 CutRodD with n = 45 is 112
 Running time is 11

 cutRodR with n = 45
 No result in 2 mins
```

```
Input the length of the rod: 50
 CutRodD with n = 50 is 125
 Running time is 12

 cutRodR with n = 50
 No result in 2 mins
```

Problem 3

Huffman encoding tree



Huffman code

Z	0
K	000001
M	00001
C	0001
U	010
D	011
L	001
E	1