Recitation (I)

▷ Asymptotic notations

Prob: rank the following funcs by asymptotic order.

$(\sqrt{2})^{\log n}$, n^3, $\log^2 n$, $\log\log n$, $3^{\log_3 n}$, $n\log^2 n$, $n^{\log\log n}$, $4^{\log n}$,

$n!$, 100^n, $n^{1/2}$

Sol: $(\sqrt{2})^{\log n} = 2^{\frac{1}{2}\log n} = \sqrt{n}$, $3^{\log_3 n} = n$, $4^{\log n} = n^2$

$$\log\log n \le \log^2 n \le (\sqrt{2})^{\log n} = n^{\frac{1}{2}} \le n \le n\log^2 n \le n^2 \le n^3 \le$$

$$n^{\log\log n} \le 100^n \le n!$$

(n: $3^{\log_3 n}$; n^2: $4^{\log n}$)

- $n^{\log\log n} \le 100^n$: $(\log\log n)\log n$ v.s $n \cdot \log 100$

- $100^n \le n!$: $\lim_{n\to\infty} \frac{n!}{100^n} = \lim_{n\to\infty} \frac{n\cdot(n-1)\cdot(n-2)\cdots 1}{100\cdot 100\cdot 100\cdots 100}$

$$= \lim_{n\to\infty} \frac{n\cdot(n-1)(n-2)\cdots 101}{100\cdot 100\cdot 100\cdots 100} \cdot \frac{100!}{100^{100}}$$

$$= \frac{100!}{100^{100}} \lim_{n\to\infty} \frac{n\cdot(n-1)(n-2)\cdots 101}{100\cdot 100\cdot 100\cdots 100}$$

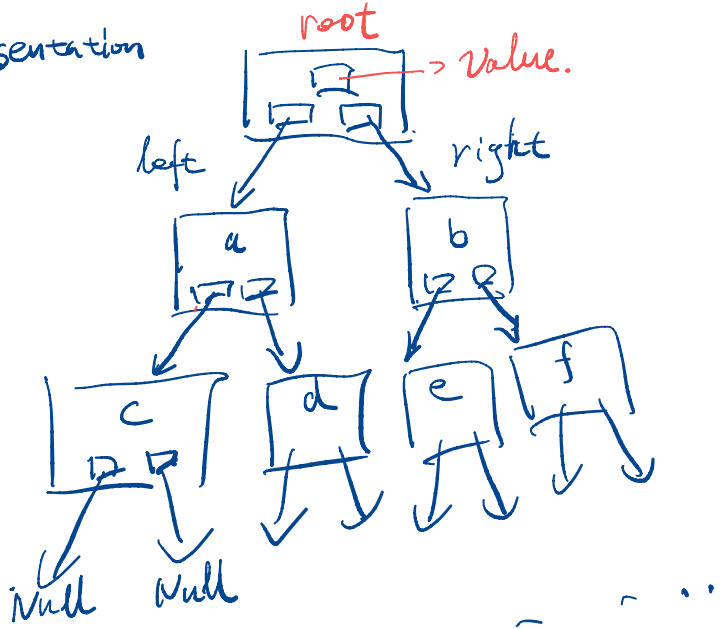
$\Theta(1)$

$$\ge \lim_{n\to\infty} \frac{n}{100} = \infty$$

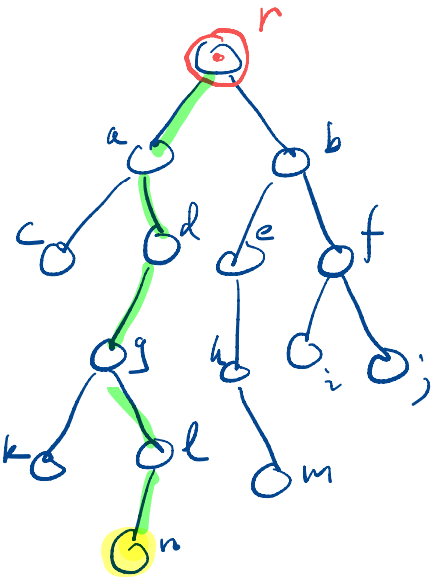
D DFS & BFS

Prob 1: Max depth of binary tree.

Representation



depth = 5.



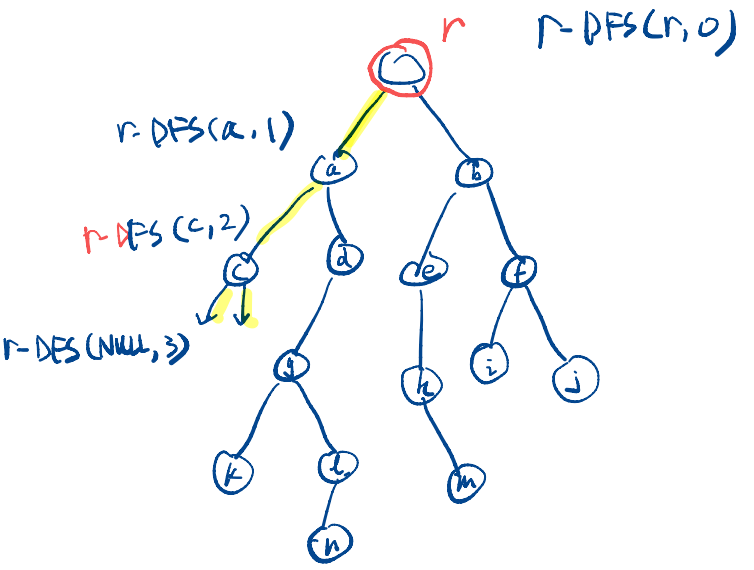
a, b are children of r.

c is a leaf

Depth = 2

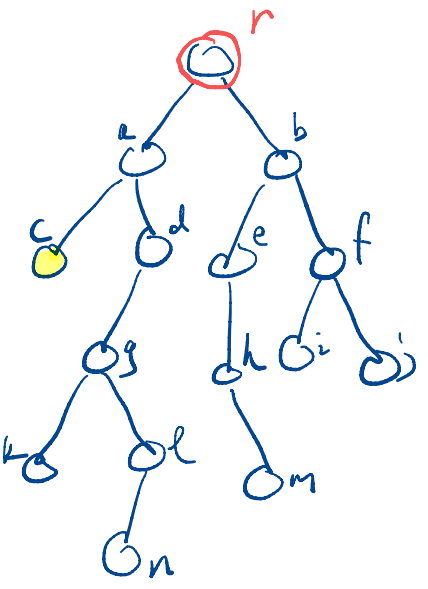
```
DFS(r)
    global Depth = 0
    recursive-DFS(r, 0)

recursive-DFS(v, d)
    If v is NULL : return.
    Depth = max(d, Depth)
    recursive-DFS(v.left, d+1)
    recursive-DFS(v.right, d+1)
```



Prob 2: Min depth of binary tree

```
BFS(r)
    Q[1] ← (r, 0)
    Depth ← ∞
    while Q is not empty:
        v, d ← Q.pop()
        If v is NULL: continue.
        If v is a leaf:
            Depth = min(Depth, d)
        Else:
            Q.append(v.left, d+1)
            Q.append(v.right, d+1)
```



Simulation:

Q

while loop ↓

- [(r,0)]
- [(a,1), (b,1)]
- [(b,1), (c,2), (d,2)]
- [(c,2), (d,2), (e,2), (f,2)]
- [(d,2), (e,2), (f,2)]
  Depth = 2