Maximum Subsequence Sum (MSS)

Thursday, October 22, 2020 5:00 PM

Reminder: HW6 & lab3 are due ~~this Sunday~~ Oct 27th

Example: A random array is given to you. Find a subsequence that gives you the max sum. $\left(\sum_{i=p}^{s} a[i]\right)$

① sol 1 → 2 for loops → $\Theta(n^2)$ ✓

② sol 2 → $T(n) = 2T\left(\frac{n}{2}\right) + \underbrace{\Theta(1)}_{\text{divide}} + \underbrace{O(n)}_{\text{combine}} = 2T\left(\frac{n}{2}\right) + O(n)$

✓ $T(n) = O(n \log n)$

$\max(6,12,4+2) = 12$

$a = [2, 4, -5, 3, -10, 6, 5, -1, 2]$

$\max(6,3,6-2) = 6$

$mss = \max(mss_L, mss_R, mss_{middle})$

mss_L mss_R mss_m

$\max(6,6,6+6) = 12$

$\max(5,2,5+1) = 6$ ✓

$mss = \max(2,4,2+4) = 6$

$mss = 3$ $mss = 6$

$mss_L = 2$ $mss_R = 4$ 5 3 -10 6 5 2

-1 2

mss → $mss_L + mss_R$, $\max(mss_L, mss_R)$, $\max(mss_L, mss_R, mss_L + mss_R)$

$mss_L = 10$ $mss_R = 15$

$sum = a[m]$

$max2 = -inf$

$m-1, m-2, m-3, \ldots, 1$

```
for i = m-1 : -1 : 1
    sum += a[i]
    if max2 < sum        → max sum in left
        max2 = sum
    end
end
```

d c b a

c b a

b a

a x y z

l d c b a x y z

mss_L mss_R

max max

s

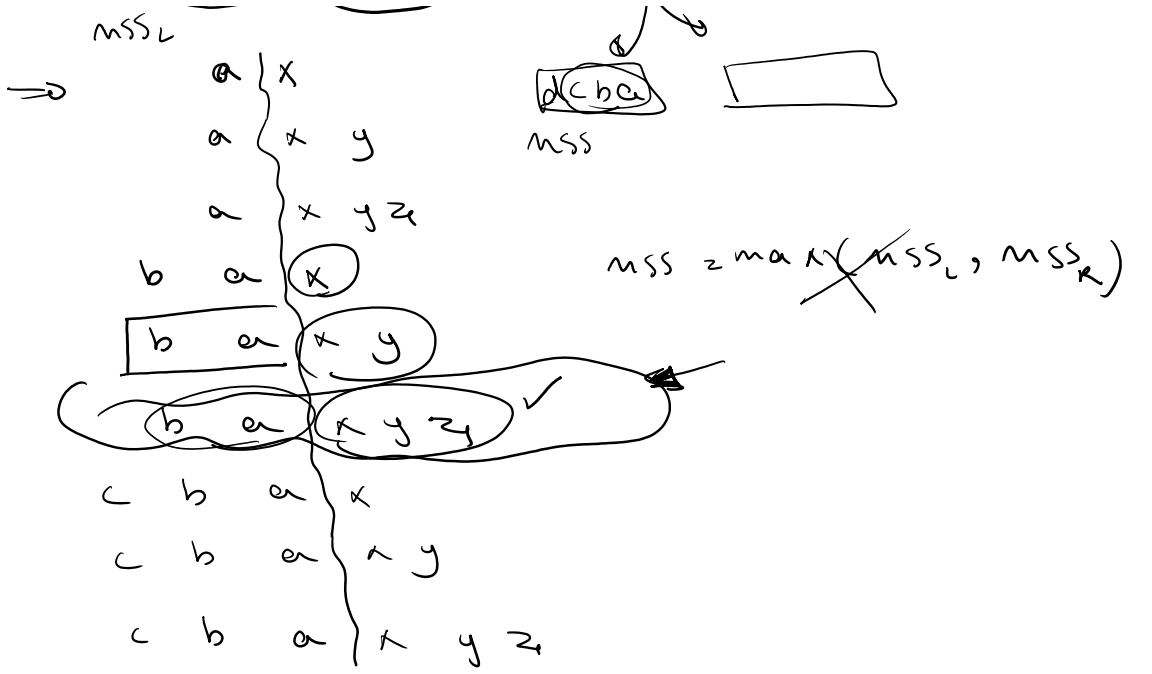
l c b a x y z

mss_L

a | x

l

d c b a



6:50

Sol 3.

$a = [2, 4, -5, 3, -10, 6, 5, -1, 2]$

$\Theta(n)$

sum =	2	6	1	4	~~-6~~ 0	6	11	10	12
mss =	2	6	6	6	6	6	11	11	12 ← mss

Example:

$a = [-1, -2, 6, -8, 4, 1, -3, 2, -1]$ → mss = 6

```
mss(a, s, e)
    if s == e      // base-case
        return [?]

    else
        mss_L = mss(a, ? ? )
        mss_R = mss(a, ? ? )
        mss_M = mss-middle( ? ? ? )
        return max(mss_L, mss_R, mss_M)
    end
```