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CSC1104 HW1

1)

| K | 1 | 2 | 3 | 4 | Arbitrary k | Stopping, K = |
|---|---|---|---|---|---|---|
| i | $2^2$ | $2^4$ | $2^8$ | $2^{16}$ | $2^{2^k}$ | $\log\log(n)$ |

$$\Theta(1) + \sum_{k=1}^{\log\log n} \Theta(1) = \Theta(\log(\log(n)))$$

$n = 2^{2^k}$

$\log(\log(n)) = k$

$$\Rightarrow \boxed{\Theta(\log(\log n))}$$

2)
$$\sum_{i=1}^{n+1} \left( \Theta(1) + \Theta\left( \sum_{k=0}^{i^3-1} \Theta(1) \right) \right)$$

$$\Theta(n) + \sum_{i=1}^{\sqrt{n}} \Theta(i^3)$$

$$\Theta(n) + \Theta\left((n^{1/2})^4\right) = \boxed{\Theta(n^2)}$$

↳ arithmetic

Sorest general form

3)
$$\sum_{i=0}^{n} \left( \sum_{k=0}^{n} \left( \Theta(1) + \sum_{k=0}^{\log k} O(1) \right) \right)$$

Since worst case of all elements being the same would cause the $\Theta \log n$ loop to be run at most n times, runtime of inside loop can be considered $\Theta(n \log n)$ and pulled and outside sum

1st → 2m

2nd → 4m

3rd → 8m

4th → 16m

5th → 32m

k → $2^k$ m

$$\therefore \sum_{k=0}^{\log k}$$

$$\Rightarrow \sum_{i=0}^{n} \left( \Theta(n) \right) + \Theta(n \log n)$$

$$\Rightarrow \Theta(n^2) + \Theta(n \log n) = \boxed{\Theta(n^2)}$$

4) $\Theta(1) + \Theta(1) + \sum_{i=0}^{n-1}\left(\Theta(1) + \sum_{i}\left(\Theta(1) + \Theta(1) + \sum_{j}^{size}\left(\Theta(1) + \Theta(1) + \Theta(1) + \Theta(1)\right)\right) + \Theta(1)\right)$

$\Theta(1) + \Theta(n) + \Theta(n)\left(\Theta(1) + \Theta(\log_{3/2}(n))\right) \Rightarrow \boxed{\Theta(n \log_{3/2}(n))}$

Size = 10 $0 \rightarrow$

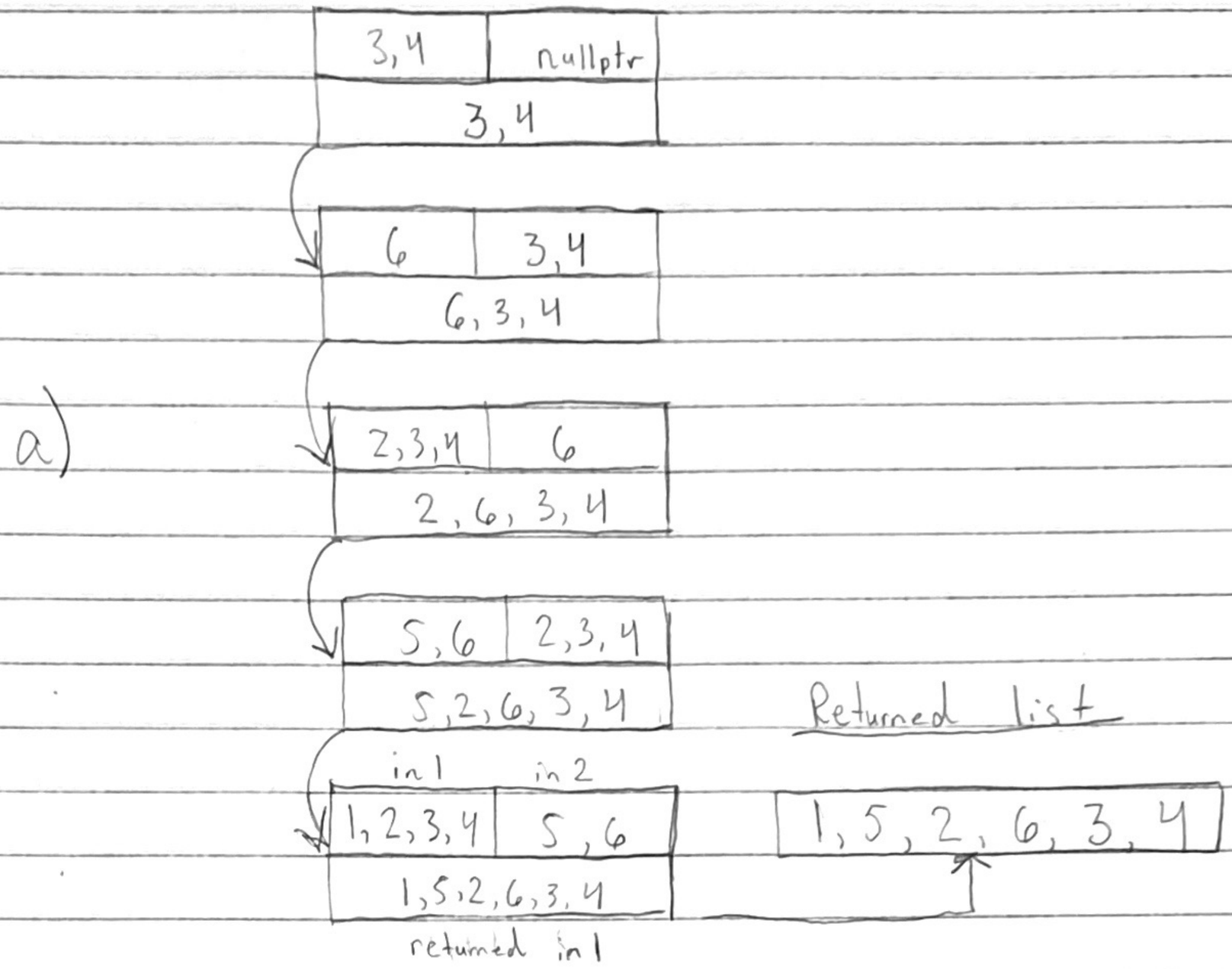
i = 10 $1 \rightarrow$

i = 15

i = 22.8

i = ... j

$j = i(3/2)$ $\log_{3/2}$


3,4
nullptr
3,4
6
3,4
6,3,4
a)
2,3,4
6
2,6,3,4
5,6
2,3,4
5,2,6,3,4
in1
in2
1,2,3,4
5,6
1,5,2,6,3,4
returned in1
Returned list
1,5,2,6,3,4
b)
in1
in2
nullptr
2
2
Returned list
2