

HW1

Problem 1

a) $i=2$ then while $i < h \rightarrow i^{2^k}$

$i=2 \rightarrow 2^{2^1}$
 $i=4 \rightarrow 2^{2^2}$
 $i=16 \rightarrow 2^{2^3}$

$i = 2^{2^k}$

$\sum_{k=0}^{K-1} O(1) = K$

2^k
 $2^0 = 1$
 $2^1 = 2$
 $2^2 = 4$

iterates $i=i \cdot i$ so use geometric

$$\sum_{i=1}^n c^i = \frac{c^{n+1} - 1}{c - 1} = \Theta(c^n) \quad 2^k \geq n \rightarrow \log_2(2^k) \geq \log_2(n)$$

$$\log_6(6^x) = x \rightarrow \log_2(2^{2^k}) = 2^k \geq \log_2(n)$$

$$\log_2(2^k) \geq \log_2(\log_2(n)) = k \geq \log_2(\log_2(n)) = \boxed{\Theta(\log_2 \log_2(n))}$$

b) 1 to n , $m = \sqrt{n}$ for each valid i we iterate $O(i^3)$

$$\sum_{i=1}^{\sqrt{n}} (i\sqrt{n})^3 = n^{3/2} \sum_{i=1}^{\sqrt{n}} i^3 = n^{3/2} (\sqrt{n})^4 = n^{3/2} \cdot n^2 = \boxed{\Theta(n^{7/2})}$$

$$\frac{3}{2} + \frac{7}{2} = \frac{3}{2} + \frac{4}{2} = \frac{7}{2}$$

c) The i loop runs up to n
 • K loop runs to n each $i \rightarrow O(n^2)$

$A[x] = i$ is ran $O(n^2)$ times double loop

m loop doubles $m = m + m \log_2(h)$ times

$$\sum_{i=1}^n \log_2(n) + n^2 = \boxed{\Theta(n^2 \log_2(n))}$$

d) When we arrive at $i=10$

$$\text{newSize} = \frac{3 \cdot \text{size}}{2} \quad \frac{3 \cdot 1}{2} = 1.5$$

* $b = [\text{newSize}]$, then iterate up to 10 & swap values

$a[i] = \text{multiple of } i, i^2$ $O(1)$ work

$$\sum_{i=1}^n O(n) + O(1) + \sum_{i=1}^n O(n) = O(2n) = \boxed{O(n)}$$

Problem 2)

$in1 = 1, 2, 3, 4$ $in2 = 5, 6$

a) $1 \rightarrow \text{next} = 5, 2$
 $7 \rightarrow \text{next} = 5, 2$
 $5 \rightarrow \text{next} = 11 \rightarrow \text{next} = 11 \rightarrow \text{next} = 11 \rightarrow \text{next} = 11$
 $11 \rightarrow \text{next} = 2, 6$
 $2 \rightarrow \text{next} = 11 \rightarrow \text{next} = 11 \rightarrow \text{next} = 11$
 $11 \rightarrow \text{next} = 6, 3$
 $6 \rightarrow \text{next} = 11 \rightarrow \text{next} = 11 \rightarrow \text{next} = 11$
 $11 \rightarrow \text{next} = 3, \text{null}$
 4

with

$6 \rightarrow \text{next} = 3 \rightarrow 4$
 $6 \rightarrow 3 \rightarrow 4$
 $2 \rightarrow \text{next} = 6 \rightarrow 3 \rightarrow 4$
 $2 \rightarrow 6 \rightarrow 3 \rightarrow 4$
 $5 \rightarrow \text{next} = 2 \rightarrow 6 \rightarrow 3 \rightarrow 4$
 $5 \rightarrow 2 \rightarrow 6 \rightarrow 3 \rightarrow 4$
 $1 \rightarrow \text{next} = 5 \rightarrow 2 \rightarrow 6 \rightarrow 3 \rightarrow 4$

$1 \rightarrow 5 \rightarrow 2 \rightarrow 6 \rightarrow 3 \rightarrow 4$

6) $ih1 = hull$ $ih2 = 2$

$llrec(hull, 2)$

$ih1 == hull = return\ ih2 = 2$

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