$n! > 2^{n+1} \quad \forall n \geq 5$

(Base case) $n = 5$ $\quad (5! > 2^{5+1})$

$5! = 5 \cdot 4 \cdot 3 \cdot 2 \cdot \cancel{1}$ $\quad 2^{5+1} = 2^6$

$\quad 20 \quad 6$

$= 120 \quad > \quad = 64$

✓

(Inductive step) $n = k+1$

Assume $k! > 2^{k+1}$ $\quad$ (Show $(k+1)! > 2^{k+2}$)

scratch

2^{k+2}

$2(2^{k+1})$

$(k+1)!$

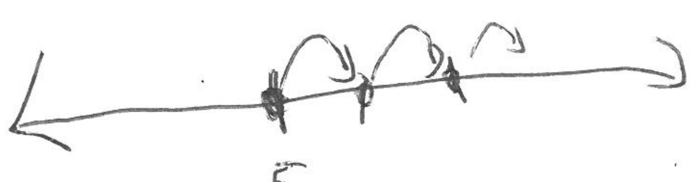
$= (k+1)\,k!$

$> (k+1)\,2^{k+1} \leftarrow$ by IH

$> 2(2^{k+1})$

$= 2^{k+2}$

$\therefore$ by induction, $n! > 2^{n+1} \quad \forall n \geq 5.$ ∎



5

4 2 3

IS (4 2)

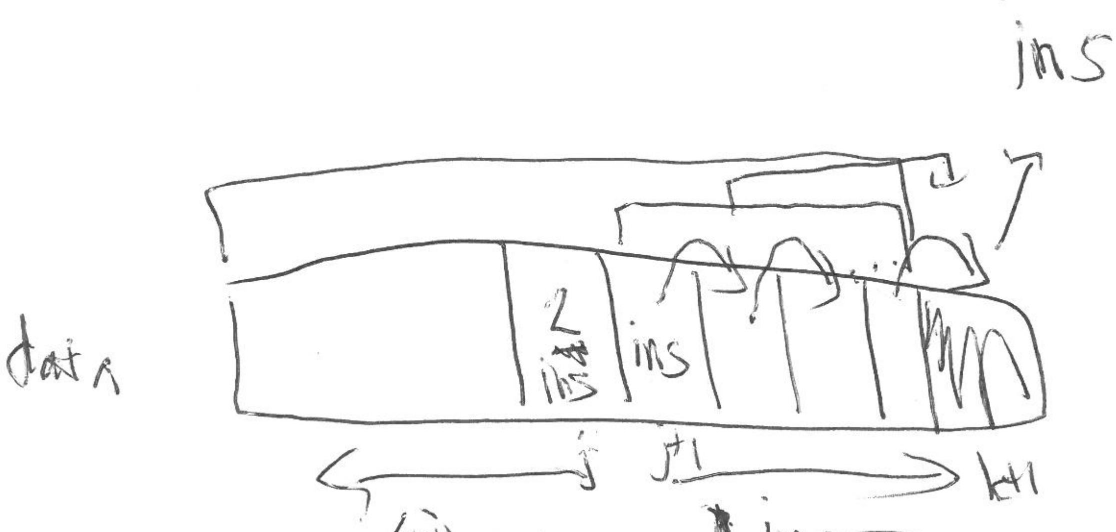
↳ IS (4)

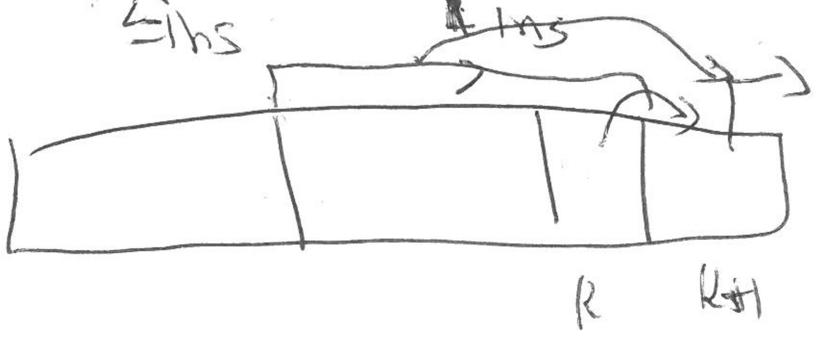
$4 \} 2 \to$ ins

$2 \} 4$

$2 \ 4 \} 3 \to$ ins

2 3 4





4 3 2 1

1 2 3 4

j j+i

n = 4

i = 3

j = 1 to n-i step i

j = 1

1 3 2 4

1

j+i

j=1

i = 2

j=1 to 4-2 step 2

2

j = 1

1 3 2 4

j=1 j+i

j j+i

i = 1

j = 1 to 4-1 step 1

j = 1, 2, 3

1 2 3 4

j j+i