CS 2341

Chapter 2

Algorithm Analysis

Bubble Sort

[0]	1	2	3	4	[5]
9	1	10	20	8	3

↑ ⤫ swap

n=6

1	9	10	20	8	3

↑ ↑ no swap

1	9	10	20	8	3

. . . . . .

1	9	10	8	3	20

last element is
in the right place

n

× n

⟹ $O(n^2)$

can only be used
for small n!

Linear Search

[0]	1	2	3	(4)	5	[6]
18	7	99	5	3	0	1

↑→↑→ → → ↑ $n = 7$

$$\Rightarrow O(n)$$
good

find $x = 3$

$18 \neq 3$

$7 \neq 3$

$3 == 3$ ✓

return [4]   took 5 steps

find $x = 100$ (worst case!)   look through the
return (-1) whole array!

Binary Search (input needs to be sorted)

[0]	1	2	3	4	5	6	7	[8]
1	8	27	30	31	80	88	92	100

$n = 9$

low ~~mid~~ low mid high
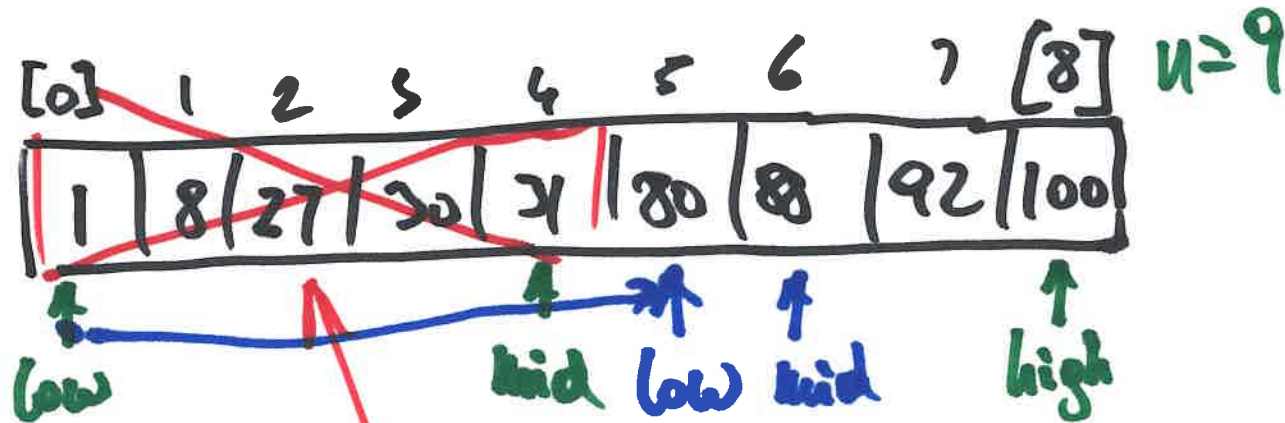
$\Rightarrow O(\log n)$ better

$mid = \left\lfloor \dfrac{low + high}{2} \right\rfloor = \left\lfloor \dfrac{0+8}{2} \right\rfloor = 4$

$\boxed{1. \text{iteration}}$

find $x = 88$

$\boxed{31 < 88} \checkmark \rightarrow low = mid + 1$

$mid = \left\lfloor \dfrac{low + high}{2} \right\rfloor = \left\lfloor \dfrac{5+8}{2} \right\rfloor = 6 \quad \boxed{2. \text{iteration}}$

88 ~~< 88~~
88 ~~> 88~~
return [6]

only took $\sqrt{2}$ steps!!!