

Algorithmic Complexity

Warm-Up

(a) What does the following code do?

```
combine with [and] items of
map [mod 2 = 0] over list [1 2 3 4 5]
```

Reports True if all the items of the list are even

(b) What is runtime?

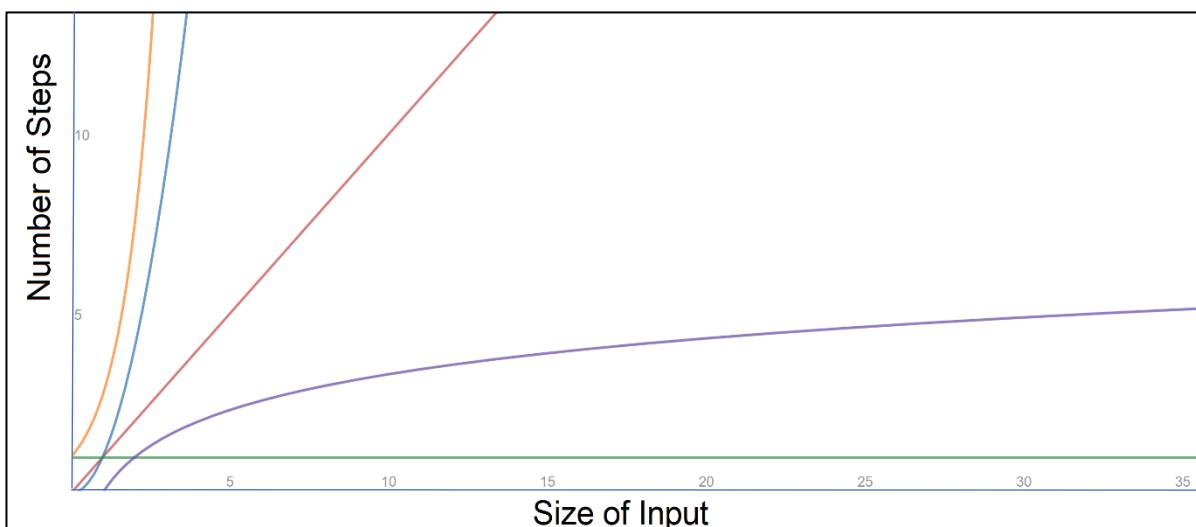
Runtime is used to measure the efficiency of an algorithm.

(c) If a function runs in $O(n)$ time, that means that it runs...

- in linear time at worst
 in linear time on average
 in linear time at best

Understanding Runtimes

Runtime	Notation (where input=n)	as input...	# of steps...
constant	$O(1)$	+1	remains constant
logarithmic	$O(\log(n))$	x2	increases by 1
linear	$O(n)$	+1	increases by 1
quadratic	$O(n^2)$	x2	increase by x4
exponential		+1	increase by x2



What are the runtimes of the following blocks?

1. Constant

```

+add+ x +++ y +
report x + y
    
```

2. Linear

```

+average+ list +
script variables sum
for each item of list
change sum by item
report sum / length of list
    
```

3. Linear

```

+is+ value +in+ list +
for each item of list
if value = item
report true
report false
    
```

4. Quadratic

```

+are+ values +in+ list +distinct?+
script variables i j current
set i to 1
repeat until i > length of list
set current to item i of list
set j to i + 1
repeat until j > length of list
if current = item j of list
report false
change j by 1
change i by 1
report true
    
```

5. Logarithmic

```

+find+ the +number+ num +in+ sorted +list+ list +
script variables min max mid
set min to 1
set max to length of list
warp
repeat until min > max
set mid to round (min + max) / 2
if item mid of list > num
set max to mid - 1
else
if item mid of list < num
set min to mid + 1
else
report mid
report 0
    
```

Challenge Problem

```

+Are+ the +elements+ of +list+ list +in+ the +list+ list2 +
script variables index
set index to 1
repeat length of list
if
not
Is the item item index of list in the list list2 (use binary search)
report false
change index by 1
    
```

(a) What is the runtime of the block to the left?

$n \log n$