

④ Give Big-O estimate in terms of number of operations used ("operation" is either multiplication or addition)

$i := 1$

$t := 0$

while  $i \leq n$

$t := t + i$

$i := 2i$

Answer  $i$  keeps doubling inside the loop.

- How many times do you double  $i$  so that its value exceeds  $n$ ?

This is the definition of  $\log$ :

$$\log_2 n = k \iff 2^k = n$$

Thus the loop executes  $k$  times, where

$$k = \log_2 n$$

- Within the loop we have 1 addition and 1 multiplication, for a total of  $2 \cdot \log n$  operations
- Thus, answer:  $O(\log n)$