CS340 Analysis of Algorithms
Fall 2026

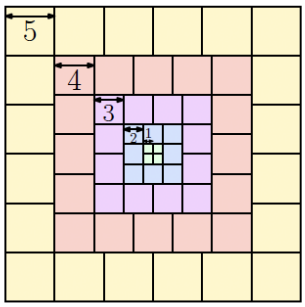
Practice Set: 1 **URL:** `http://cs.brynmawr.edu/cs340`

Rigorous proofs can be difficult to write in the beginning. Consult the `algorithm write-up guidelines` on the course website before proceeding. In addition, a `sample write-up` of Gale-Shapley, as well as a `latex template` have been provided for your reference. Numerous handouts will also be given throughout the semester as writing examples.

1. Around 100 A.D., Nicomachus of Gerasa (in ancient Greece) proved the following remarkable identity. For all $n \geq 0$,

$$\sum_{i=1}^{n} i^3 = \left(\sum_{i=1}^{n} i\right)^2$$

1. Prove this by induction on n.



2. Explain why this figure provides a proof of this identity.

2. For each of the lists below, put the functions in increasing asymptotic order, i.e. $f(n) \prec g(n) \prec h(n)$. If two functions $f(n)$ and $g(n)$ are asymptotically equivalent, write $f(n) \approx g(n)$. Note that *log* without a specified base is assumed to be base 2.

(a)	$(3/2)^n$	$3^{(n/2)}$	$2^{(n/3)}$
(b)	$log\ n$	$ln\ n$	$log\ n^2$
(c)	$n^{log\ 4}$	$2^{log\ n}$	$2^{2log\ n}$
(d)	$max(50n^2, n^3)$	$50n^2 + n^3$	$min(50n^2, n^3)$
(e)	$\lceil n^2/20 \rceil$	$\lfloor n^2/20 \rfloor$	$n^2/20$

3. Problem 1.4 (Chapter 1, exercise 4 of your textbook). This problem should have a full Algorithm Write-up according to the guidelines on the website. In your write-up, please use the following definitions:

1. H: the set of hospitals, $|H| = m$
2. S: the set of students, $|S| = n$
3. If each $h_i \in H$ has p_i positions, then let $k = \sum_{i=1}^{m} p_i$ be the number of total positions

4. Problem 1.8. Clearly state whether you are proving or disproving that lying works, before you launch into whatever justifications you have. In other words, clearly tell us if you are doing (a) or (b).