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Assignment 2

Exercise 1.

Exercise 2.

Exercise 3.

(a) $\Theta(n^3)$
(b) $\Theta(n)$
(c) $\Theta(n^4)$
(d) $\Theta(\log n)$
(e) $\Theta(n \log n)$

Exercise 4.

(a) The sum of all integers from 500 to 999 is 374,750.
(b) The sum of all odd integers from 1 to 999 is 250,000.
(c) There are 27,405 possible committees.
(d) The estimation $o(n^3)$ is incorrect for the problem. To find the number of ways 4 people can be chosen out of n people, we use the combination formula which comes to $\frac{n!}{4!(n-4)!}$. Analyzing the asymptotic behavior, the formula comes to $\frac{n^4}{24}$ meaning this is equal to $\Theta(n^4)$. Compared to the asymptotic behavior of $o(n^3)$, $\Theta(n^4)$ grows faster. So the problem's asymptotic behavior is not equal to $o(n^3)$.

Exercise 5.

A $\Theta(.)$ evaluation for the sum S is $\Theta(n^{7/2})$. Using the integral method, the sum S $= \sum_{k=1}^{n} k^2\sqrt{k}$ comes out to S $= \sum_{k=1}^{n} k^{5/2}$. For the integral, $\int_1^n k^{5/2}\, dk = \frac{2}{7}(n^{7/2} - 1)$. For both the upper bound $\frac{2}{7}(n^{7/2} - 1) + n^{5/2}$ and the lower bound $\frac{2}{7}(n^{7/2} - 1)$ both have the dominant term $n^{7/2}$ since $n^{5/2}$ grows slower. Therefore, the Theta evaluation of the sum S is $\Theta(n^{7/2})$.

Programming Task 1.