Supplemental Exercises: Unit 4
Scientific Computing with Case Studies
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1.

- Suppose that we have n uniformly distributed random vectors $\boldsymbol{x}_j \in S$, where
$$S = \{\boldsymbol{x} \in \mathcal{R}^5 : -2 \le x_i \le 2, \quad i = 1, \ldots, 5\}.$$

- Suppose we have a region $T \subset S$ and a function $\hat{T}(\boldsymbol{x})$ that equals 1 if $\boldsymbol{x} \in T$ and 0 otherwise.

(a) Use this information to estimate the volume of T.

(b) In what way would your estimate improve if you were given $2n$ points?

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2. Consider the following counting problem. Let $C(k)$ be the number of distinct arrangements of k dimers on a particular lattice. We are told that $C(20) = 200$, and we want to determine $C(55)$.

Suppose that we have sampled 6,000,000 arrangements (uniformly among all possible arrangements), counted the number of dimers in each of these arrangements, and stored the counts in a 6,000,000×1 vector called d. Write MATLAB statements to estimate $C(55)$.