Algorithm Design
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Solution of Exercise C-13.10

To show that PARTITION is in NP, note that we can guess a partition of the set of numbers and then check that they sum to the same value.

To show that PARTITION is *NP*-hard, we will reduce SUBSET-SUM to this problem. So, suppose we are given a set of numbers S and a goal sum M that comprise an input to the SUBSET-SUM problem. We begin our transformation of this input into an instance of PARTITION by including every number in S as input numbers for PARTITION. Let N denote the total sum of all the numbers in S. Then, in addition to the numbers already included, we add the number $|N - 2M|$, which is a kind of ***enforcer***. If there is a subset T of S that sums to M, then T will make a partition such that T is on one side and $S - T$ (the rest of the elements) is on the other, with the enforcer element $|N - 2M|$ either on T's side or the other side so as to make the two sides sum to the same value.