

### 5.2.7 Splitting the Pirate Loot

#### 3-Partition Problem

*Partition a set of integers into three subsets with equal sums.*

**Input:** A sequence of integers  $v_1, v_2, \dots, v_n$ .

**Output:** Check whether it is possible to partition them into three subsets with equal sums, i.e., check whether there exist three disjoint sets  $S_1, S_2, S_3 \subseteq \{1, 2, \dots, n\}$  such that  $S_1 \cup S_2 \cup S_3 = \{1, 2, \dots, n\}$  and

$$\sum_{i \in S_1} v_i = \sum_{j \in S_2} v_j = \sum_{k \in S_3} v_k.$$

3	6	4	1	9	6	9	1
---	---	---	---	---	---	---	---

Three pirates are splitting their loot consisting of  $n$  items of varying value. Can you help them to evenly split the loot?

**Input format.** The first line contains an integer  $n$ . The second line contains integers  $v_1, v_2, \dots, v_n$  separated by spaces.

**Output format.** Output 1, if it possible to partition  $v_1, v_2, \dots, v_n$  into three subsets with equal sums, and 0 otherwise.

**Constraints.**  $1 \leq n \leq 20$ ,  $1 \leq v_i \leq 30$  for all  $i$ .

#### Sample 1.

Input:

```
4
3 3 3 3
```

Output:

```
0
```

**Sample 2.**

Input:

```
1
30
```

Output:

```
0
```

**Sample 3.**

Input:

```
13
1 2 3 4 5 5 7 7 8 10 12 19 25
```

Output:

```
1
```

$$1 + 3 + 7 + 25 = 2 + 4 + 5 + 7 + 8 + 10 = 5 + 12 + 19.$$