Code Jam 2022 - Qualification Round

Analysis: d1000000

Test Set 1

There are multiple of ways to solve Test Set 1 of this problem. A particularly funny one is to throw the solution of an old finals problem at it (even the Test Set 1 solution of that problem works).

Test Set 2

Test Set 2 has very big numbers, so we need insights that are specific to this problem.

Insight 1. If a straight from A to B can be done, then one from 1 to $B - A + 1$ can be done as well using the same dice in the same order, since a die showing a number X can always be used to show number $X - A + 1$.

Insight 2. If a straight is done with a di showing number X and a dj showing number $X + 1$ with $i > j$, we can build the same straight but using dj for X and di for $X + 1$.

Insight 2b. Any straight that can be done, can also be done while using the dice in non-decreasing order of number of faces.

Combining insights 1 and 2b gives an algorithm: start by sorting the dice. Then, in that order, try to extend the current straight if possible. Or, in pseudo-code:

```
maximum_straight_length(S):
  sort(S)
  length = 0
  for si in S:
    if si > length: length += 1
  return length
```

This algorithm requires only linear time beyond sorting the input, which means $O(\mathbf{N} \log \mathbf{N})$ overall. This is fast enough to pass Test Set 2.