Possible or never — Up to 20 things

Name: ____________________ Date: __________

Some of these cannot be done. Say which, and say how you know.

1. A panel has 17 switches and 1 of them is on. You may throw exactly 4 of them at a time, never more and never fewer.

   What is the fewest throws that leaves every switch on? Write NEVER if it cannot be done.

   Why

   ______

2. 18 cups stand upside down on a tray. You may turn over exactly 2 of them at a time, never more and never fewer.

   What is the fewest turns that leaves them all the right way up? Write NEVER if it cannot be done.

   Why

   ______

Name: ____________________ Date: ________

Some of these cannot be done. Say which, and say how you know.

3 19 cups stand on a tray and 2 of them are the right way up. You may turn over exactly 4 of them at a time, never more and never fewer.

What is the fewest turns that leaves them all the right way up? Write NEVER if it cannot be done.

Why

____

4 A panel has 7 switches and 6 of them are on. You may throw exactly 4 of them at a time, never more and never fewer.

What is the fewest throws that leaves every switch on? Write NEVER if it cannot be done.

Why

____

Possible or never · Up to 20 things — Answer key

If they are stuck

- Trying it will not settle this. Ask what ONE move does to the count.

1. There are 17 to work with. One throw changes the number switched on by at most 4, and there are 17 − 1 = 16 to gain, so fewer than 4 throws cannot possibly do it. And 4 can, counting the number switched on as you go: 1 → 5 → 9 → 13 → 17.

2. There are 18 to work with. One turn changes the number standing the right way up by at most 2, and there are 18 − 0 = 18 to gain, so fewer than 9 turns cannot possibly do it. And 9 can, counting the number standing the right way up as you go: 0 → 2 → 4 → 6 → 8 → 10 → 12 → 14 → 16 → 18.

3. Every turn touches 4 of the 19, and whatever state those 4 were in, the number standing the right way up changes by an EVEN amount — 4, or 2, and so on down to −4. So it keeps its odd-or-even-ness forever. It starts at 2 and would have to reach 19, and 19 − 2 = 17 is odd. No number of turns can ever get there.

4. Every throw touches 4 of the 7, and whatever state those 4 were in, the number switched on changes by an EVEN amount — 4, or 2, and so on down to −4. So it keeps its odd-or-even-ness forever. It starts at 6 and would have to reach 7, and 7 − 6 = 1 is odd. No number of throws can ever get there.