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Algorithm Worksheet Answer Key

1. **Add the two numbers below using the ADDITION algorithm you studied in school.**
   345 + 176 + _____ Show all steps, as done on the slide 5 example.

```
  1 1
  3 4 5
+ 1 7 6
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  5 2 1
```
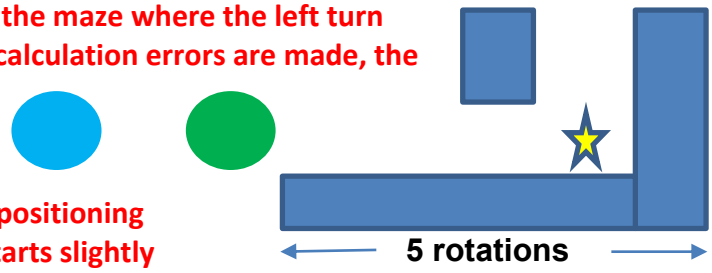

2. **Now, come up with the steps for the addition you just performed. Start with step 1, "Write both numbers one above the other," and so on. Do not miss any steps. This creates your algorithm!**
   Example answer:
   1. **Write both numbers, one above the other so that all decimal places are aligned.**
   2. **Place a line beneath the bottom number.**
   3. **Add together the numbers in the far right columns of all rows.**
   4. **Record below the line in the column just added the one's digit of the sum of that column's numbers.**
   5. **Add together the numbers in the column one to the left of the previous column, which is the second column from the right (if no such column exists, add a column of zeroes).**
   6. **If the sum from step 3 is nonzero, write its 10s digit in a new row at the top of the current column.**
   7. **While at least one of the numbers in the current column is nonzero, repeat steps 3-6.**

3. **Consider the maze shown below. The task is to make the robot move from either the green or blue circle, and go through the maze, that is, move forward and then turn left to go through the two blocks without bumping into the walls. Based on the material covered in the slides so far, <u>discuss all the problems you may face</u> if you use only move blocks using exact distances, such as "move 5 rotations forward."**



   - **The exact distance to the bend in the maze where the left turn occurs must be calculated. If any calculation errors are made, the robot wouldn't turn left at the correct spot and would bump into the walls.**
   - **Another issue may be if the start positioning is not exact, that is, if the robot starts slightly behind or in front of the measured start point, it would cause the calculations to be off.**
   - **Other?**
   - **Notice that measurements, calculations and robot placement must be very accurate for this very specific "algorithm" to work. Can we think of a simpler algorithm that would also work? Let's look at that next.**

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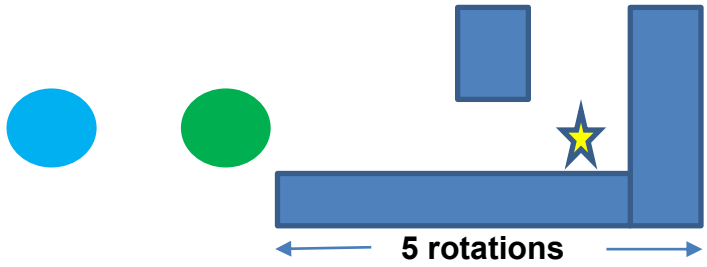
4. **Use the conditional command "until" to write a sequence of steps to tell a robot to stop when it bumps into a wall. Example: Play at recess until you hear the bell ring; then go back to class.**

   ***Example answer*: Move forward continuously; stop if you sense a wall (maybe using a touch sensor). Notice whether or not students use simple, clear and complete instructions.**

5. **Write down in steps the "algorithm" you will use to have a robot navigate the maze diagram drawn below, using conditional commands (and NOT move commands). Write out your algorithm in words, such as: "Move forward," etc.**



   1. **Move forward until the touch sensor is pressed.**
   2. **If touch sensor is pressed, turn left by 90°and keep moving forward.**

   This will get the robot through the maze!

6. **Now draw the NXT program blocks (such as those we learned about on slides 14-18) that you will use to implement the algorithm above. Approximate forms of the blocks are fine.**