

Evo Guesses a Number by Using the Chinese Remainder Theorem

by Richard Born
Associate Professor Emeritus
Northern Illinois University
rborn2@niu.edu

Introduction

CCSS math standards require grade 4 students to find whole number quotients and *remainders* in division. With knowledge of multiplication tables, determining remainders mentally for two-digit numbers divided by a single digit number would be a reasonable task for these students.

In this lesson, the goal is to make finding remainders fun. This is accomplished by having Evo guess a number between 0 and 29. To accomplish this, the student tells Evo the remainders when the number is divided by 2, 3, and 5. If the student is able to determine these remainders mentally, that would be great. If not, the student is given time to calculate the remainders using pencil and paper.

This lesson also provides a challenge for high school AP students to discover the math behind Evo's ability to guess the number from 0 to 29. These students will learn the basics of modular math and use the Chinese remainder theorem to meet this challenge.

Working with the OzoBlockly Program

The OzoBlockly program *Remainders.ozocode* is loaded into Evo. Evo is then placed at the start location facing the direction of the arrow in the Ozomap shown in Figure 1. A full-size copy of this Ozomap, for students to work with, can be printed from the file *Ozomap for Remainders.pdf*.

With Evo at the start location, Evo is turned on by pressing the button once. Then the button is double-pressed to start the OzoBlockly program. Evo's top light turns white, and then Evo moves to the first red vertical bar where he stops. The top light then turns red. As indicated on the Ozomap, the student thinks of a number between 0 and 29, and presses Evo's button to continue. Evo moves to the next red bar and is asked to calculate the remainder when dividing the number by 2. Once the student has determined the remainder, Evo's button is pressed, and Evo moves to the red bar with the large blue dot. Evo's top light will turn blue. To tell Evo the remainder, the button is pressed the number of times equal to the remainder. The student has six seconds to do this. Note that with each press of the button, Evo will quickly flash white to confirm that Evo has recognized the button press.

In a similar manner, the student computes and tells Evo the remainders when the number is divided by 3 and 5. When Evo reaches the red bar at the bottom of the Ozomap, he will speak the value of the number that the student was thinking of.

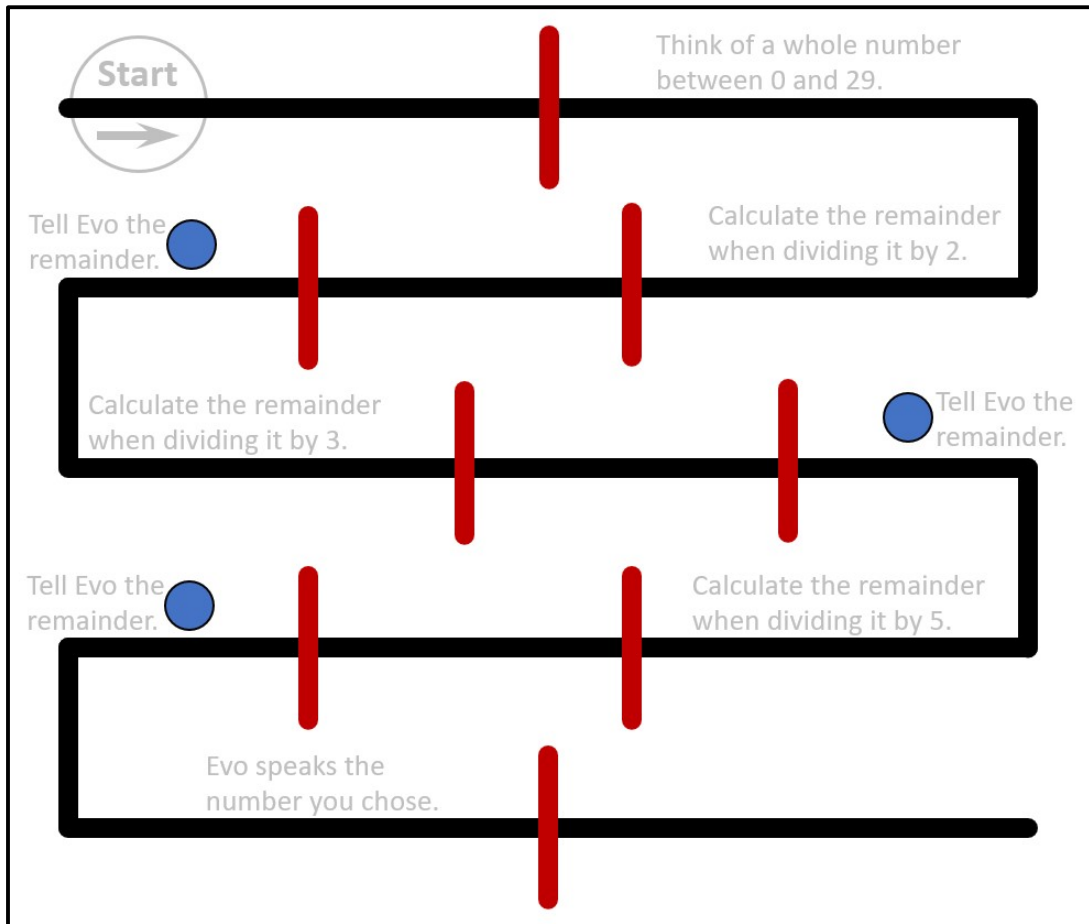


Figure 1