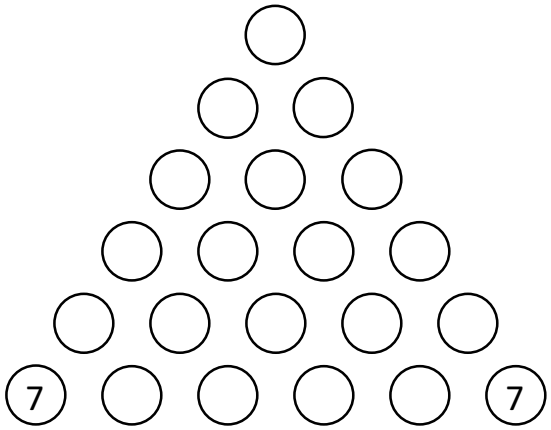
Name: _____ School Grade: _____

Central Florida Math Circle

University of Central Florida
Department of Mathematics

Each student first works on these problems individually, then forms into groups and conducts group discussion.

Problem 1 (At the Apex) Put any four digits (1-9) you like in the four vacant circles of the bottom row. They needn't be all different, and you may include one or more zeros if you like. The remaining circles are filled with digits as follows: Add two adjacent pairs of numbers, divide the sum by 5, and put the remainder in the circle just above the adjacent pair of numbers. Continue in this way, going up the triangle, until all the circles have digits. Don't tell but allow me to guess the digit at the apex of the triangle.



Can you explain why one can always make the correct "guess"?

Would it be possible to change the pre-located numbers at the two bottom corners?

Problem 2 (The Red and the Black) Shuffle a deck of cards (a standard 52-card deck), then deal 30 cards to the table to form a pile. Count the number of black cards in the pile. From this number, subtract the number of red cards in the rest of the deck. Don't tell me but allow me to guess the difference you just calculated. Can you explain why one can always make the correct "guess"?

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Problem 3 (Golden Balls) Someone has given you nine golden balls. One of them weighs a tiny bit more than the others. The others all weigh the same. By using only a pan balance, how can you find the heavy ball?

Most people need three weighings or more. Can you figure out how to find it only two weighings?

If there are 100 golden balls, with one ball weighing more than the others (the others all weigh the same), how many weighings do you need to find the heavy ball?

Problem 4 (Exploring the Desert) A group of students organize an expedition to explore the interior of a vast desert region. They arrive at the edge of the desert with supplies (petrol, water, food, etc.) for a journey of 1600 miles. Unfortunately, they only have one lorry, and fully laden it can only carry sufficient supplies for 400 miles. What is the greatest distance they can travel into the desert and return safely? (It is understood that supplies can be stashed in the desert for later use.)

You are welcome to submit your solutions to all or part of problems to ucfmathcircle@gmail.com or bring a hard copy to our next meeting. Thanks and have fun!