

MBMT Counting and Probability Round – Zermelo

May 21, 2022

Full Name _____

Student ID Number _____

**DO NOT BEGIN UNTIL YOU ARE
INSTRUCTED TO DO SO.**

This round consists of **8** questions. You will have **30** minutes to complete the round. Each question is *not* worth the same number of points. Questions answered correctly by fewer competitors will be weighted more heavily. Please write your answers in a reasonably simplified form.

- _____ 1 Two identical caps each have 4 paper slips with numbers 1, 2, 4, and 8 written on them. Madeline takes out one paper slip from each cap, multiplies the two numbers she sees, and buys that number of strawberries. How many different values are possible for the number of strawberries that she will buy?
- _____ 2 Two different positive integers sum to 10. How many possibilities are there for their product?
- _____ 3 A triangle has sides of length 2, a square has sides of length 3, and a pentagon has sides of length 4. Two sides are chosen from the 12 sides. What is the probability that the two chosen sides have the same length?
- _____ 4 Gose shuffles a standard deck of 52 cards. He flips over the first three cards: 8, 2, and 3. What is the probability that when he flips over the fourth card, the sum of the four values is greater than 21? Jacks, queens, and kings have a value of 10, and aces have a value of 11.
- _____ 5 Bread has a bag of two forks and three spoons. Squash reaches into the bag and pulls out three utensils. What is the probability that Squash has more spoons than forks?
- _____ 6 Kevin initially has 4 coins atop a table. He flips all of them and puts each coin with heads facing up in his pocket. If any coins remain on the table, he repeats the procedure. What is the probability that, after these two steps, all 4 coins will be in Kevin's pocket?
- _____ 7 Two people play a game. They alternate rolling a die and each keeps a running sum of all the numbers they've rolled. The first person with a positive multiple of 3 wins. What is the probability that the first person wins?
- _____ 8 Knights only tell the truth, and Knaves only tell lies. 7 people that are each either Knights or Knaves line up in a line. Everyone except the person at the very right knows whether the person to their right is a Knight or a Knave. If 3 people say that the person to their right is a Knight, and 3 people say that the person to their right is a Knave, how many possible orderings of Knights and Knaves are there?