Problem of the Week
Problem E
What’s Your Unlucky Number?

Everyone has a lucky number. Sue Perstitious does not have a lucky number but considers the number 13 to be unlucky.

Three bags each contain tokens. The green bag contains 20 round green tokens, each with a different integer from 1 to 20. The red bag contains 12 triangular red tokens, each with a different integer from 1 to 12. The blue bag contains 8 square blue tokens, each with a different integer from 1 to 8.

Any token in a specific bag has the same chance of being selected as any other token from that same bag. There is a total of $20 \times 12 \times 8 = 1920$ different combinations of tokens that can be created by selecting one token from each bag. Note that the order of selection does not matter. Also note that selecting the 7 red token, the 5 blue token and 1 green token is different than selecting the 5 red token, 7 blue token and the 1 green token.

Sue selects one token from each bag. What is the probability that the sum of the numbers selected is divisible by 13, her unlucky number?