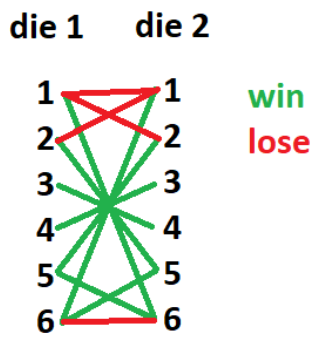
Name: Wang Yuanxi Student ID: a1805637

Assumptions: The dice are fair and independent.

The dice are both six-sided.

Model: When rolling 2 6-sided dice, there are 36 total possible outcomes. Of those, 8 outcomes immediately win, while 4 outcomes immediately lose, shown in the figure below.



For the remaining 24 outcomes, 6 outcomes result in a total of 4 or 10, 8 result in a total of 5 or 9, and 10 result in a total of 6 or 8.

There are 6 possible outcomes that result in a total of 7.

Solution: If the first total result is 4 or 10, there are 3 possible combinations for each, while 6 combinations are possible to result in a total of 7. Since the game is only stopped when the same number or 7 is reached, all other results are irrelevant. For example, if a 4 was the result of the first round, the game will only end when another 4, or a 7 is achieved. Since there are 3 possible outcomes for 4 (1,3;2,2;3,1) to 6 possible outcomes for 7 (1,6;2,5;3,4;4,3;5,2;6,1), 1/3 times is won, while the other 2/3 is lost. This also applies to the initial result of 10, which also has 3 possible combinations (4,6;5,5;6,4).

There are 4 possible combinations each for the result of 5 or 9, and 5 possible combinations each for the results of 6 and 8. Applying the same principle above, when the initial result is 5 or 9, the chance of winning is 2/5. When the initial result is 6 or 8, the chance to win is 5/11.

To calculate the total chances of winning, we simply need to add up all of the possible winning scenarios.

$$P(win) = P(instant\ win) + P(getting\ 4\ twice) + P(getting\ 5\ twice) + P(getting\ 6\ twice) + P(getting\ 8\ twice) + P(getting\ 9\ twice) + P(getting\ 10\ twice)$$

$$P(win) = \frac{8}{36} + \left(\frac{3}{36} \times \frac{1}{3}\right) + \left(\frac{4}{36} \times \frac{2}{5}\right) + \left(\frac{5}{36} \times \frac{5}{11}\right) + \left(\frac{5}{36} \times \frac{5}{11}\right) + \left(\frac{4}{36} \times \frac{2}{5}\right) + \left(\frac{3}{36} \times \frac{1}{3}\right)$$

$$P(win) = \frac{244}{495}$$

Discussion: It is important to assume that both dice are six-sided, as the question does not state the sizes of each die. Likewise, it is important to assume that the dice are fair, and that the outcome of one die does not affect the other in any way, such that the probability of getting each number is the same for all sides.