

The Prisoner Problem

You are sent to prison — though quite innocent! After a few years, the king decides to play a “life or death” game with you.

He gives you 12 blue marbles, 12 red marbles, and two cloth bags. You are allowed to fill the bags with the twenty-four marbles as you wish. The king will then choose a bag first and then a marble from that bag. If the marble he chooses is blue, you are set free! If the marble is red (or there are no marbles in the bag), you are executed.

- (1) You decide to place 6 red marbles and 6 blue marbles in each bag. Find the probability that the king will set you free using a tree diagram.
- (2) If you decide to place 12 red marbles in one bag and 12 blue marbles in the other bag, has your probability of freedom increased, decreased, or remained the same? Explain why.
- (3) If you decide to put 5 blue marbles and 1 red marble in one bag and the rest of the marbles in the other bag, what is your probability of freedom? Give an exact fractional answer and an approximate answer rounded to the nearest percent.
- (4) There is a better strategy than these three options. What strategy would give you the greatest chance for freedom?
- (5) Using this optimal strategy, what is the probability that you will be released? Give an exact fractional answer and an approximate answer rounded to the nearest percent.

