Joint distributions - Expectation by conditioning


**Example 1:**
A miner is trapped in a mine containing 3 doors. The first door leads to a tunnel that will take him to safety after 3 hours of travel. The second door leads to a tunnel that will return him to the mine after 5 hours of travel. The third door leads to a tunnel that will return him to the mine after 7 hours of travel. If we assume that the miner is at all times equally likely to choose any of the doors, what is the expected length of time until he reaches safety?

**Example 2:**
The game of craps is begun by rolling an ordinary pair of dice. If the sum of the dice is 2, 3, or 12, the player loses. If it is 7 or 11, the player wins. If it is any other number (i.e., 4, 5, 6, 8, 9, 10), the player continues to roll until the sum is either 7 or i. If it is 7, the player loses; if it is i, the player wins. Let R denote the number of rolls of the dice until a game of craps stops. Find \( E(R) \) by conditioning on \( S \), the initial sum. In other words use: \( E(R) = E(ER|S = i) \).