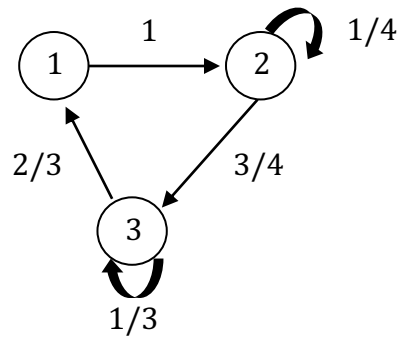


- (B) What is the expected number of rolling until you see the sum of the last two rolled numbers is 7? Use Markov chain (1 point).

3. You are playing with another person using a coin.
- (A) Suppose that the coin is fair meaning the probability of head is equal to  $\frac{1}{2}$  and probability of tail is equal to  $\frac{1}{2}$ . You get one point at each flipping if you see the head and loses one point if you see the tail. The flippings are independent from each other. You play continuously until either you accumulate 10,000 points or lose all your points. What is the probability of eventually accumulating the 10,000 points when you start the game with 100 points (1 point)?
- (B) Suppose that the coin is unfair in that the probability of head is equal to  $\frac{1}{3}$  and probability of tail is equal to  $\frac{2}{3}$ . You get one point at each flipping if you see the head and loses one point if you see the tail. The flippings are independent from each other. You play continuously until either you accumulate 10,000 points or lose all your points. What is the probability of eventually accumulating the 10,000 points when you start the game with 100 points (1 point)?

4. See the following Markov chain below. Assume that the process is in state 1 just before the first transition (2 points).



- (A) What is the probability that the process will be in state 1 just after the fifth transition?
- (B) Determine the expected value and variance of the number of transitions up to and including the next transition during which the process returns to state 1.