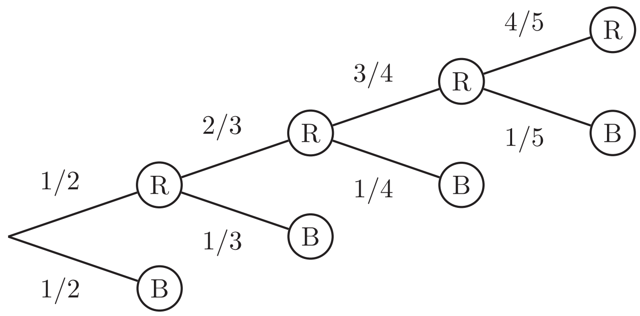


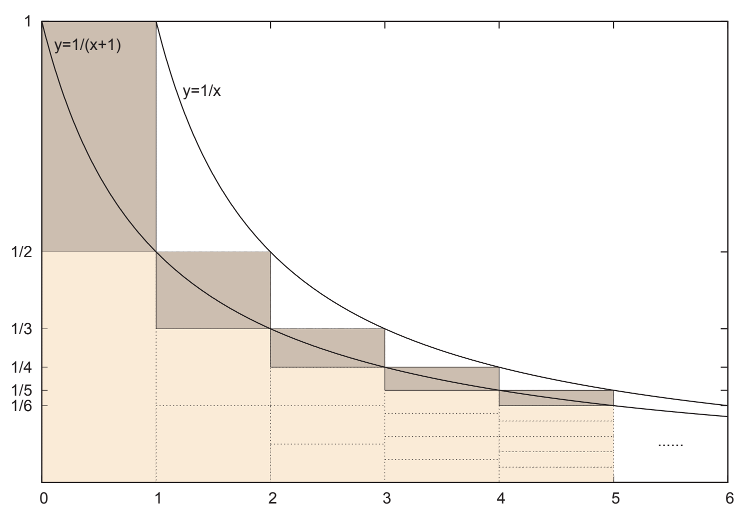
Let B_n be the event of drawing a blue marble (i.e. winning) on the nth draw. It follows that the probability of winning (eventually) is given by

$$P(B_1) + P(B_2) + P(B_3) + P(B_4) + \cdots \quad = \quad \frac{1}{2} + \frac{1}{6} + \frac{1}{12} + \frac{1}{20} + \cdots.$$

Now let R_n be the event of drawing n consecutive red marbles, and notice that $P(R_n) = 1/(n+1)$. Since $P(R_n) \to 0$, the events B_i exhaust the sample space. So you must eventually draw a blue marble, and the sum above must converge to 1.

Incidentally, it is easy to show that the expected number of draws required to win is given by $\sum_{n=2}^{\infty} 1/n$. Since the harmonic series diverges, this is a game you will win, but it should take forever. (You can play the game while you're painting Gabriel's horn!)

10 A proof without words



$$\left(1 \cdot \frac{1}{2}\right) + \left(\frac{1}{2} \cdot \frac{1}{3}\right) + \left(\frac{1}{3} \cdot \frac{1}{4}\right) + \left(\frac{1}{4} \cdot \frac{1}{5}\right) + \left(\frac{1}{5} \cdot \frac{1}{6}\right) + \cdots = 1$$