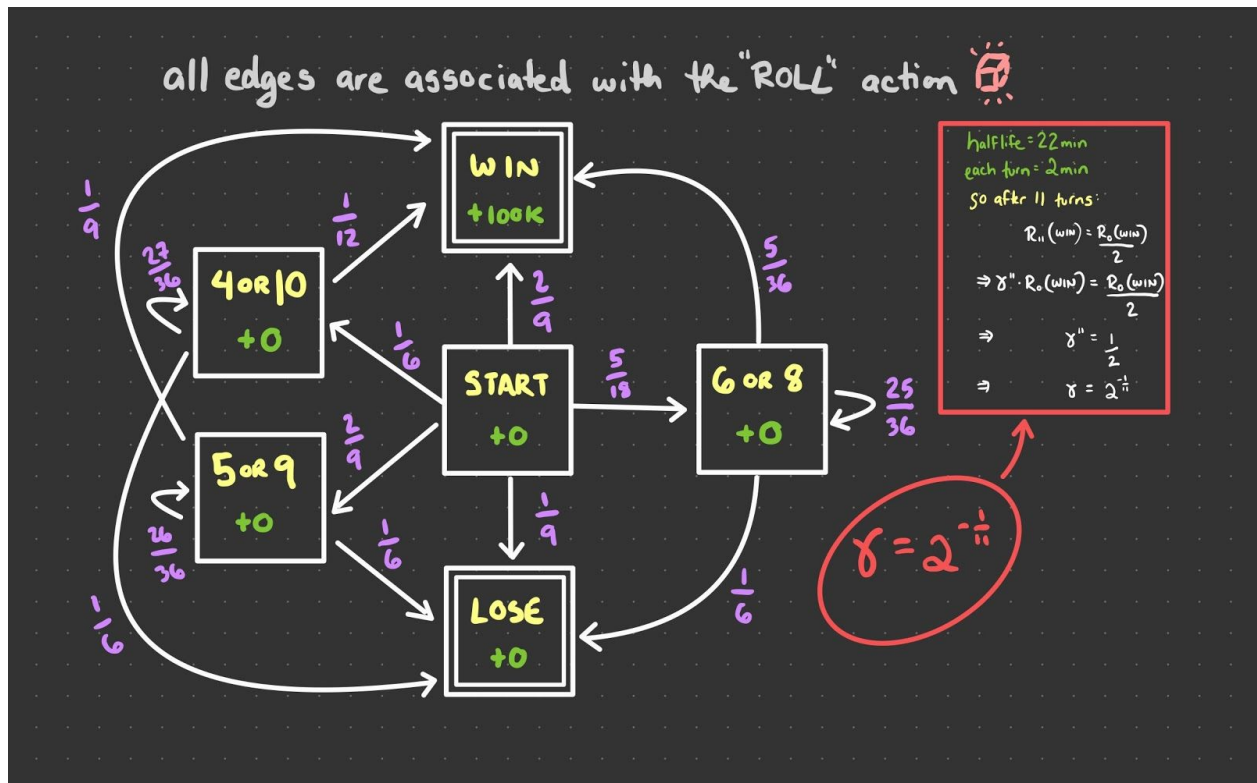


SOLUTION: MDP 1

Here's a diagram of the MDP:



And an explicit formalization:

(M, R, w) such that:

$M = (Q, \Sigma, \Delta, q_0, F)$

- $Q = \{ \text{START}, \text{WIN}, \text{LOSE}, 4\text{or}10, 5\text{or}9, 6\text{or}8 \}$
- $\Sigma = \{ \theta \}$
- $\Delta = \{ \langle \text{START}, \theta, \text{WIN} \rangle, \langle \text{START}, \theta, \text{LOSE} \rangle, \langle \text{START}, \theta, 4\text{or}10 \rangle, \langle \text{START}, \theta, 5\text{or}9 \rangle, \langle \text{START}, \theta, 6\text{or}8 \rangle, \langle 6\text{or}8, \theta, 6\text{or}8 \rangle, \langle 6\text{or}8, \theta, \text{WIN} \rangle, \langle 6\text{or}8, \theta, \text{LOSE} \rangle, \langle 5\text{or}9, \theta, 5\text{or}9 \rangle, \langle 5\text{or}9, \theta, \text{WIN} \rangle, \langle 5\text{or}9, \theta, \text{LOSE} \rangle, \langle 4\text{or}10, \theta, 4\text{or}10 \rangle, \langle 4\text{or}10, \theta, \text{WIN} \rangle, \langle 4\text{or}10, \theta, \text{LOSE} \rangle \}$
- $q_0 = \text{START}$
- $F = \{ \text{WIN}, \text{LOSE} \}$

$w:$

$\langle \text{START}, \theta, \text{WIN} \rangle \mapsto \frac{1}{2}$	$\langle 6\text{or}8, \theta, 6\text{or}8 \rangle \mapsto \frac{25}{36}$
$\langle \text{START}, \theta, \text{LOSE} \rangle \mapsto \frac{5}{36}$	$\langle 6\text{or}8, \theta, \text{WIN} \rangle \mapsto \frac{5}{36}$
$\langle \text{START}, \theta, 4\text{or}10 \rangle \mapsto \frac{1}{6}$	$\langle 6\text{or}8, \theta, \text{LOSE} \rangle \mapsto \frac{1}{6}$
$\langle \text{START}, \theta, 5\text{or}9 \rangle \mapsto \frac{1}{6}$	$\langle 5\text{or}9, \theta, 5\text{or}9 \rangle \mapsto \frac{25}{36}$
$\langle \text{START}, \theta, 6\text{or}8 \rangle \mapsto \frac{1}{6}$	$\langle 5\text{or}9, \theta, \text{WIN} \rangle \mapsto \frac{1}{9}$
$\langle 4\text{or}10, \theta, 4\text{or}10 \rangle \mapsto \frac{1}{6}$	$\langle 5\text{or}9, \theta, \text{LOSE} \rangle \mapsto \frac{1}{6}$
$\langle 4\text{or}10, \theta, \text{WIN} \rangle \mapsto \frac{1}{12}$	
$\langle 4\text{or}10, \theta, \text{LOSE} \rangle \mapsto \frac{1}{6}$	

$$R(q, t) = \begin{cases} \gamma^t \cdot 100000000 & \text{if } q = \text{WIN} \\ 0 & \text{otherwise} \end{cases}$$
 where $\gamma = 2^{-\frac{1}{11}}$