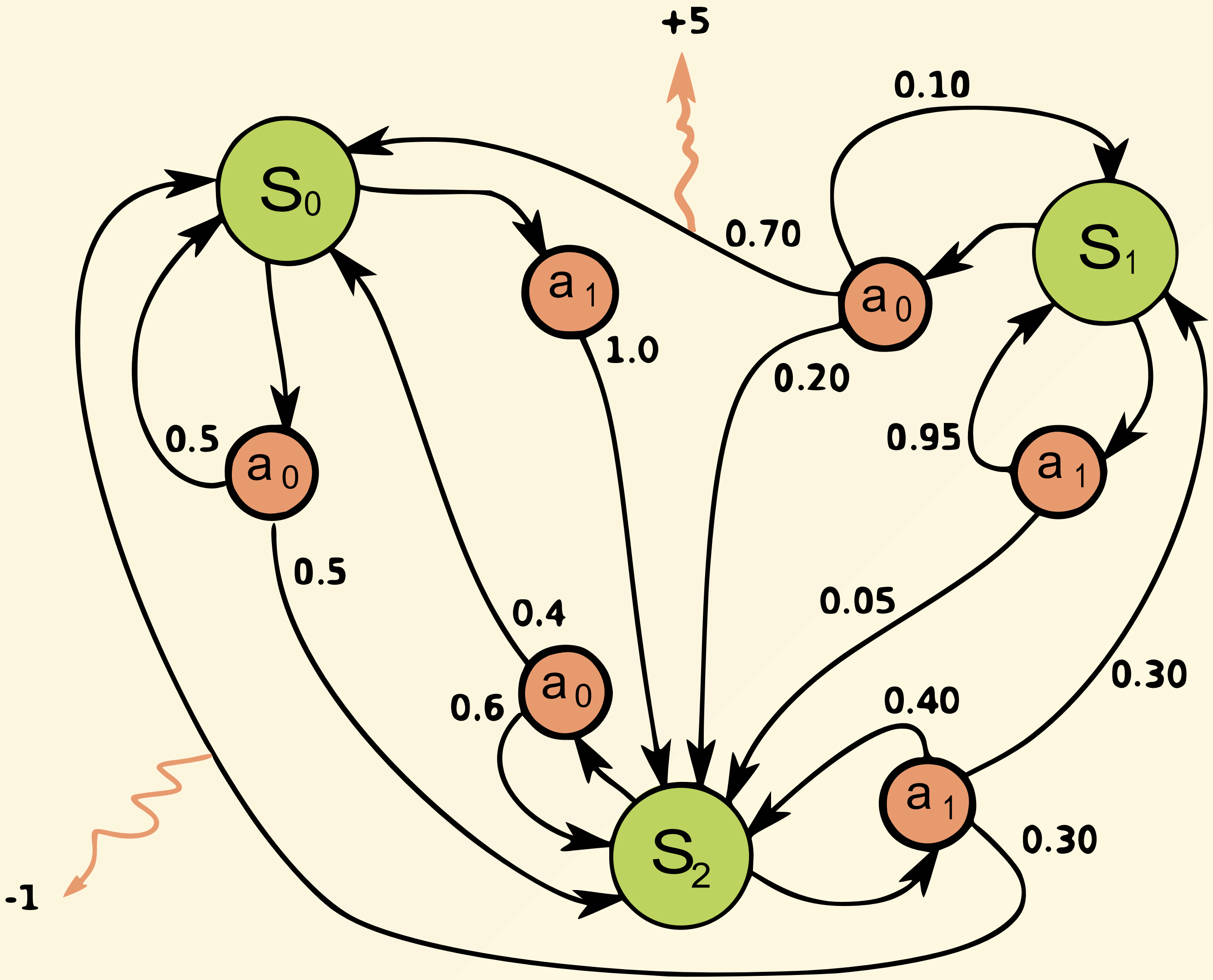
Definitions

1. Agent.
2. Environment.
3. State.
4. Observation.
5. Episode.

MDP

A MDP is a 4-tuple (S, A, P_a, R_a), where:

- $S :=$ is a set of states called the state space.
- $A :=$ is a set of actions called the action space.
- $A_s :=$ is a set of actions available from state $s \epsilon S$.
- $P_a(s, s') := \mathbb{P}(s_{t+1} = s' | s_t = s, a_t = a)$ is the probability that action a in state s at time t will lead to state s' at time $t+1$.
- $R_a(s, s')$ is the immediate reward recived after transition from s to s' .



+5
0.10
0.70
1.0
0.20
0.5
0.95
0.5
0.05
0.4
0.30
0.40
0.6
0.30
-1

Marcov property

$$\mathbb{P}(S_{t+1} | S_t, A_t) = \mathbb{P}(S_{t+1} | S_t, A_t, S_{t-1}, A_{t-1}, \ldots)$$

Episode

Is a sequence :

$$[(S_0, A_0, R_0), (S_1, A_1, R_1), ..., (S_T, A_T, R_T)]$$

its just one run.

Return

A given episode $[(S_0, A_0, R_0), (S_1, A_1, R_1), ..., (S_T, A_T, R_T)]$ of MDP and a given $\gamma \epsilon [0, 1]$.

$$G_t = R_{t+1} + \gamma R_{t+2} + ... = \sum_{k=0}^{\infty} \gamma^k R_{t+k+1}$$

or

$$G_t = R_{t+1} + \gamma G_{t+1}$$

Reward function.

Given MDP we define reward function. $s, s' \epsilon S, a \epsilon A$

$$r(s) = \mathbb{E}_{a,s'}[R_{t+1} | S_t = s]$$

$$r(s,a) = \mathbb{E}_{s'}[R_{t+1} | S_t = s, A_t = a]$$

$$r(s,a,s') = \mathbb{E}[R_{t+1} | S_t = s, A_t = a, S_{t+1} = s']$$

Policy

Given a MPD we define

$$\pi(a|s) = \mathbb{P}[A_t = a|S_t = s]$$

- A policy fully defines the behavior of an agent.

State value function V

Given a MDP and a policy π on it we define

$$V_\pi(s) = \mathbb{E}_\pi[G_t | S_t = s] \ \ \forall s \epsilon S$$