

# Appendix for “Subgame-perfect free trade networks”

## A.1 Bellman equations in the alternative approach

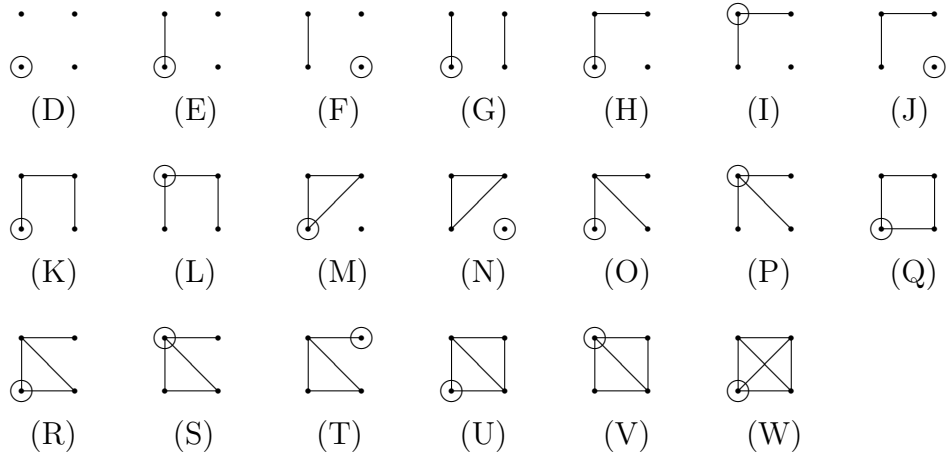


Figure 5: The states in each period.

**State D.**

$$\begin{aligned}
 V_t \left( \begin{array}{c} \cdot \\ \cdot \\ \odot \\ \cdot \end{array} \right) &= u \left( \begin{array}{c} \cdot \\ \cdot \\ \odot \\ \cdot \end{array} \right) \\
 &+ \left( \frac{3}{6} \beta V_{t+1} \left( \begin{array}{c} \cdot \\ \cdot \\ \odot \\ \cdot \end{array} \right) + \frac{3}{6} \beta V_{t+1} \left( \begin{array}{c} \cdot \\ \cdot \\ \odot \\ \cdot \end{array} \right) \right) \times \text{AND} \left( V_{t+1} \left( \begin{array}{c} \cdot \\ \cdot \\ \odot \\ \cdot \end{array} \right) \leq V_{t+1} \left( \begin{array}{c} \cdot \\ \cdot \\ \odot \\ \cdot \end{array} \right) \right) \\
 &+ \beta V_{t+1} \left( \begin{array}{c} \cdot \\ \cdot \\ \odot \\ \cdot \end{array} \right) \times \text{OR} \left( V_{t+1} \left( \begin{array}{c} \cdot \\ \cdot \\ \odot \\ \cdot \end{array} \right) > V_{t+1} \left( \begin{array}{c} \cdot \\ \cdot \\ \odot \\ \cdot \end{array} \right) \right).
 \end{aligned}$$

$$\begin{aligned}
 V_t(\text{D}) &= u(\text{D}) \\
 &+ \left( \frac{3}{6} \beta V_{t+1}(\text{E}) + \frac{3}{6} \beta V_{t+1}(\text{F}) \right) \times \text{AND} (V_{t+1}(\text{D}) \leq V_{t+1}(\text{E})) \\
 &+ \beta V_{t+1}(\text{D}) \times \text{OR} (V_{t+1}(\text{D}) > V_{t+1}(\text{E})).
 \end{aligned}$$

**State E.**

$$\begin{aligned}
V_t \left( \begin{array}{c} \uparrow \\ \circlearrowleft \end{array} \cdot \right) &= u \left( \begin{array}{c} \uparrow \\ \circlearrowleft \end{array} \cdot \right) \\
&+ \frac{1}{6} \beta V_{t+1} \left( \begin{array}{c} \uparrow \\ \circlearrowleft \end{array} \uparrow \right) \times \text{AND} \left( V_{t+1} \left( \begin{array}{c} \uparrow \\ \circlearrowleft \end{array} \cdot \right) \leq V_{t+1} \left( \begin{array}{c} \uparrow \\ \uparrow \\ \circlearrowleft \end{array} \right) \right) \\
&+ \frac{1}{6} \beta V_{t+1} \left( \begin{array}{c} \uparrow \\ \circlearrowleft \end{array} \cdot \right) \times \text{OR} \left( V_{t+1} \left( \begin{array}{c} \uparrow \\ \circlearrowleft \end{array} \cdot \right) > V_{t+1} \left( \begin{array}{c} \uparrow \\ \uparrow \\ \circlearrowleft \end{array} \right) \right) \\
&+ \left( \frac{2}{6} \beta V_{t+1} \left( \begin{array}{c} \uparrow \\ \circlearrowleft \end{array} \cdot \right) + \frac{2}{6} \beta V_{t+1} \left( \begin{array}{c} \uparrow \\ \circlearrowleft \end{array} \cdot \right) \right) \\
&\quad \times \text{AND} \left( V_{t+1} \left( \begin{array}{c} \uparrow \\ \circlearrowleft \end{array} \cdot \right) \leq V_{t+1} \left( \begin{array}{c} \uparrow \\ \circlearrowleft \end{array} \cdot \right), V_{t+1} \left( \begin{array}{c} \uparrow \\ \circlearrowleft \end{array} \cdot \right) \leq V_{t+1} \left( \begin{array}{c} \uparrow \\ \circlearrowleft \end{array} \cdot \right) \right) \\
&+ \frac{4}{6} \beta V_{t+1} \left( \begin{array}{c} \uparrow \\ \circlearrowleft \end{array} \cdot \right) \times \text{OR} \left( V_{t+1} \left( \begin{array}{c} \uparrow \\ \circlearrowleft \end{array} \cdot \right) > V_{t+1} \left( \begin{array}{c} \uparrow \\ \circlearrowleft \end{array} \cdot \right), V_{t+1} \left( \begin{array}{c} \uparrow \\ \circlearrowleft \end{array} \cdot \right) > V_{t+1} \left( \begin{array}{c} \uparrow \\ \circlearrowleft \end{array} \cdot \right) \right) \\
&+ \frac{1}{6} \beta V_{t+1} \left( \begin{array}{c} \uparrow \\ \circlearrowleft \end{array} \cdot \right) \times \text{AND} \left( V_{t+1} \left( \begin{array}{c} \uparrow \\ \circlearrowleft \end{array} \cdot \right) \leq V_{t+1} \left( \begin{array}{c} \uparrow \\ \circlearrowleft \end{array} \cdot \right) \right) \\
&+ \frac{1}{6} \beta V_{t+1} \left( \begin{array}{c} \uparrow \\ \circlearrowleft \end{array} \cdot \right) \times \text{OR} \left( V_{t+1} \left( \begin{array}{c} \uparrow \\ \circlearrowleft \end{array} \cdot \right) > V_{t+1} \left( \begin{array}{c} \uparrow \\ \circlearrowleft \end{array} \cdot \right) \right).
\end{aligned}$$

$$\begin{aligned}
V_t(\mathbf{E}) &= u(\mathbf{E}) \\
&+ \frac{1}{6} \beta V_{t+1}(\mathbf{G}) \times \text{AND} (V_{t+1}(\mathbf{F}) \leq V_{t+1}(\mathbf{G})) \\
&+ \frac{1}{6} \beta V_{t+1}(\mathbf{E}) \times \text{OR} (V_{t+1}(\mathbf{F}) > V_{t+1}(\mathbf{G})) \\
&+ \left( \frac{2}{6} \beta V_{t+1}(\mathbf{H}) + \frac{2}{6} \beta V_{t+1}(\mathbf{I}) \right) \times \text{AND} (V_{t+1}(\mathbf{E}) \leq V_{t+1}(\mathbf{I}), V_{t+1}(\mathbf{F}) \leq V_{t+1}(\mathbf{H})) \\
&+ \frac{4}{6} \beta V_{t+1}(\mathbf{E}) \times \text{OR} (V_{t+1}(\mathbf{E}) > V_{t+1}(\mathbf{I}), V_{t+1}(\mathbf{F}) > V_{t+1}(\mathbf{H})) \\
&+ \frac{1}{6} \beta V_{t+1}(\mathbf{E}) \times \text{AND} (V_{t+1}(\mathbf{D}) \leq V_{t+1}(\mathbf{E})) \\
&+ \frac{1}{6} \beta V_{t+1}(\mathbf{D}) \times \text{OR} (V_{t+1}(\mathbf{D}) > V_{t+1}(\mathbf{E})).
\end{aligned}$$

**State F.**

$$\begin{aligned}
V_t \left( \begin{array}{c} \uparrow \cdot \\ \ominus \end{array} \right) &= u \left( \begin{array}{c} \uparrow \cdot \\ \ominus \end{array} \right) \\
&+ \frac{1}{6} \beta V_{t+1} \left( \begin{array}{c} \uparrow \downarrow \\ \ominus \end{array} \right) \times \text{AND} \left( V_{t+1} \left( \begin{array}{c} \uparrow \cdot \\ \ominus \end{array} \right) \leq V_{t+1} \left( \begin{array}{c} \uparrow \downarrow \\ \ominus \end{array} \right) \right) \\
&+ \frac{1}{6} \beta V_{t+1} \left( \begin{array}{c} \uparrow \cdot \\ \ominus \end{array} \right) \times \text{OR} \left( V_{t+1} \left( \begin{array}{c} \uparrow \cdot \\ \ominus \end{array} \right) > V_{t+1} \left( \begin{array}{c} \uparrow \downarrow \\ \ominus \end{array} \right) \right) \\
&+ \left( \frac{2}{6} \beta V_{t+1} \left( \begin{array}{c} \uparrow \leftarrow \\ \ominus \end{array} \right) + \frac{2}{6} \beta V_{t+1} \left( \begin{array}{c} \downarrow \cdot \\ \ominus \end{array} \right) \right) \\
&\quad \times \text{AND} \left( V_{t+1} \left( \begin{array}{c} \ominus \cdot \\ \ominus \end{array} \right) \leq V_{t+1} \left( \begin{array}{c} \ominus \leftarrow \\ \ominus \end{array} \right), V_{t+1} \left( \begin{array}{c} \uparrow \cdot \\ \ominus \end{array} \right) \leq V_{t+1} \left( \begin{array}{c} \uparrow \ominus \\ \ominus \end{array} \right) \right) \\
&+ \frac{4}{6} \beta V_{t+1} \left( \begin{array}{c} \uparrow \cdot \\ \ominus \end{array} \right) \times \text{OR} \left( V_{t+1} \left( \begin{array}{c} \ominus \cdot \\ \ominus \end{array} \right) > V_{t+1} \left( \begin{array}{c} \ominus \leftarrow \\ \ominus \end{array} \right), V_{t+1} \left( \begin{array}{c} \uparrow \cdot \\ \ominus \end{array} \right) > V_{t+1} \left( \begin{array}{c} \uparrow \ominus \\ \ominus \end{array} \right) \right) \\
&+ \frac{1}{6} \beta V_{t+1} \left( \begin{array}{c} \uparrow \cdot \\ \ominus \end{array} \right) \times \text{AND} \left( V_{t+1} \left( \begin{array}{c} \cdot \cdot \\ \ominus \end{array} \right) \leq V_{t+1} \left( \begin{array}{c} \downarrow \cdot \\ \ominus \end{array} \right) \right) \\
&+ \frac{1}{6} \beta V_{t+1} \left( \begin{array}{c} \cdot \cdot \\ \ominus \end{array} \right) \times \text{OR} \left( V_{t+1} \left( \begin{array}{c} \cdot \cdot \\ \ominus \end{array} \right) > V_{t+1} \left( \begin{array}{c} \downarrow \cdot \\ \ominus \end{array} \right) \right).
\end{aligned}$$

$$\begin{aligned}
V_t(\text{F}) &= u(\text{F}) \\
&+ \frac{1}{6} \beta V_{t+1}(\text{G}) \times \text{AND} (V_{t+1}(\text{F}) \leq V_{t+1}(\text{G})) \\
&+ \frac{1}{6} \beta V_{t+1}(\text{F}) \times \text{OR} (V_{t+1}(\text{F}) > V_{t+1}(\text{G})) \\
&+ \left( \frac{2}{6} \beta V_{t+1}(\text{J}) + \frac{2}{6} \beta V_{t+1}(\text{H}) \right) \times \text{AND} (V_{t+1}(\text{E}) \leq V_{t+1}(\text{I}), V_{t+1}(\text{F}) \leq V_{t+1}(\text{H})) \\
&+ \frac{4}{6} \beta V_{t+1}(\text{F}) \times \text{OR} (V_{t+1}(\text{E}) > V_{t+1}(\text{I}), V_{t+1}(\text{F}) > V_{t+1}(\text{H})) \\
&+ \frac{1}{6} \beta V_{t+1}(\text{F}) \times \text{AND} (V_{t+1}(\text{D}) \leq V_{t+1}(\text{E})) \\
&+ \frac{1}{6} \beta V_{t+1}(\text{D}) \times \text{OR} (V_{t+1}(\text{D}) > V_{t+1}(\text{E})).
\end{aligned}$$

**State G.**

$$\begin{aligned}
V_t \left( \begin{array}{c} \downarrow \\ \circlearrowleft \\ \downarrow \end{array} \right) &= u \left( \begin{array}{c} \downarrow \\ \circlearrowleft \\ \downarrow \end{array} \right) \\
&+ \left( \frac{2}{6} \beta V_{t+1} \left( \begin{array}{c} \uparrow \uparrow \\ \circlearrowleft \\ \downarrow \end{array} \right) + \frac{2}{6} \beta V_{t+1} \left( \begin{array}{c} \downarrow \downarrow \\ \circlearrowleft \\ \downarrow \end{array} \right) \right) \times \text{AND} \left( V_{t+1} \left( \begin{array}{c} \circlearrowright \\ \downarrow \end{array} \right) \leq V_{t+1} \left( \begin{array}{c} \circlearrowright \\ \uparrow \uparrow \end{array} \right) \right) \\
&+ \frac{4}{6} \beta V_{t+1} \left( \begin{array}{c} \downarrow \downarrow \\ \circlearrowleft \\ \downarrow \end{array} \right) \times \text{OR} \left( V_{t+1} \left( \begin{array}{c} \circlearrowright \\ \downarrow \end{array} \right) > V_{t+1} \left( \begin{array}{c} \circlearrowright \\ \uparrow \uparrow \end{array} \right) \right) \\
&+ \frac{2}{6} \beta V_{t+1} \left( \begin{array}{c} \downarrow \downarrow \\ \circlearrowleft \\ \downarrow \end{array} \right) \times \text{AND} \left( V_{t+1} \left( \begin{array}{c} \circlearrowright \\ \downarrow \end{array} \right) \leq V_{t+1} \left( \begin{array}{c} \downarrow \downarrow \\ \circlearrowleft \\ \downarrow \end{array} \right) \right) \\
&+ \left( \frac{1}{6} \beta V_{t+1} \left( \begin{array}{c} \circlearrowright \\ \downarrow \end{array} \right) + \frac{1}{6} \beta V_{t+1} \left( \begin{array}{c} \downarrow \downarrow \\ \circlearrowleft \\ \downarrow \end{array} \right) \right) \times \text{OR} \left( V_{t+1} \left( \begin{array}{c} \circlearrowright \\ \downarrow \end{array} \right) > V_{t+1} \left( \begin{array}{c} \downarrow \downarrow \\ \circlearrowleft \\ \downarrow \end{array} \right) \right).
\end{aligned}$$

$$\begin{aligned}
V_t(\text{G}) &= u(\text{G}) \\
&+ \left( \frac{2}{6} \beta V_{t+1}(\text{K}) + \frac{2}{6} \beta V_{t+1}(\text{L}) \right) \times \text{AND} (V_{t+1}(\text{G}) \leq V_{t+1}(\text{L})) \\
&+ \frac{4}{6} \beta V_{t+1}(\text{G}) \times \text{OR} (V_{t+1}(\text{G}) > V_{t+1}(\text{L})) \\
&+ \frac{2}{6} \beta V_{t+1}(\text{G}) \times \text{AND} (V_{t+1}(\text{F}) \leq V_{t+1}(\text{G})) \\
&+ \left( \frac{1}{6} \beta V_{t+1}(\text{F}) + \frac{1}{6} \beta V_{t+1}(\text{G}) \right) \times \text{OR} (V_{t+1}(\text{F}) > V_{t+1}(\text{G})).
\end{aligned}$$

**State H.**

$$\begin{aligned}
V_t \left( \begin{array}{c} \Gamma \\ \circlearrowleft \end{array} \right) &= u \left( \begin{array}{c} \Gamma \\ \circlearrowleft \end{array} \right) \\
&+ \left( \frac{1}{6} \beta V_{t+1} \left( \begin{array}{c} \Gamma \\ \circlearrowleft \uparrow \end{array} \right) + \frac{1}{6} \beta V_{t+1} \left( \begin{array}{c} \Gamma \\ \circlearrowleft \downarrow \end{array} \right) \right) \\
&\quad \times \text{AND} \left( V_{t+1} \left( \begin{array}{c} \Gamma \\ \circlearrowleft \right) \leq V_{t+1} \left( \begin{array}{c} \Gamma \\ \uparrow \end{array} \right), V_{t+1} \left( \begin{array}{c} \Gamma \\ \circlearrowleft \right) \leq V_{t+1} \left( \begin{array}{c} \Gamma \\ \downarrow \end{array} \right) \right) \\
&+ \frac{2}{6} \beta V_{t+1} \left( \begin{array}{c} \Gamma \\ \circlearrowleft \end{array} \right) \times \text{OR} \left( V_{t+1} \left( \begin{array}{c} \Gamma \\ \circlearrowleft \right) > V_{t+1} \left( \begin{array}{c} \Gamma \\ \uparrow \end{array} \right), V_{t+1} \left( \begin{array}{c} \Gamma \\ \circlearrowleft \right) > V_{t+1} \left( \begin{array}{c} \Gamma \\ \downarrow \end{array} \right) \right) \\
&+ \frac{1}{6} \beta V_{t+1} \left( \begin{array}{c} \Gamma \\ \circlearrowleft \downarrow \end{array} \right) \times \text{AND} \left( V_{t+1} \left( \begin{array}{c} \Gamma \\ \circlearrowleft \end{array} \right) \leq V_{t+1} \left( \begin{array}{c} \Gamma \\ \downarrow \end{array} \right) \right) \\
&+ \frac{1}{6} \beta V_{t+1} \left( \begin{array}{c} \Gamma \\ \circlearrowleft \uparrow \end{array} \right) \times \text{OR} \left( V_{t+1} \left( \begin{array}{c} \Gamma \\ \circlearrowleft \end{array} \right) > V_{t+1} \left( \begin{array}{c} \Gamma \\ \uparrow \end{array} \right) \right) \\
&+ \frac{1}{6} \beta V_{t+1} \left( \begin{array}{c} \Gamma \\ \circlearrowleft \right) \times \text{AND} \left( V_{t+1} \left( \begin{array}{c} \Gamma \\ \uparrow \end{array} \right) \leq V_{t+1} \left( \begin{array}{c} \Gamma \\ \downarrow \end{array} \right), V_{t+1} \left( \begin{array}{c} \Gamma \\ \circlearrowleft \right) \leq V_{t+1} \left( \begin{array}{c} \Gamma \\ \downarrow \end{array} \right) \right) \\
&+ \frac{1}{6} \beta V_{t+1} \left( \begin{array}{c} \Gamma \\ \circlearrowleft \end{array} \right) \times \text{OR} \left( V_{t+1} \left( \begin{array}{c} \Gamma \\ \uparrow \end{array} \right) > V_{t+1} \left( \begin{array}{c} \Gamma \\ \downarrow \end{array} \right), V_{t+1} \left( \begin{array}{c} \Gamma \\ \circlearrowleft \right) > V_{t+1} \left( \begin{array}{c} \Gamma \\ \downarrow \end{array} \right) \right) \\
&+ \frac{2}{6} \beta V_{t+1} \left( \begin{array}{c} \Gamma \\ \circlearrowleft \end{array} \right) \times \text{AND} \left( V_{t+1} \left( \begin{array}{c} \Gamma \\ \circlearrowleft \right) \leq V_{t+1} \left( \begin{array}{c} \Gamma \\ \circlearrowleft \right), V_{t+1} \left( \begin{array}{c} \Gamma \\ \circlearrowleft \right) \leq V_{t+1} \left( \begin{array}{c} \Gamma \\ \uparrow \end{array} \right) \right) \\
&+ \left( \frac{1}{6} \beta V_{t+1} \left( \begin{array}{c} \Gamma \\ \circlearrowleft \right) + \frac{1}{6} \beta V_{t+1} \left( \begin{array}{c} \Gamma \\ \circlearrowleft \right) \right) \\
&\quad \times \text{OR} \left( V_{t+1} \left( \begin{array}{c} \Gamma \\ \circlearrowleft \right) > V_{t+1} \left( \begin{array}{c} \Gamma \\ \circlearrowleft \right), V_{t+1} \left( \begin{array}{c} \Gamma \\ \circlearrowleft \right) > V_{t+1} \left( \begin{array}{c} \Gamma \\ \uparrow \end{array} \right) \right).
\end{aligned}$$

$$\begin{aligned}
V_t (\text{H}) &= u (\text{H}) \\
&+ \left( \frac{1}{6} \beta V_{t+1} (\text{K}) + \frac{1}{6} \beta V_{t+1} (\text{L}) \right) \times \text{AND} (V_{t+1} (\text{H}) \leq V_{t+1} (\text{L}), V_{t+1} (\text{J}) \leq V_{t+1} (\text{K})) \\
&+ \frac{2}{6} \beta V_{t+1} (\text{H}) \times \text{OR} (V_{t+1} (\text{H}) > V_{t+1} (\text{L}), V_{t+1} (\text{J}) > V_{t+1} (\text{K})) \\
&+ \frac{1}{6} \beta V_{t+1} (\text{M}) \times \text{AND} (V_{t+1} (\text{H}) \leq V_{t+1} (\text{M})) \\
&+ \frac{1}{6} \beta V_{t+1} (\text{H}) \times \text{OR} (V_{t+1} (\text{H}) > V_{t+1} (\text{M})) \\
&+ \frac{1}{6} \beta V_{t+1} (\text{O}) \times \text{AND} (V_{t+1} (\text{I}) \leq V_{t+1} (\text{P}), V_{t+1} (\text{J}) \leq V_{t+1} (\text{O})) \\
&+ \frac{1}{6} \beta V_{t+1} (\text{H}) \times \text{OR} (V_{t+1} (\text{I}) > V_{t+1} (\text{P}), V_{t+1} (\text{J}) > V_{t+1} (\text{O})) \\
&+ \frac{2}{6} \beta V_{t+1} (\text{H}) \times \text{AND} (V_{t+1} (\text{F}) \leq V_{t+1} (\text{H}), V_{t+1} (\text{E}) \leq V_{t+1} (\text{I})) \\
&+ \left( \frac{1}{6} \beta V_{t+1} (\text{F}) + \frac{1}{6} \beta V_{t+1} (\text{E}) \right) \times \text{OR} (V_{t+1} (\text{F}) > V_{t+1} (\text{H}), V_{t+1} (\text{E}) > V_{t+1} (\text{I})).
\end{aligned}$$



**State J.**

$$\begin{aligned}
V_t \left( \begin{array}{c} \Gamma \\ \odot \end{array} \right) &= u \left( \begin{array}{c} \Gamma \\ \odot \end{array} \right) \\
&+ \frac{2}{6} \beta V_{t+1} \left( \begin{array}{c} \Gamma \\ \odot \end{array} \right) \times \text{AND} \left( V_{t+1} \left( \begin{array}{c} \odot \\ \cdot \end{array} \right) \leq V_{t+1} \left( \begin{array}{c} \Gamma \\ \uparrow \end{array} \right), V_{t+1} \left( \begin{array}{c} \Gamma \\ \odot \end{array} \right) \leq V_{t+1} \left( \begin{array}{c} \Gamma \\ \downarrow \end{array} \right) \right) \\
&+ \frac{2}{6} \beta V_{t+1} \left( \begin{array}{c} \Gamma \\ \odot \end{array} \right) \times \text{OR} \left( V_{t+1} \left( \begin{array}{c} \odot \\ \cdot \end{array} \right) > V_{t+1} \left( \begin{array}{c} \Gamma \\ \uparrow \end{array} \right), V_{t+1} \left( \begin{array}{c} \Gamma \\ \odot \end{array} \right) > V_{t+1} \left( \begin{array}{c} \Gamma \\ \downarrow \end{array} \right) \right) \\
&+ \frac{1}{6} \beta V_{t+1} \left( \begin{array}{c} \Gamma \\ \odot \end{array} \right) \times \text{AND} \left( V_{t+1} \left( \begin{array}{c} \Gamma \\ \odot \end{array} \right) \leq V_{t+1} \left( \begin{array}{c} \Gamma \\ \odot \end{array} \right) \right) \\
&+ \frac{1}{6} \beta V_{t+1} \left( \begin{array}{c} \Gamma \\ \odot \end{array} \right) \times \text{OR} \left( V_{t+1} \left( \begin{array}{c} \Gamma \\ \odot \end{array} \right) > V_{t+1} \left( \begin{array}{c} \Gamma \\ \odot \end{array} \right) \right) \\
&+ \frac{1}{6} \beta V_{t+1} \left( \begin{array}{c} \Gamma \\ \odot \end{array} \right) \times \text{AND} \left( V_{t+1} \left( \begin{array}{c} \odot \\ \cdot \end{array} \right) \leq V_{t+1} \left( \begin{array}{c} \odot \\ \cdot \end{array} \right), V_{t+1} \left( \begin{array}{c} \Gamma \\ \odot \end{array} \right) \leq V_{t+1} \left( \begin{array}{c} \Gamma \\ \odot \end{array} \right) \right) \\
&+ \frac{1}{6} \beta V_{t+1} \left( \begin{array}{c} \Gamma \\ \odot \end{array} \right) \times \text{OR} \left( V_{t+1} \left( \begin{array}{c} \odot \\ \cdot \end{array} \right) > V_{t+1} \left( \begin{array}{c} \odot \\ \cdot \end{array} \right), V_{t+1} \left( \begin{array}{c} \Gamma \\ \odot \end{array} \right) > V_{t+1} \left( \begin{array}{c} \Gamma \\ \odot \end{array} \right) \right) \\
&+ \frac{2}{6} \beta V_{t+1} \left( \begin{array}{c} \Gamma \\ \odot \end{array} \right) \times \text{AND} \left( V_{t+1} \left( \begin{array}{c} \odot \\ \cdot \end{array} \right) \leq V_{t+1} \left( \begin{array}{c} \odot \\ \cdot \end{array} \right), V_{t+1} \left( \begin{array}{c} \odot \\ \cdot \end{array} \right) \leq V_{t+1} \left( \begin{array}{c} \odot \\ \cdot \end{array} \right) \right) \\
&+ \frac{2}{6} \beta V_{t+1} \left( \begin{array}{c} \odot \\ \cdot \end{array} \right) \times \text{OR} \left( V_{t+1} \left( \begin{array}{c} \odot \\ \cdot \end{array} \right) > V_{t+1} \left( \begin{array}{c} \odot \\ \cdot \end{array} \right), V_{t+1} \left( \begin{array}{c} \odot \\ \cdot \end{array} \right) > V_{t+1} \left( \begin{array}{c} \odot \\ \cdot \end{array} \right) \right).
\end{aligned}$$

$$\begin{aligned}
V_t(\text{J}) &= u(\text{J}) \\
&+ \frac{2}{6} \beta V_{t+1}(\text{K}) \times \text{AND} (V_{t+1}(\text{H}) \leq V_{t+1}(\text{L}), V_{t+1}(\text{J}) \leq V_{t+1}(\text{K})) \\
&+ \frac{2}{6} \beta V_{t+1}(\text{J}) \times \text{OR} (V_{t+1}(\text{H}) > V_{t+1}(\text{L}), V_{t+1}(\text{J}) > V_{t+1}(\text{K})) \\
&+ \frac{1}{6} \beta V_{t+1}(\text{N}) \times \text{AND} (V_{t+1}(\text{H}) \leq V_{t+1}(\text{M})) \\
&+ \frac{1}{6} \beta V_{t+1}(\text{J}) \times \text{OR} (V_{t+1}(\text{H}) > V_{t+1}(\text{M})) \\
&+ \frac{1}{6} \beta V_{t+1}(\text{O}) \times \text{AND} (V_{t+1}(\text{I}) \leq V_{t+1}(\text{P}), V_{t+1}(\text{J}) \leq V_{t+1}(\text{O})) \\
&+ \frac{1}{6} \beta V_{t+1}(\text{J}) \times \text{OR} (V_{t+1}(\text{I}) > V_{t+1}(\text{P}), V_{t+1}(\text{J}) > V_{t+1}(\text{O})) \\
&+ \frac{2}{6} \beta V_{t+1}(\text{J}) \times \text{AND} (V_{t+1}(\text{F}) \leq V_{t+1}(\text{H}), V_{t+1}(\text{E}) \leq V_{t+1}(\text{I})) \\
&+ \frac{2}{6} \beta V_{t+1}(\text{E}) \times \text{OR} (V_{t+1}(\text{F}) > V_{t+1}(\text{H}), V_{t+1}(\text{E}) > V_{t+1}(\text{I})).
\end{aligned}$$





**State L.**

$$\begin{aligned}
V_t \left( \begin{array}{c} \odot \\ \uparrow \downarrow \end{array} \right) &= u \left( \begin{array}{c} \odot \\ \uparrow \downarrow \end{array} \right) \\
&+ \frac{1}{6} \beta V_{t+1} \left( \begin{array}{c} \odot \\ \square \end{array} \right) \times \text{AND} \left( V_{t+1} \left( \begin{array}{c} \uparrow \downarrow \\ \odot \end{array} \right) \leq V_{t+1} \left( \begin{array}{c} \square \\ \odot \end{array} \right) \right) \\
&+ \frac{1}{6} \beta V_{t+1} \left( \begin{array}{c} \odot \\ \uparrow \downarrow \end{array} \right) \times \text{OR} \left( V_{t+1} \left( \begin{array}{c} \uparrow \downarrow \\ \odot \end{array} \right) > V_{t+1} \left( \begin{array}{c} \square \\ \odot \end{array} \right) \right) \\
&+ \left( \frac{1}{6} \beta V_{t+1} \left( \begin{array}{c} \odot \\ \nearrow \end{array} \right) + \frac{1}{6} \beta V_{t+1} \left( \begin{array}{c} \odot \\ \searrow \end{array} \right) \right) \\
&\quad \times \text{AND} \left( V_{t+1} \left( \begin{array}{c} \uparrow \downarrow \\ \odot \end{array} \right) \leq V_{t+1} \left( \begin{array}{c} \nearrow \\ \odot \end{array} \right), V_{t+1} \left( \begin{array}{c} \uparrow \downarrow \\ \odot \end{array} \right) \leq V_{t+1} \left( \begin{array}{c} \searrow \\ \odot \end{array} \right) \right) \\
&+ \frac{2}{6} \beta V_{t+1} \left( \begin{array}{c} \odot \\ \uparrow \downarrow \end{array} \right) \times \text{OR} \left( V_{t+1} \left( \begin{array}{c} \uparrow \downarrow \\ \odot \end{array} \right) > V_{t+1} \left( \begin{array}{c} \nearrow \\ \odot \end{array} \right), V_{t+1} \left( \begin{array}{c} \uparrow \downarrow \\ \odot \end{array} \right) > V_{t+1} \left( \begin{array}{c} \searrow \\ \odot \end{array} \right) \right) \\
&+ \frac{2}{6} \beta V_{t+1} \left( \begin{array}{c} \odot \\ \uparrow \downarrow \end{array} \right) \times \text{AND} \left( V_{t+1} \left( \begin{array}{c} \leftarrow \rightarrow \\ \odot \end{array} \right) \leq V_{t+1} \left( \begin{array}{c} \uparrow \downarrow \\ \odot \end{array} \right), V_{t+1} \left( \begin{array}{c} \odot \\ \leftarrow \rightarrow \end{array} \right) \leq V_{t+1} \left( \begin{array}{c} \uparrow \downarrow \\ \odot \end{array} \right) \right) \\
&+ \left( \frac{1}{6} \beta V_{t+1} \left( \begin{array}{c} \odot \\ \leftarrow \rightarrow \end{array} \right) + \frac{1}{6} \beta V_{t+1} \left( \begin{array}{c} \odot \\ \rightarrow \leftarrow \end{array} \right) \right) \\
&\quad \times \text{OR} \left( V_{t+1} \left( \begin{array}{c} \leftarrow \rightarrow \\ \odot \end{array} \right) > V_{t+1} \left( \begin{array}{c} \uparrow \downarrow \\ \odot \end{array} \right), V_{t+1} \left( \begin{array}{c} \odot \\ \leftarrow \rightarrow \end{array} \right) > V_{t+1} \left( \begin{array}{c} \uparrow \downarrow \\ \odot \end{array} \right) \right) \\
&+ \frac{1}{6} \beta V_{t+1} \left( \begin{array}{c} \odot \\ \uparrow \downarrow \end{array} \right) \times \text{AND} \left( V_{t+1} \left( \begin{array}{c} \odot \\ \uparrow \downarrow \end{array} \right) \leq V_{t+1} \left( \begin{array}{c} \odot \\ \uparrow \downarrow \end{array} \right) \right) \\
&+ \frac{1}{6} \beta V_{t+1} \left( \begin{array}{c} \odot \\ \uparrow \downarrow \end{array} \right) \times \text{OR} \left( V_{t+1} \left( \begin{array}{c} \odot \\ \uparrow \downarrow \end{array} \right) > V_{t+1} \left( \begin{array}{c} \odot \\ \uparrow \downarrow \end{array} \right) \right).
\end{aligned}$$

$$\begin{aligned}
V_t (\text{L}) &= u (\text{L}) \\
&+ \frac{1}{6} \beta V_{t+1} (\text{Q}) \times \text{AND} (V_{t+1} (\text{K}) \leq V_{t+1} (\text{Q})) \\
&+ \frac{1}{6} \beta V_{t+1} (\text{L}) \times \text{OR} (V_{t+1} (\text{K}) > V_{t+1} (\text{Q})) \\
&+ \left( \frac{1}{6} \beta V_{t+1} (\text{R}) + \frac{1}{6} \beta V_{t+1} (\text{S}) \right) \times \text{AND} (V_{t+1} (\text{K}) \leq V_{t+1} (\text{R}), V_{t+1} (\text{L}) \leq V_{t+1} (\text{S})) \\
&+ \frac{2}{6} \beta V_{t+1} (\text{L}) \times \text{OR} (V_{t+1} (\text{K}) > V_{t+1} (\text{R}), V_{t+1} (\text{L}) > V_{t+1} (\text{S})) \\
&+ \frac{2}{6} \beta V_{t+1} (\text{L}) \times \text{AND} (V_{t+1} (\text{J}) \leq V_{t+1} (\text{K}), V_{t+1} (\text{H}) \leq V_{t+1} (\text{L})) \\
&+ \left( \frac{1}{6} \beta V_{t+1} (\text{H}) + \frac{1}{6} \beta V_{t+1} (\text{I}) \right) \times \text{OR} (V_{t+1} (\text{J}) > V_{t+1} (\text{K}), V_{t+1} (\text{H}) > V_{t+1} (\text{L})) \\
&+ \frac{1}{6} \beta V_{t+1} (\text{L}) \times \text{AND} (V_{t+1} (\text{G}) \leq V_{t+1} (\text{L})) \\
&+ \frac{1}{6} \beta V_{t+1} (\text{G}) \times \text{OR} (V_{t+1} (\text{G}) > V_{t+1} (\text{L})).
\end{aligned}$$

**State M.**

$$\begin{aligned}
V_t(\downarrow \cdot) &= u(\downarrow \cdot) \\
&+ \left( \frac{1}{6} \beta V_{t+1}(\downarrow \cdot) + \frac{2}{6} \beta V_{t+1}(\downarrow \cdot) \right) \\
&\quad \times \text{AND} \left( V_{t+1}(\downarrow \cdot) \leq V_{t+1}(\downarrow \cdot), V_{t+1}(\downarrow \cdot) \leq V_{t+1}(\downarrow \cdot) \right) \\
&+ \frac{3}{6} \beta V_{t+1}(\downarrow \cdot) \times \text{OR} \left( V_{t+1}(\downarrow \cdot) > V_{t+1}(\downarrow \cdot), V_{t+1}(\downarrow \cdot) > V_{t+1}(\downarrow \cdot) \right) \\
&+ \frac{3}{6} \beta V_{t+1}(\downarrow \cdot) \times \text{AND} \left( V_{t+1}(\downarrow \cdot) \leq V_{t+1}(\downarrow \cdot) \right) \\
&+ \left( \frac{2}{6} \beta V_{t+1}(\downarrow \cdot) + \frac{1}{6} \beta V_{t+1}(\downarrow \cdot) \right) \times \text{OR} \left( V_{t+1}(\downarrow \cdot) > V_{t+1}(\downarrow \cdot) \right).
\end{aligned}$$

$$\begin{aligned}
V_t(\text{M}) &= u(\text{M}) \\
&+ \left( \frac{1}{6} \beta V_{t+1}(\text{S}) + \frac{2}{6} \beta V_{t+1}(\text{R}) \right) \times \text{AND} \left( V_{t+1}(\text{M}) \leq V_{t+1}(\text{S}), V_{t+1}(\text{N}) \leq V_{t+1}(\text{T}) \right) \\
&+ \frac{3}{6} \beta V_{t+1}(\text{M}) \times \text{OR} \left( V_{t+1}(\text{M}) > V_{t+1}(\text{S}), V_{t+1}(\text{N}) > V_{t+1}(\text{T}) \right) \\
&+ \frac{3}{6} \beta V_{t+1}(\text{M}) \times \text{AND} \left( V_{t+1}(\text{H}) \leq V_{t+1}(\text{M}) \right) \\
&+ \left( \frac{2}{6} \beta V_{t+1}(\text{H}) + \frac{1}{6} \beta V_{t+1}(\text{I}) \right) \times \text{OR} \left( V_{t+1}(\text{H}) > V_{t+1}(\text{M}) \right).
\end{aligned}$$

**State N.**

$$\begin{aligned}
V_t(\mathbb{V}_{\odot}) &= u(\mathbb{V}_{\odot}) \\
&+ \frac{3}{6}\beta V_{t+1}(\mathbb{Z}_{\odot}) \times \text{AND}(V_{t+1}(\mathbb{V}_{\odot}) \leq V_{t+1}(\mathbb{Z}_{\odot}), V_{t+1}(\mathbb{V}_{\odot}) \leq V_{t+1}(\mathbb{Z}_{\odot})) \\
&+ \frac{3}{6}\beta V_{t+1}(\mathbb{V}_{\odot}) \times \text{OR}(V_{t+1}(\mathbb{V}_{\odot}) > V_{t+1}(\mathbb{Z}_{\odot}), V_{t+1}(\mathbb{V}_{\odot}) > V_{t+1}(\mathbb{Z}_{\odot})) \\
&+ \frac{3}{6}\beta V_{t+1}(\mathbb{V}_{\odot}) \times \text{AND}(V_{t+1}(\mathbb{V}_{\odot}) \leq V_{t+1}(\mathbb{V}_{\odot})) \\
&+ \frac{3}{6}\beta V_{t+1}(\mathbb{V}_{\odot}) \times \text{OR}(V_{t+1}(\mathbb{V}_{\odot}) > V_{t+1}(\mathbb{V}_{\odot})).
\end{aligned}$$

$$\begin{aligned}
V_t(\text{N}) &= u(\text{N}) \\
&+ \frac{3}{6}\beta V_{t+1}(\text{T}) \times \text{AND}(V_{t+1}(\text{M}) \leq V_{t+1}(\text{S}), V_{t+1}(\text{N}) \leq V_{t+1}(\text{T})) \\
&+ \frac{3}{6}\beta V_{t+1}(\text{N}) \times \text{OR}(V_{t+1}(\text{M}) > V_{t+1}(\text{S}), V_{t+1}(\text{N}) > V_{t+1}(\text{T})) \\
&+ \frac{3}{6}\beta V_{t+1}(\text{N}) \times \text{AND}(V_{t+1}(\text{H}) \leq V_{t+1}(\text{M})) \\
&+ \frac{3}{6}\beta V_{t+1}(\text{J}) \times \text{OR}(V_{t+1}(\text{H}) > V_{t+1}(\text{M})).
\end{aligned}$$

**State O.**

$$\begin{aligned}
V_t \left( \begin{array}{c} \nearrow \\ \circlearrowleft \end{array} \right) &= u \left( \begin{array}{c} \nearrow \\ \circlearrowleft \end{array} \right) \\
&+ \left( \frac{2}{6} \beta V_{t+1} \left( \begin{array}{c} \nearrow \\ \circlearrowleft \end{array} \right) + \frac{1}{6} \beta V_{t+1} \left( \begin{array}{c} \nearrow \\ \circlearrowright \end{array} \right) \right) \times \text{AND} \left( V_{t+1} \left( \begin{array}{c} \nearrow \\ \circlearrowleft \end{array} \right) \leq V_{t+1} \left( \begin{array}{c} \nearrow \\ \circlearrowleft \end{array} \right) \right) \\
&+ \frac{3}{6} \beta V_{t+1} \left( \begin{array}{c} \nearrow \\ \circlearrowleft \end{array} \right) \times \text{OR} \left( V_{t+1} \left( \begin{array}{c} \nearrow \\ \circlearrowleft \end{array} \right) > V_{t+1} \left( \begin{array}{c} \nearrow \\ \circlearrowleft \end{array} \right) \right) \\
&+ \frac{3}{6} \beta V_{t+1} \left( \begin{array}{c} \nearrow \\ \circlearrowleft \end{array} \right) \times \text{AND} \left( V_{t+1} \left( \begin{array}{c} \nearrow \\ \circlearrowleft \end{array} \right) \leq V_{t+1} \left( \begin{array}{c} \nearrow \\ \circlearrowleft \end{array} \right), V_{t+1} \left( \begin{array}{c} \circlearrowright \\ \nearrow \end{array} \right) \leq V_{t+1} \left( \begin{array}{c} \circlearrowright \\ \nearrow \end{array} \right) \right) \\
&+ \left( \frac{1}{6} \beta V_{t+1} \left( \begin{array}{c} \nearrow \\ \circlearrowleft \end{array} \right) + \frac{2}{6} \beta V_{t+1} \left( \begin{array}{c} \nearrow \\ \circlearrowright \end{array} \right) \right) \\
&\quad \times \text{OR} \left( V_{t+1} \left( \begin{array}{c} \nearrow \\ \circlearrowleft \end{array} \right) > V_{t+1} \left( \begin{array}{c} \nearrow \\ \circlearrowleft \end{array} \right), V_{t+1} \left( \begin{array}{c} \circlearrowright \\ \nearrow \end{array} \right) > V_{t+1} \left( \begin{array}{c} \circlearrowright \\ \nearrow \end{array} \right) \right).
\end{aligned}$$

$$\begin{aligned}
V_t (O) &= u(O) \\
&+ \left( \frac{2}{6} \beta V_{t+1} (R) + \frac{1}{6} \beta V_{t+1} (T) \right) \times \text{AND} (V_{t+1} (O) \leq V_{t+1} (R)) \\
&+ \frac{3}{6} \beta V_{t+1} (O) \times \text{OR} (V_{t+1} (O) > V_{t+1} (R)) \\
&+ \frac{3}{6} \beta V_{t+1} (O) \times \text{AND} (V_{t+1} (J) \leq V_{t+1} (O), V_{t+1} (I) \leq V_{t+1} (P)) \\
&+ \left( \frac{1}{6} \beta V_{t+1} (J) + \frac{2}{6} \beta V_{t+1} (H) \right) \times \text{OR} (V_{t+1} (J) > V_{t+1} (O), V_{t+1} (I) > V_{t+1} (P)).
\end{aligned}$$

**State P.**

$$\begin{aligned}
V_t \left( \begin{array}{c} \textcircled{N} \\ \text{N} \end{array} \right) &= u \left( \begin{array}{c} \textcircled{N} \\ \text{N} \end{array} \right) \\
&+ \frac{3}{6} \beta V_{t+1} \left( \begin{array}{c} \textcircled{N} \\ \text{N} \end{array} \right) \times \text{AND} \left( V_{t+1} \left( \begin{array}{c} \textcircled{N} \\ \text{N} \end{array} \right) \leq V_{t+1} \left( \begin{array}{c} \textcircled{N} \\ \text{N} \end{array} \right) \right) \\
&+ \frac{3}{6} \beta V_{t+1} \left( \begin{array}{c} \textcircled{N} \\ \text{N} \end{array} \right) \times \text{OR} \left( V_{t+1} \left( \begin{array}{c} \textcircled{N} \\ \text{N} \end{array} \right) > V_{t+1} \left( \begin{array}{c} \textcircled{N} \\ \text{N} \end{array} \right) \right) \\
&+ \frac{3}{6} \beta V_{t+1} \left( \begin{array}{c} \textcircled{N} \\ \text{N} \end{array} \right) \times \text{AND} \left( V_{t+1} \left( \begin{array}{c} \textcircled{N} \\ \text{N} \end{array} \right) \leq V_{t+1} \left( \begin{array}{c} \textcircled{N} \\ \text{N} \end{array} \right), V_{t+1} \left( \begin{array}{c} \textcircled{N} \\ \text{N} \end{array} \right) \leq V_{t+1} \left( \begin{array}{c} \textcircled{N} \\ \text{N} \end{array} \right) \right) \\
&+ \frac{3}{6} \beta V_{t+1} \left( \begin{array}{c} \textcircled{N} \\ \text{N} \end{array} \right) \times \text{OR} \left( V_{t+1} \left( \begin{array}{c} \textcircled{N} \\ \text{N} \end{array} \right) > V_{t+1} \left( \begin{array}{c} \textcircled{N} \\ \text{N} \end{array} \right), V_{t+1} \left( \begin{array}{c} \textcircled{N} \\ \text{N} \end{array} \right) > V_{t+1} \left( \begin{array}{c} \textcircled{N} \\ \text{N} \end{array} \right) \right).
\end{aligned}$$

$$\begin{aligned}
V_t(\text{P}) &= u(\text{P}) \\
&+ \frac{3}{6} \beta V_{t+1}(\text{S}) \times \text{AND} (V_{t+1}(\text{O}) \leq V_{t+1}(\text{R})) \\
&+ \frac{3}{6} \beta V_{t+1}(\text{P}) \times \text{OR} (V_{t+1}(\text{O}) > V_{t+1}(\text{R})) \\
&+ \frac{3}{6} \beta V_{t+1}(\text{P}) \times \text{AND} (V_{t+1}(\text{J}) \leq V_{t+1}(\text{O}), V_{t+1}(\text{I}) \leq V_{t+1}(\text{P})) \\
&+ \frac{3}{6} \beta V_{t+1}(\text{I}) \times \text{OR} (V_{t+1}(\text{J}) > V_{t+1}(\text{O}), V_{t+1}(\text{I}) > V_{t+1}(\text{P})).
\end{aligned}$$

**State Q.**

$$\begin{aligned}
V_t \left( \begin{array}{|c|} \hline \square \\ \hline \ominus \\ \hline \end{array} \right) &= u \left( \begin{array}{|c|} \hline \square \\ \hline \ominus \\ \hline \end{array} \right) \\
&+ \left( \frac{1}{6} \beta V_{t+1} \left( \begin{array}{|c|} \hline \nearrow \\ \hline \ominus \\ \hline \end{array} \right) + \frac{1}{6} \beta V_{t+1} \left( \begin{array}{|c|} \hline \searrow \\ \hline \ominus \\ \hline \end{array} \right) \right) \times \text{AND} \left( V_{t+1} \left( \begin{array}{|c|} \hline \square \\ \hline \ominus \\ \hline \end{array} \right) \leq V_{t+1} \left( \begin{array}{|c|} \hline \nearrow \\ \hline \ominus \\ \hline \end{array} \right) \right) \\
&+ \frac{2}{6} \beta V_{t+1} \left( \begin{array}{|c|} \hline \square \\ \hline \ominus \\ \hline \end{array} \right) \times \text{OR} \left( V_{t+1} \left( \begin{array}{|c|} \hline \square \\ \hline \ominus \\ \hline \end{array} \right) > V_{t+1} \left( \begin{array}{|c|} \hline \nearrow \\ \hline \ominus \\ \hline \end{array} \right) \right) \\
&+ \frac{4}{6} \beta V_{t+1} \left( \begin{array}{|c|} \hline \square \\ \hline \ominus \\ \hline \end{array} \right) \times \text{AND} \left( V_{t+1} \left( \begin{array}{|c|} \hline \square \\ \hline \ominus \\ \hline \end{array} \right) \leq V_{t+1} \left( \begin{array}{|c|} \hline \square \\ \hline \ominus \\ \hline \end{array} \right) \right) \\
&+ \left( \frac{2}{6} \beta V_{t+1} \left( \begin{array}{|c|} \hline \square \\ \hline \ominus \\ \hline \end{array} \right) + \frac{2}{6} \beta V_{t+1} \left( \begin{array}{|c|} \hline \square \\ \hline \ominus \\ \hline \end{array} \right) \right) \times \text{OR} \left( V_{t+1} \left( \begin{array}{|c|} \hline \square \\ \hline \ominus \\ \hline \end{array} \right) > V_{t+1} \left( \begin{array}{|c|} \hline \square \\ \hline \ominus \\ \hline \end{array} \right) \right).
\end{aligned}$$

$$\begin{aligned}
V_t (Q) &= u(Q) \\
&+ \left( \frac{1}{6} \beta V_{t+1} (V) + \frac{1}{6} \beta V_{t+1} (U) \right) \times \text{AND} (V_{t+1} (Q) \leq V_{t+1} (V)) \\
&+ \frac{2}{6} \beta V_{t+1} (Q) \times \text{OR} (V_{t+1} (Q) > V_{t+1} (V)) \\
&+ \frac{4}{6} \beta V_{t+1} (Q) \times \text{AND} (V_{t+1} (K) \leq V_{t+1} (Q)) \\
&+ \left( \frac{2}{6} \beta V_{t+1} (K) + \frac{2}{6} \beta V_{t+1} (L) \right) \times \text{OR} (V_{t+1} (K) > V_{t+1} (Q)).
\end{aligned}$$







**State T.**

$$\begin{aligned}
V_t(\mathbb{N}^\circ) &= u(\mathbb{N}^\circ) \\
&+ \frac{2}{6}\beta V_{t+1}(\mathbb{N}^\circ) \times \text{AND}(V_{t+1}(\mathbb{N}) \leq V_{t+1}(\mathbb{N}), V_{t+1}(\mathbb{N}^\circ) \leq V_{t+1}(\mathbb{N}^\circ)) \\
&+ \frac{2}{6}\beta V_{t+1}(\mathbb{N}^\circ) \times \text{OR}(V_{t+1}(\mathbb{N}) > V_{t+1}(\mathbb{N}), V_{t+1}(\mathbb{N}^\circ) > V_{t+1}(\mathbb{N}^\circ)) \\
&+ \frac{1}{6}\beta V_{t+1}(\mathbb{N}^\circ) \times \text{AND}(V_{t+1}(\mathbb{N}) \leq V_{t+1}(\mathbb{N})) \\
&+ \frac{1}{6}\beta V_{t+1}(\mathbb{N}^\circ) \times \text{OR}(V_{t+1}(\mathbb{N}) > V_{t+1}(\mathbb{N})) \\
&+ \frac{2}{6}\beta V_{t+1}(\mathbb{N}^\circ) \times \text{AND}(V_{t+1}(\mathbb{N}) \leq V_{t+1}(\mathbb{N}), V_{t+1}(\mathbb{N}^\circ) \leq V_{t+1}(\mathbb{N}^\circ)) \\
&+ \frac{2}{6}\beta V_{t+1}(\mathbb{N}^\circ) \times \text{OR}(V_{t+1}(\mathbb{N}) > V_{t+1}(\mathbb{N}), V_{t+1}(\mathbb{N}^\circ) > V_{t+1}(\mathbb{N}^\circ)) \\
&+ \frac{1}{6}\beta V_{t+1}(\mathbb{N}^\circ) \times \text{AND}(V_{t+1}(\mathbb{N}) \leq V_{t+1}(\mathbb{N}), V_{t+1}(\mathbb{N}^\circ) \leq V_{t+1}(\mathbb{N}^\circ)) \\
&+ \frac{1}{6}\beta V_{t+1}(\mathbb{N}^\circ) \times \text{OR}(V_{t+1}(\mathbb{N}) > V_{t+1}(\mathbb{N}), V_{t+1}(\mathbb{N}^\circ) > V_{t+1}(\mathbb{N}^\circ)).
\end{aligned}$$

$$\begin{aligned}
V_t(\text{T}) &= u(\text{T}) \\
&+ \frac{2}{6}\beta V_{t+1}(\text{U}) \times \text{AND}(V_{t+1}(\text{R}) \leq V_{t+1}(\text{V}), V_{t+1}(\text{T}) \leq V_{t+1}(\text{U})) \\
&+ \frac{2}{6}\beta V_{t+1}(\text{T}) \times \text{OR}(V_{t+1}(\text{R}) > V_{t+1}(\text{V}), V_{t+1}(\text{T}) > V_{t+1}(\text{U})) \\
&+ \frac{1}{6}\beta V_{t+1}(\text{T}) \times \text{AND}(V_{t+1}(\text{O}) \leq V_{t+1}(\text{R})) \\
&+ \frac{1}{6}\beta V_{t+1}(\text{O}) \times \text{OR}(V_{t+1}(\text{O}) > V_{t+1}(\text{R})) \\
&+ \frac{2}{6}\beta V_{t+1}(\text{T}) \times \text{AND}(V_{t+1}(\text{K}) \leq V_{t+1}(\text{R}), V_{t+1}(\text{L}) \leq V_{t+1}(\text{S})) \\
&+ \frac{2}{6}\beta V_{t+1}(\text{K}) \times \text{OR}(V_{t+1}(\text{K}) > V_{t+1}(\text{R}), V_{t+1}(\text{L}) > V_{t+1}(\text{S})) \\
&+ \frac{1}{6}\beta V_{t+1}(\text{T}) \times \text{AND}(V_{t+1}(\text{M}) \leq V_{t+1}(\text{S}), V_{t+1}(\text{N}) \leq V_{t+1}(\text{T})) \\
&+ \frac{1}{6}\beta V_{t+1}(\text{N}) \times \text{OR}(V_{t+1}(\text{M}) > V_{t+1}(\text{S}), V_{t+1}(\text{N}) > V_{t+1}(\text{T})).
\end{aligned}$$

**State U.**

$$\begin{aligned}
V_t(\textcircled{\text{N}}) &= u(\textcircled{\text{N}}) \\
&+ \frac{1}{6}\beta V_{t+1}(\textcircled{\text{N}}) \times \text{AND}(V_{t+1}(\textcircled{\text{N}}) \leq V_{t+1}(\textcircled{\text{N}})) \\
&+ \frac{1}{6}\beta V_{t+1}(\textcircled{\text{N}}) \times \text{OR}(V_{t+1}(\textcircled{\text{N}}) > V_{t+1}(\textcircled{\text{N}})) \\
&+ \frac{1}{6}\beta V_{t+1}(\textcircled{\text{N}}) \times \text{AND}(V_{t+1}(\textcircled{\text{N}}) \leq V_{t+1}(\textcircled{\text{N}})) \\
&+ \frac{1}{6}\beta V_{t+1}(\textcircled{\text{N}}) \times \text{OR}(V_{t+1}(\textcircled{\text{N}}) > V_{t+1}(\textcircled{\text{N}})) \\
&+ \frac{4}{6}\beta V_{t+1}(\textcircled{\text{N}}) \times \text{AND}(V_{t+1}(\textcircled{\text{N}}) \leq V_{t+1}(\textcircled{\text{N}}), V_{t+1}(\textcircled{\text{N}}) \leq V_{t+1}(\textcircled{\text{N}})) \\
&+ \left( \frac{2}{6}\beta V_{t+1}(\textcircled{\text{N}}) + \frac{2}{6}\beta V_{t+1}(\textcircled{\text{N}}) \right) \\
&\quad \times \text{OR}(V_{t+1}(\textcircled{\text{N}}) > V_{t+1}(\textcircled{\text{N}}), V_{t+1}(\textcircled{\text{N}}) > V_{t+1}(\textcircled{\text{N}})).
\end{aligned}$$

$$\begin{aligned}
V_t(\text{U}) &= u(\text{U}) \\
&+ \frac{1}{6}\beta V_{t+1}(\text{W}) \times \text{AND}(V_{t+1}(\text{U}) \leq V_{t+1}(\text{W})) \\
&+ \frac{1}{6}\beta V_{t+1}(\text{U}) \times \text{OR}(V_{t+1}(\text{U}) > V_{t+1}(\text{W})) \\
&+ \frac{1}{6}\beta V_{t+1}(\text{U}) \times \text{AND}(V_{t+1}(\text{Q}) \leq V_{t+1}(\text{V})) \\
&+ \frac{1}{6}\beta V_{t+1}(\text{Q}) \times \text{OR}(V_{t+1}(\text{Q}) > V_{t+1}(\text{V})) \\
&+ \frac{4}{6}\beta V_{t+1}(\text{U}) \times \text{AND}(V_{t+1}(\text{R}) \leq V_{t+1}(\text{V}), V_{t+1}(\text{T}) \leq V_{t+1}(\text{U})) \\
&+ \left( \frac{2}{6}\beta V_{t+1}(\text{R}) + \frac{2}{6}\beta V_{t+1}(\text{T}) \right) \times \text{OR}(V_{t+1}(\text{R}) > V_{t+1}(\text{V}), V_{t+1}(\text{T}) > V_{t+1}(\text{U})).
\end{aligned}$$

**State V.**

$$\begin{aligned}
V_t(\textcircled{\mathbb{N}}) &= u(\textcircled{\mathbb{N}}) \\
&+ \frac{1}{6}\beta V_{t+1}(\textcircled{\mathbb{N}}) \times \text{AND}(V_{t+1}(\textcircled{\mathbb{N}}) \leq V_{t+1}(\textcircled{\mathbb{N}})) \\
&+ \frac{1}{6}\beta V_{t+1}(\textcircled{\mathbb{N}}) \times \text{OR}(V_{t+1}(\textcircled{\mathbb{N}}) > V_{t+1}(\textcircled{\mathbb{N}})) \\
&+ \frac{1}{6}\beta V_{t+1}(\textcircled{\mathbb{N}}) \times \text{AND}(V_{t+1}(\textcircled{\square}) \leq V_{t+1}(\textcircled{\mathbb{N}})) \\
&+ \frac{1}{6}\beta V_{t+1}(\textcircled{\square}) \times \text{OR}(V_{t+1}(\textcircled{\square}) > V_{t+1}(\textcircled{\mathbb{N}})) \\
&+ \frac{4}{6}\beta V_{t+1}(\textcircled{\mathbb{N}}) \times \text{AND}(V_{t+1}(\textcircled{\mathbb{N}}) \leq V_{t+1}(\textcircled{\mathbb{N}}), V_{t+1}(\textcircled{\mathbb{N}}) \leq V_{t+1}(\textcircled{\mathbb{N}})) \\
&+ \left( \frac{2}{6}\beta V_{t+1}(\textcircled{\mathbb{N}}) + \frac{2}{6}\beta V_{t+1}(\textcircled{\mathbb{N}}) \right) \\
&\quad \times \text{OR}(V_{t+1}(\textcircled{\mathbb{N}}) > V_{t+1}(\textcircled{\mathbb{N}}), V_{t+1}(\textcircled{\mathbb{N}}) > V_{t+1}(\textcircled{\mathbb{N}})).
\end{aligned}$$

$$\begin{aligned}
V_t(\mathbb{V}) &= u(\mathbb{V}) \\
&+ \frac{1}{6}\beta V_{t+1}(\mathbb{W}) \times \text{AND}(V_{t+1}(\mathbb{U}) \leq V_{t+1}(\mathbb{W})) \\
&+ \frac{1}{6}\beta V_{t+1}(\mathbb{V}) \times \text{OR}(V_{t+1}(\mathbb{U}) > V_{t+1}(\mathbb{W})) \\
&+ \frac{1}{6}\beta V_{t+1}(\mathbb{V}) \times \text{AND}(V_{t+1}(\mathbb{Q}) \leq V_{t+1}(\mathbb{V})) \\
&+ \frac{1}{6}\beta V_{t+1}(\mathbb{Q}) \times \text{OR}(V_{t+1}(\mathbb{Q}) > V_{t+1}(\mathbb{V})) \\
&+ \frac{4}{6}\beta V_{t+1}(\mathbb{V}) \times \text{AND}(V_{t+1}(\mathbb{R}) \leq V_{t+1}(\mathbb{V}), V_{t+1}(\mathbb{T}) \leq V_{t+1}(\mathbb{U})) \\
&+ \left( \frac{2}{6}\beta V_{t+1}(\mathbb{S}) + \frac{2}{6}\beta V_{t+1}(\mathbb{R}) \right) \times \text{OR}(V_{t+1}(\mathbb{R}) > V_{t+1}(\mathbb{V}), V_{t+1}(\mathbb{T}) > V_{t+1}(\mathbb{U})).
\end{aligned}$$

**State W.**

$$\begin{aligned}
V_t(\text{W}) &= u(\text{W}) \\
&+ \beta V_{t+1}(\text{W}) \times \text{AND}(V_{t+1}(\text{U}) \leq V_{t+1}(\text{W})) \\
&+ \left( \frac{3}{6} \beta V_{t+1}(\text{U}) + \frac{3}{6} \beta V_{t+1}(\text{V}) \right) \times \text{OR}(V_{t+1}(\text{U}) > V_{t+1}(\text{W})).
\end{aligned}$$

$$\begin{aligned}
V_t(\text{W}) &= u(\text{W}) \\
&+ \beta V_{t+1}(\text{W}) \times \text{AND}(V_{t+1}(\text{U}) \leq V_{t+1}(\text{W})) \\
&+ \left( \frac{3}{6} \beta V_{t+1}(\text{U}) + \frac{3}{6} \beta V_{t+1}(\text{V}) \right) \times \text{OR}(V_{t+1}(\text{U}) > V_{t+1}(\text{W})).
\end{aligned}$$

## A.2 Calculating probabilities

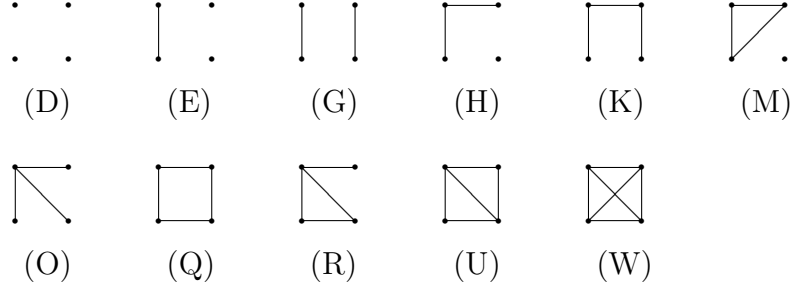


Figure 6: Networks (relabelled).

**Network D (0).**

$$\pi_{t+1}(\begin{smallmatrix} \cdot & \cdot \\ \cdot & \cdot \end{smallmatrix}) = \left( \pi_t(\begin{smallmatrix} \cdot & \cdot \\ \cdot & \cdot \end{smallmatrix}) + \frac{1}{6}\pi_t(\begin{smallmatrix} \cdot & \cdot \\ \cdot & \cdot \end{smallmatrix}) \right) \times \text{OR} \left( V_{t+1}(\begin{smallmatrix} \cdot & \cdot \\ \odot & \cdot \end{smallmatrix}) > V_{t+1}(\begin{smallmatrix} \cdot & \cdot \\ \cdot & \odot \end{smallmatrix}) \right).$$

$$\pi_{t+1}(\text{D}) = \left( \pi_t(\text{D}) + \frac{1}{6}\pi_t(\text{E}) \right) \times \text{OR} (V_{t+1}(\text{D}) > V_{t+1}(\text{E})).$$

**Network E (1).**

$$\begin{aligned} \pi_{t+1}(\begin{smallmatrix} \uparrow & \cdot \\ \cdot & \cdot \end{smallmatrix}) &= \left( \frac{2}{6}\pi_t(\begin{smallmatrix} \uparrow & \uparrow \\ \cdot & \cdot \end{smallmatrix}) + \frac{1}{6}\pi_t(\begin{smallmatrix} \uparrow & \cdot \\ \cdot & \cdot \end{smallmatrix}) \right) \times \text{OR} \left( V_{t+1}(\begin{smallmatrix} \uparrow & \cdot \\ \cdot & \odot \end{smallmatrix}) > V_{t+1}(\begin{smallmatrix} \uparrow & \uparrow \\ \cdot & \odot \end{smallmatrix}) \right) \\ &+ \left( \frac{2}{6}\pi_t(\begin{smallmatrix} \uparrow & \cdot \\ \cdot & \cdot \end{smallmatrix}) + \frac{4}{6}\pi_t(\begin{smallmatrix} \uparrow & \cdot \\ \cdot & \cdot \end{smallmatrix}) \right) \\ &\quad \times \text{OR} \left( V_{t+1}(\begin{smallmatrix} \odot & \cdot \\ \uparrow & \cdot \end{smallmatrix}) > V_{t+1}(\begin{smallmatrix} \odot & \cdot \\ \cdot & \cdot \end{smallmatrix}), V_{t+1}(\begin{smallmatrix} \uparrow & \odot \\ \cdot & \cdot \end{smallmatrix}) > V_{t+1}(\begin{smallmatrix} \uparrow & \cdot \\ \cdot & \cdot \end{smallmatrix}) \right) \\ &+ \left( \pi_t(\begin{smallmatrix} \cdot & \cdot \\ \cdot & \cdot \end{smallmatrix}) + \frac{1}{6}\pi_t(\begin{smallmatrix} \uparrow & \cdot \\ \cdot & \cdot \end{smallmatrix}) \right) \times \text{AND} \left( V_{t+1}(\begin{smallmatrix} \cdot & \cdot \\ \odot & \cdot \end{smallmatrix}) \leq V_{t+1}(\begin{smallmatrix} \uparrow & \cdot \\ \cdot & \cdot \end{smallmatrix}) \right). \end{aligned}$$

$$\begin{aligned} \pi_{t+1}(\text{E}) &= \left( \frac{2}{6}\pi_t(\text{G}) + \frac{1}{6}\pi_t(\text{E}) \right) \times \text{OR} (V_{t+1}(\text{F}) > V_{t+1}(\text{G})) \\ &+ \left( \frac{2}{6}\pi_t(\text{H}) + \frac{4}{6}\pi_t(\text{E}) \right) \times \text{OR} (V_{t+1}(\text{E}) > V_{t+1}(\text{I}), V_{t+1}(\text{F}) > V_{t+1}(\text{H})) \\ &+ \left( \pi_t(\text{D}) + \frac{1}{6}\pi_t(\text{E}) \right) \times \text{AND} (V_{t+1}(\text{D}) \leq V_{t+1}(\text{E})). \end{aligned}$$

**Network G (2a).**

$$\begin{aligned}\pi_{t+1}(\downarrow \downarrow) &= \left( \frac{1}{6}\pi_t(\uparrow \downarrow) + \frac{4}{6}\pi_t(\downarrow \downarrow) \right) \times \text{OR} \left( V_{t+1}(\uparrow \downarrow) > V_{t+1}(\uparrow \uparrow) \right) \\ &\quad + \left( \frac{1}{6}\pi_t(\cdot \downarrow) + \frac{2}{6}\pi_t(\downarrow \downarrow) \right) \times \text{AND} \left( V_{t+1}(\cdot \downarrow) \leq V_{t+1}(\downarrow \downarrow) \right).\end{aligned}$$

$$\begin{aligned}\pi_{t+1}(\text{G}) &= \left( \frac{1}{6}\pi_t(\text{K}) + \frac{4}{6}\pi_t(\text{G}) \right) \times \text{OR} \left( V_{t+1}(\text{G}) > V_{t+1}(\text{L}) \right) \\ &\quad + \left( \frac{1}{6}\pi_t(\text{E}) + \frac{2}{6}\pi_t(\text{G}) \right) \times \text{AND} \left( V_{t+1}(\text{F}) \leq V_{t+1}(\text{G}) \right).\end{aligned}$$

**Network H (2b).**

$$\begin{aligned}\pi_{t+1}(\uparrow \cdot) &= \left( \frac{2}{6}\pi_t(\uparrow \uparrow) + \frac{2}{6}\pi_t(\uparrow \cdot) \right) \\ &\quad \times \text{OR} \left( V_{t+1}(\uparrow \cdot) > V_{t+1}(\uparrow \downarrow), V_{t+1}(\uparrow \cdot) > V_{t+1}(\uparrow \downarrow) \right) \\ &\quad + \left( \frac{3}{6}\pi_t(\uparrow \cdot) + \frac{1}{6}\pi_t(\uparrow \cdot) \right) \times \text{OR} \left( V_{t+1}(\uparrow \cdot) > V_{t+1}(\uparrow \cdot) \right) \\ &\quad + \left( \frac{3}{6}\pi_t(\uparrow \cdot) + \frac{1}{6}\pi_t(\uparrow \cdot) \right) \\ &\quad \times \text{OR} \left( V_{t+1}(\uparrow \cdot) > V_{t+1}(\uparrow \cdot), V_{t+1}(\uparrow \cdot) > V_{t+1}(\uparrow \cdot) \right) \\ &\quad + \left( \frac{4}{6}\pi_t(\uparrow \cdot) + \frac{2}{6}\pi_t(\uparrow \cdot) \right) \\ &\quad \times \text{AND} \left( V_{t+1}(\uparrow \cdot) \leq V_{t+1}(\uparrow \cdot), V_{t+1}(\uparrow \cdot) \leq V_{t+1}(\uparrow \cdot) \right).\end{aligned}$$

$$\begin{aligned}\pi_{t+1}(\text{H}) &= \left( \frac{2}{6}\pi_t(\text{K}) + \frac{2}{6}\pi_t(\text{H}) \right) \times \text{OR} \left( V_{t+1}(\text{H}) > V_{t+1}(\text{L}), V_{t+1}(\text{J}) > V_{t+1}(\text{K}) \right) \\ &\quad + \left( \frac{3}{6}\pi_t(\text{M}) + \frac{1}{6}\pi_t(\text{H}) \right) \times \text{OR} \left( V_{t+1}(\text{H}) > V_{t+1}(\text{M}) \right) \\ &\quad + \left( \frac{3}{6}\pi_t(\text{O}) + \frac{1}{6}\pi_t(\text{H}) \right) \times \text{OR} \left( V_{t+1}(\text{I}) > V_{t+1}(\text{P}), V_{t+1}(\text{J}) > V_{t+1}(\text{O}) \right) \\ &\quad + \left( \frac{4}{6}\pi_t(\text{E}) + \frac{2}{6}\pi_t(\text{H}) \right) \times \text{AND} \left( V_{t+1}(\text{F}) \leq V_{t+1}(\text{H}), V_{t+1}(\text{E}) \leq V_{t+1}(\text{I}) \right).\end{aligned}$$

**Network K (3a).**

$$\begin{aligned}
\pi_{t+1}(\Gamma) &= \left( \frac{4}{6}\pi_t(\square) + \frac{1}{6}\pi_t(\Gamma) \right) \times \text{OR} \left( V_{t+1}(\downarrow\Gamma) > V_{t+1}(\downarrow\square) \right) \\
&\quad + \left( \frac{2}{6}\pi_t(\nearrow) + \frac{2}{6}\pi_t(\Gamma) \right) \\
&\quad \times \text{OR} \left( V_{t+1}(\downarrow\Gamma) > V_{t+1}(\downarrow\nearrow), V_{t+1}(\uparrow\circ) > V_{t+1}(\uparrow\nearrow) \right) \\
&\quad + \left( \frac{2}{6}\pi_t(\overleftarrow{\Gamma}) + \frac{2}{6}\pi_t(\Gamma) \right) \\
&\quad \times \text{AND} \left( V_{t+1}(\downarrow\circ) \leq V_{t+1}(\downarrow\Gamma), V_{t+1}(\uparrow\circ) \leq V_{t+1}(\uparrow\Gamma) \right) \\
&\quad + \left( \frac{1}{6}\pi_t(\uparrow\downarrow) + \frac{1}{6}\pi_t(\Gamma) \right) \times \text{AND} \left( V_{t+1}(\uparrow\downarrow) \leq V_{t+1}(\uparrow\Gamma) \right).
\end{aligned}$$

$$\begin{aligned}
\pi_{t+1}(\text{K}) &= \left( \frac{4}{6}\pi_t(\text{Q}) + \frac{1}{6}\pi_t(\text{K}) \right) \times \text{OR} \left( V_{t+1}(\text{K}) > V_{t+1}(\text{Q}) \right) \\
&\quad + \left( \frac{2}{6}\pi_t(\text{R}) + \frac{2}{6}\pi_t(\text{K}) \right) \times \text{OR} \left( V_{t+1}(\text{K}) > V_{t+1}(\text{R}), V_{t+1}(\text{L}) > V_{t+1}(\text{S}) \right) \\
&\quad + \left( \frac{2}{6}\pi_t(\text{H}) + \frac{2}{6}\pi_t(\text{K}) \right) \times \text{AND} \left( V_{t+1}(\text{J}) \leq V_{t+1}(\text{K}), V_{t+1}(\text{H}) \leq V_{t+1}(\text{L}) \right) \\
&\quad + \left( \frac{4}{6}\pi_t(\text{G}) + \frac{1}{6}\pi_t(\text{K}) \right) \times \text{AND} \left( V_{t+1}(\text{G}) \leq V_{t+1}(\text{L}) \right).
\end{aligned}$$

**Network M (3b).**

$$\begin{aligned}
\pi_{t+1}(\searrow) &= \left( \frac{1}{6}\pi_t(\searrow) + \frac{3}{6}\pi_t(\searrow) \right) \\
&\quad \times \text{OR} \left( V_{t+1}(\downarrow\searrow) > V_{t+1}(\downarrow\searrow), V_{t+1}(\uparrow\circ) > V_{t+1}(\uparrow\searrow) \right) \\
&\quad + \left( \frac{1}{6}\pi_t(\overleftarrow{\searrow}) + \frac{3}{6}\pi_t(\searrow) \right) \times \text{AND} \left( V_{t+1}(\downarrow\circ) \leq V_{t+1}(\downarrow\searrow) \right).
\end{aligned}$$

$$\begin{aligned}
\pi_{t+1}(\text{M}) &= \left( \frac{1}{6}\pi_t(\text{R}) + \frac{3}{6}\pi_t(\text{M}) \right) \times \text{OR} \left( V_{t+1}(\text{M}) > V_{t+1}(\text{S}), V_{t+1}(\text{N}) > V_{t+1}(\text{T}) \right) \\
&\quad + \left( \frac{1}{6}\pi_t(\text{H}) + \frac{3}{6}\pi_t(\text{M}) \right) \times \text{AND} \left( V_{t+1}(\text{H}) \leq V_{t+1}(\text{M}) \right).
\end{aligned}$$

**Network O (3c).**

$$\begin{aligned}\pi_{t+1}(\mathbb{N}) &= \left( \frac{1}{6}\pi_t(\mathbb{N}) + \frac{3}{6}\pi_t(\mathbb{N}) \right) \times \text{OR} \left( V_{t+1}(\mathbb{N}) > V_{t+1}(\mathbb{N}) \right) \\ &\quad + \left( \frac{1}{6}\pi_t(\mathbb{N}) + \frac{3}{6}\pi_t(\mathbb{N}) \right) \\ &\quad \times \text{AND} \left( V_{t+1}(\mathbb{N}) \leq V_{t+1}(\mathbb{N}), V_{t+1}(\mathbb{N}) \leq V_{t+1}(\mathbb{N}) \right).\end{aligned}$$

$$\begin{aligned}\pi_{t+1}(\text{O}) &= \left( \frac{1}{6}\pi_t(\text{R}) + \frac{3}{6}\pi_t(\text{O}) \right) \times \text{OR} \left( V_{t+1}(\text{O}) > V_{t+1}(\text{R}) \right) \\ &\quad + \left( \frac{1}{6}\pi_t(\text{H}) + \frac{3}{6}\pi_t(\text{O}) \right) \times \text{AND} \left( V_{t+1}(\text{J}) \leq V_{t+1}(\text{O}), V_{t+1}(\text{I}) \leq V_{t+1}(\text{P}) \right).\end{aligned}$$

**Network Q (4a).**

$$\begin{aligned}\pi_{t+1}(\mathbb{Q}) &= \left( \frac{1}{6}\pi_t(\mathbb{Q}) + \frac{2}{6}\pi_t(\mathbb{Q}) \right) \times \text{OR} \left( V_{t+1}(\mathbb{Q}) > V_{t+1}(\mathbb{Q}) \right) \\ &\quad + \left( \frac{1}{6}\pi_t(\mathbb{Q}) + \frac{4}{6}\pi_t(\mathbb{Q}) \right) \times \text{AND} \left( V_{t+1}(\mathbb{Q}) \leq V_{t+1}(\mathbb{Q}) \right).\end{aligned}$$

$$\begin{aligned}\pi_{t+1}(\text{Q}) &= \left( \frac{1}{6}\pi_t(\text{U}) + \frac{2}{6}\pi_t(\text{Q}) \right) \times \text{OR} \left( V_{t+1}(\text{Q}) > V_{t+1}(\text{V}) \right) \\ &\quad + \left( \frac{1}{6}\pi_t(\text{K}) + \frac{4}{6}\pi_t(\text{Q}) \right) \times \text{AND} \left( V_{t+1}(\text{K}) \leq V_{t+1}(\text{Q}) \right).\end{aligned}$$



**Network R (4b).**

$$\begin{aligned}
\pi_{t+1}(\mathbb{N}) &= \left( \frac{4}{6}\pi_t(\mathbb{N}) + \frac{2}{6}\pi_t(\mathbb{N}) \right) \\
&\quad \times \text{OR} \left( V_{t+1}(\mathbb{N}) > V_{t+1}(\mathbb{N}), V_{t+1}(\mathbb{N}) > V_{t+1}(\mathbb{N}) \right) \\
&+ \left( \frac{3}{6}\pi_t(\mathbb{N}) + \frac{1}{6}\pi_t(\mathbb{N}) \right) \times \text{AND} \left( V_{t+1}(\mathbb{N}) \leq V_{t+1}(\mathbb{N}) \right) \\
&+ \left( \frac{2}{6}\pi_t(\mathbb{N}) + \frac{2}{6}\pi_t(\mathbb{N}) \right) \\
&\quad \times \text{AND} \left( V_{t+1}(\mathbb{N}) \leq V_{t+1}(\mathbb{N}), V_{t+1}(\mathbb{N}) \leq V_{t+1}(\mathbb{N}) \right) \\
&+ \left( \frac{3}{6}\pi_t(\mathbb{N}) + \frac{1}{6}\pi_t(\mathbb{N}) \right) \\
&\quad \times \text{AND} \left( V_{t+1}(\mathbb{N}) \leq V_{t+1}(\mathbb{N}), V_{t+1}(\mathbb{N}) \leq V_{t+1}(\mathbb{N}) \right).
\end{aligned}$$

$$\begin{aligned}
\pi_{t+1}(\mathbb{R}) &= \left( \frac{4}{6}\pi_t(\mathbb{U}) + \frac{2}{6}\pi_t(\mathbb{R}) \right) \times \text{OR} \left( V_{t+1}(\mathbb{R}) > V_{t+1}(\mathbb{V}), V_{t+1}(\mathbb{T}) > V_{t+1}(\mathbb{U}) \right) \\
&+ \left( \frac{3}{6}\pi_t(\mathbb{O}) + \frac{1}{6}\pi_t(\mathbb{R}) \right) \times \text{AND} \left( V_{t+1}(\mathbb{O}) \leq V_{t+1}(\mathbb{R}) \right) \\
&+ \left( \frac{2}{6}\pi_t(\mathbb{K}) + \frac{2}{6}\pi_t(\mathbb{R}) \right) \times \text{AND} \left( V_{t+1}(\mathbb{K}) \leq V_{t+1}(\mathbb{R}), V_{t+1}(\mathbb{L}) \leq V_{t+1}(\mathbb{S}) \right) \\
&+ \left( \frac{3}{6}\pi_t(\mathbb{M}) + \frac{1}{6}\pi_t(\mathbb{R}) \right) \times \text{AND} \left( V_{t+1}(\mathbb{M}) \leq V_{t+1}(\mathbb{S}), V_{t+1}(\mathbb{N}) \leq V_{t+1}(\mathbb{T}) \right).
\end{aligned}$$

**Network U (5).**

$$\begin{aligned}
\pi_{t+1}(\mathbb{N}) &= \left( \pi_t(\mathbb{N}) + \frac{1}{6}\pi_t(\mathbb{N}) \right) \times \text{OR} \left( V_{t+1}(\mathbb{N}) > V_{t+1}(\mathbb{N}) \right) \\
&+ \left( \frac{2}{6}\pi_t(\mathbb{N}) + \frac{1}{6}\pi_t(\mathbb{N}) \right) \times \text{AND} \left( V_{t+1}(\mathbb{N}) \leq V_{t+1}(\mathbb{N}) \right) \\
&+ \left( \frac{2}{6}\pi_t(\mathbb{N}) + \frac{4}{6}\pi_t(\mathbb{N}) \right) \\
&\quad \times \text{AND} \left( V_{t+1}(\mathbb{N}) \leq V_{t+1}(\mathbb{N}), V_{t+1}(\mathbb{N}) \leq V_{t+1}(\mathbb{N}) \right).
\end{aligned}$$

$$\begin{aligned}
\pi_{t+1}(\text{U}) &= \left( \pi_t(\text{W}) + \frac{1}{6}\pi_t(\text{U}) \right) \times \text{OR} \left( V_{t+1}(\text{U}) > V_{t+1}(\text{W}) \right) \\
&+ \left( \frac{2}{6}\pi_t(\text{Q}) + \frac{1}{6}\pi_t(\text{U}) \right) \times \text{AND} \left( V_{t+1}(\text{Q}) \leq V_{t+1}(\text{V}) \right) \\
&+ \left( \frac{2}{6}\pi_t(\text{R}) + \frac{4}{6}\pi_t(\text{U}) \right) \times \text{AND} \left( V_{t+1}(\text{R}) \leq V_{t+1}(\text{V}), V_{t+1}(\text{T}) \leq V_{t+1}(\text{U}) \right).
\end{aligned}$$

**Network W (6).**

$$\pi_{t+1}(\mathbb{N}) = \left( \frac{1}{6}\pi_t(\mathbb{N}) + \pi_t(\mathbb{N}) \right) \times \text{AND} \left( V_{t+1}(\mathbb{N}) \leq V_{t+1}(\mathbb{N}) \right).$$

$$\pi_{t+1}(\text{W}) = \left( \frac{1}{6}\pi_t(\text{U}) + \pi_t(\text{W}) \right) \times \text{AND} \left( V_{t+1}(\text{U}) \leq V_{t+1}(\text{W}) \right).$$