1(a)

$$V_{opt}(s,d) = \begin{cases} \text{Utility}(s) & \text{if IsEnd}(s) \\ \text{Eval}(s) & \text{if } d=0 \\ \max\limits_{a \in \text{Actions}(s)} V_{opt}(\text{Succ}(s,a),d) & \text{if Player}(s) = a_0 \\ \vdots & \vdots \\ \max\limits_{a \in \text{Actions}(s)} V_{opt}(\text{Succ}(s,a),d) & \text{if Player}(s) = a_{n-1} \\ \max\limits_{a \in \text{Actions}(s)} V_{opt}(\text{Succ}(s,a),d-1) & \text{if Player}(s) = a_n \end{cases}$$

3(a)

$$V_{opt,\pi}(s,d) \begin{cases} \text{Utility}(s) & \text{if IsEnd}(s) \\ \text{Eval}(s) & d=0 \\ \max\limits_{a \in \text{Actions}(s)} V_{opt,\pi}(\text{Succ}(s,a),d) & \text{Player}(s) = a_0 \\ \sum\limits_{a \in \text{Actions}(s)} \dfrac{1}{|\text{Actions}(s)|} V_{opt,\pi}(\text{Succ}(s,a),d) & \text{Player}(s) = a_1 \\ \vdots \\ \sum\limits_{a \in \text{Actions}(s)} \dfrac{1}{|\text{Actions}(s)|} V_{opt,\pi}(\text{Succ}(s,a),d) & \text{Player}(s) = a_{n-1} \\ \sum\limits_{a \in \text{Actions}(s)} \dfrac{1}{|\text{Actions}(s)|} V_{opt,\pi}(\text{Succ}(s,a),d-1) & \text{Player}(s) = a_n \end{cases}$$