1 INITIALIZATION

2 **for** $1 \leq m \leq N$

3 $\beta_T(m) = 1$, $D_T = \frac{1}{\sum_{i=1}^{N} \beta_T(i)}$, $\tilde{\beta}_T(m) = D_T\, \beta_T(m)$

4 **for** $1 \leq i, j \leq N$ where $i \in \mathcal{T}$

5 $\tilde{T}_{i,j}(T, m) = 0$

6 **for** $1 \leq i \leq N$, $1 \leq \gamma \leq D$

7 **if** $(i \in \mathcal{E})$ $\tilde{E}_m(\gamma, T, m) = \tilde{\beta}_T(i)\, \text{SCORE}(o_T, \gamma)$

8 **else** $\tilde{E}_i(\gamma, T, m) = \tilde{\beta}_T(i)\, \text{SCORE}(o_T, \gamma)$

9 RECURRENCE

10 **for** $t = T - 1, \ldots, 1$

11 **for** $1 \leq m \leq N$

12 $\bar{\beta}_t(m) = \sum_{j=1}^{N} a_{m,j}\, b_j(o_{t+1})\, \tilde{\beta}_{t+1}(j)$

13 $d_t = \frac{1}{\sum_{i=1}^{N} \bar{\beta}_t(i)}$

14 **for** $1 \leq m \leq N$

15 **for** $1 \leq i, j \leq N$ where $i \in \mathcal{T}$

16 $\bar{T}_{i,j}(t, m) = \tilde{\beta}_{t+1}(j)\, a_{m,j}\, b_j(o_{t+1})\, \delta(i = m) + \sum_{n=1}^{N} a_{m,n}\, \tilde{T}_{i,j}(t+1, n)\, b_n(o_{t+1})$

17 $\tilde{T}_{i,j}(t, m) = d_t\, \bar{T}_{i,j}(t, m)$

18 **for** $i \in \mathcal{E}$

19 **for** $1 \leq \gamma \leq D$

20 $\bar{E}_i(\gamma, t, m) = \sum_{n=1}^{N} b_n(o_{t+1})\, a_{m,n}\, \tilde{E}_i(\gamma, t+1, n) + \bar{\beta}_t(m)\, \text{SCORE}(o_t, \gamma, i)\, \delta(m = i)$

21 $\tilde{E}_i(\gamma, t, m) = d_t\, \bar{E}_i(\gamma, t, m)$

22 $\tilde{\beta}_t(m) = d_t\, \bar{\beta}_t(m)$

23 TERMINATION

24 $\tilde{E}_i^{END}(\gamma) = \sum_{m=1}^{N} \tilde{E}_i(\gamma, 1, m)\, \pi_m\, b_m(o_1)$

25 $\tilde{T}_{i,j}^{END} = \sum_{m=1}^{N} \tilde{T}_{i,j}(1, m)\, \pi_m\, b_m(o_1)$

26 **for** $1 \leq i \leq N$

27 $\alpha_1(i) = \pi_i\, b_i(o_1)$