Algorithm 1 The Buffer State Transition Matrix Algorithm

1: **Inputs:**

$n \in \{0, 1, ...\}$

l^n : `Data arrival, i.i.d`

$$\text{states} = \begin{cases} b^n \in \{0, \cdots, \mathrm{B}\} : \texttt{Buffer State} \\ h^n : \texttt{Channel State} \\ x^n \in \{\text{on}, \text{off}\} : \texttt{Power Management State} \end{cases}$$

$$\text{actions} = \begin{cases} z^n, 0 \le z^n \le b^n : \texttt{Packet Throughput} \\ \mathrm{BEP}^n : \texttt{Bit Error Probability} \\ y^n \in \{s_{\text{on}}, s_{\text{off}}\} : \texttt{Power Management Action} \\ f^n, 0 \le f^n \le z^n : \texttt{Goodput} \end{cases}$$

2: **Initialize:**

$b^0 \leftarrow b_{init}$

3: $b^n \leftarrow \min(b^n - f^n(\mathrm{BEP}^n, z^n) + l^n, \mathrm{B})$

4: $\mathrm{P}^x = \mathrm{P}^x(y) = [\mathrm{P}^x(x^{'}|x, y)]_{x,x'}$

5: $\mathrm{P}^h = \mathrm{P}^h(h^{'}|h)$

6: $\mathrm{P}^b = \mathrm{P}^b([b, h, x], \mathrm{BEP}, y, x) = \begin{cases} \sum_{f=0}^{z} \mathrm{P}^l(b^{'} - [b - f])\mathrm{P}^f(f|\mathrm{BEP}, z), & \text{if } b^{'} \le \mathrm{B} \\ \sum_{f=0}^{z} \sum_{l=\mathrm{B}-[b-f]}^{\infty} \mathrm{P}^l(l)\mathrm{P}^f(f|\mathrm{BEP}, z), & \text{if } b^{'} = \mathrm{B} \end{cases}$

7: $s \leftarrow (b, h, x)$

8: $a \leftarrow (\mathrm{BEP}, y, z)$

9: $\mathrm{P}(s^{'}|s, a) = \mathrm{P}^b \times \mathrm{P}^h \times \mathrm{P}^x$