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① a) $X = \{(loc, b, c, d, load) \mid loc \in \{R, A, B, C, D, E, F\}, b \in \{0,1\}, c \in \{0,1\}, d \in \{0,1\}, load \in \{0,1\}\}$

$A = \{(D)\text{nop garbage}, (c)\text{ollect garbage}, (MU)\text{ move up}, (MD)\text{ move down}, (ML)\text{ move left}, (MR)\text{ move right}\}$

$Z = \{(loc, g) \mid loc \in \{B, C, D\}, g \in \{0,1\}\}$

b)

$$
cost(loc, b, c, d, load, a) =
\begin{cases}
0 & \text{if } loc = R \text{ and } load = 1 \text{ and } a = D \\[4pt]
1/30 & \text{if } (loc = B \text{ and } load = 0 \text{ and } b = 1 \text{ and } a = C) \text{ or} \\
& (loc = C \text{ and } load = 0 \text{ and } c = 1 \text{ and } a = C) \text{ or} \\
& (loc = D \text{ and } load = 0 \text{ and } d = 1 \text{ and } a = C) \\[4pt]
2/30 & \text{if } (loc = E \text{ and } a = MR) \text{ or } (loc = F \text{ and } a = MD) \\[4pt]
0,1 & \text{if } (loc = R \text{ and } a = MR) \text{ or } (loc = A \text{ and } a = ML) \\[4pt]
5,5/30 & \text{if } (loc = A \text{ and } a = MD) \text{ or } (loc = C \text{ and } a = ML) \text{ or} \\
& (loc = C \text{ and } a = MR) \text{ or } (loc = E \text{ and } a = ML) \\[4pt]
4/30 & \text{if } (loc = A \text{ and } a = MR) \text{ or } (loc = B \text{ and } a = ML) \\[4pt]
7/30 & \text{if } (loc = A \text{ and } a = MU) \text{ or } (loc = D \text{ and } a = ML) \text{ or} \\
& (loc = D \text{ and } a = MR) \text{ or } (loc = F \text{ and } a = MU) \\[4pt]
8/30 & \text{if } (loc = B \text{ and } a = MR) \text{ or } (loc = F \text{ and } a = ML) \\[4pt]
\infty & \text{else}
\end{cases}
$$

state

c) The driver only observes if there is garbage or not if he is in the location itself. This means that at time step $t+1$, because the driver is at location D, there is only two possible beliefs 0 and 1. 0 if the driver makes the observation that there is no garbage and 1 if he makes the observation that there is garbage.