

$$\begin{aligned}
r_{1,2}^2 &= r_{1,2}^1 (r_{2,2}^1)^* r_{2,2}^1 + r_{1,2}^1 \\
&= 0(\epsilon + 00)^* (\epsilon + 00) + 0 \\
&= 0(00)^* \epsilon + 0(00)^* (00) + 0 \\
&= 0(00)^* + 0 \\
&= 0(00)^*
\end{aligned}$$