Evidently, ν and μ have identical marginal distributions: $\nu_{X_i} = \mu_{X_i}$, and also identical joint distributions of any consecutive pairs: $\nu_{X_i,X_{i+1}} = \mu_{X_i,X_{i+1}}$. Therefore

$$\nu_{X_i}(\{0\}) = \mu_{X_i}(\{0\}) \tag{100}$$

and

$$\nu_{X_i,X_{i+1}}(\{x_i = 0, x_{i+1} \neq 0\}) = \mu_{X_i,X_{i+1}}(\{x_i = 0, x_{i+1} \neq 0\}. \tag{101}$$

Since $\mu \in \Lambda(\gamma, q, c)$, we have $\nu \in \Lambda(\gamma, q, c)$. Let $\{X_i\}$ follow distribution μ and $\{Z_i\}$ follow distribution ν. Then

$$\begin{aligned}
I(Z_1; Z_2^\infty) &= I(Z_1; Z_2) + I(Z_1; Z_3^\infty | Z_2) && (102)\\
&= I(Z_1; Z_2) && (103)\\
&= I(X_1; X_2) && (104)\\
&\leq I(X_1; X_2^\infty) && (105)
\end{aligned}$$

where equality holds if and only if $\{X_i\}$ is a first-order Markov process. By (11) and (105), $L(\nu) \geq L(\mu)$. So for any μ which maximizes $L(\mu)$, ν can be generated from μ by (99) with $L(\nu) \geq L(\mu)$. $L(\mu)$ must be maximized by a first-order Markov process.

Property (c): Suppose ν is a stationary fist-order Markov process, sufficiently denote as $\nu = \{\mathcal{X}, P_{X_2|X_1}\}$, where $\mathcal{X}$ is the state space of ν and $P_{X_2|X_1}$ is the transition probability distribution. Define a new first-order Markov process $\bar{\nu}$ from ν as follows.

Definition 1: Let $\bar{\nu}$, defined on the same state space $\mathcal{X}$ as ν, be a first-order Markov process denoted by $(\mathcal{X}, P_{Z_2|Z_1})$, where

$$P_{Z_2|Z_1}(z_2|z_1) = \begin{cases} \alpha & z_1 = 0 \; z_2 = 0, \\ 1 - \beta & z_1 \neq 0 \; z_2 = 0, \\ \dfrac{1-\alpha}{\eta} P_X(z_2) & z_1 = 0 \; z_2 \neq 0, \\ \dfrac{\beta}{\eta} P_X(z_2) & z_1 \neq 0 \; z_2 \neq 0, \end{cases} \tag{106}$$