Q1: We first define $\Omega = \{(x,y) : a < x \leq y \leq b\}$. Using Fubini-Tonelli Theorem, we compute

$$\begin{aligned}
\mu_F \times \mu_G(\Omega) &= \int_{(a,b]} \int_{(a,y]} dF(x) dG(y) \\
&= \int_{(a,b]} [F(y) - F(a)] dG(y) \\
&= \int_{(a,b]} \mathit{\Delta} F dG(y) + \int_{(a,b]} F_{-} dG(y) - \int_{(a,b]} F(a) dG(y) \quad \text{(since } F = \mathit{\Delta}F + F_{-} \text{ and linearity)} \\
&= \sum_{x, \mathit{\Delta}F \neq 0} \int_x \mathit{\Delta} F dG(x) + \int_{(a,b]} F_{-} dG(x) - F(a)[G(b) - G(a)] \\
&\qquad \text{(}\mathit{\Delta}F \text{ nonzero on countable points)} \\
&= \sum_{x, \mathit{\Delta}F \neq 0} \mathit{\Delta}F(x) \mathit{\Delta}G(x) + \int_{(a,b]} F_{-} dG(x) - F(a)[G(b) - G(a)] \quad \text{(using the definition of } dG\text{)}
\end{aligned}$$

Similarly, we compute that

$$\begin{aligned}
\mu_F \times \mu_G(\Omega) &= \int_{(a,b]} \int_{(x,b]} dG(y) dF(x) \\
&= \int_{(a,b]} [G(b) - G(x)] dF(x) \\
&\qquad \text{(take decreasing sequence to } (x,b] \text{, apply downward measure cont.)} \\
&= \int_{(a,b]} G(b) dF(x) - \int_{(a,b]} \mathit{\Delta}G(x) dF(x) - \int_{(a,b]} G_{-}(x) dF(x) \\
&= G(b)[F(b) - F(a)] - \sum_{x, \mathit{\Delta}G(x) \neq 0} \int_x \mathit{\Delta}G(x) dF(x) - \int_{(a,b]} G_{-} dF(x) \\
&= G(b)[F(b) - F(a)] - \sum_{x, \mathit{\Delta}G(x) \neq 0} \mathit{\Delta}F(x) \mathit{\Delta}G(x) - \int_{(a,b]} G_{-} dF(x)
\end{aligned}$$

Taking the differences we get that

$$G(b)F(b) - G(a)F(a) = \int_{(a,b]} F_{-} dG + \int_{(a,b]} G_{-} dF + \sum_{a < x \leq b} \mathit{\Delta}G(x) \mathit{\Delta}F(x)$$

Since the points where either is $\mathit{\Delta}G(x)$ or $\mathit{\Delta}F(x)$ are zero will vanish in either of the equations we take the difference.