B.25 Let $x_1 < x_2$ be two neigbouring values of X and $y_1 < y_2$ be two neigbouring values of Y. Then

$$P(X = x_2, Y = y_2) = F(x_2, y_2) - F(x_2, y_1) - F(x_1, y_2) + F(x_1, y_1),$$

see Section B.9.3. Employing the independence of X and Y we obtain

$$\begin{aligned}
P(X &= x_2, Y = y_2) \\
&= F_X(x_2)F_Y(y_2) - F_X(x_2)F_Y(y_1) - F_X(x_1)F_Y(y_2) + F_X(x_1)F_Y(y_1) \\
&= F_X(x_2)\left(F_Y(y_2) - F_Y(y_1)\right) - F_X(x_1)\left(F_Y(y_2) - F_Y(y_1)\right) \\
&= \left(F_X(x_2) - F_X(x_1)\right)\left(F_Y(y_2) - F_Y(y_1)\right) \\
&= P(X = x_2)P(Y = y_2).
\end{aligned}$$