

1.10

$$\begin{aligned}
 E[x+z] &= \iint (x+z) P(x, z) dx dz \\
 &= \iint (x+z) P(x) P(z) dx dz \\
 &= \int x P(x) dx + \int z P(z) dz \\
 &= E[x] + E[z]
 \end{aligned}$$

$$\begin{aligned}
 \text{var}[x+z] &= E[(x+z) - E[x+z]]^2 \\
 &= \iint ((x+z) - E[x+z])^2 P(x, z) dx dz \\
 &= \iint ((x - E[x]) + (z - E[z]))^2 P(x) P(z) dx dz \\
 &= \iint ((x - E[x])^2 + (z - E[z])^2 + \underbrace{2(x - E[x])(z - E[z])}_{=0}) P(x) P(z) dx dz \\
 &= \int (x - E[x])^2 P(x) dx \int (z - E[z])^2 P(z) dz \\
 &= \text{var}[x] + \text{var}[z]
 \end{aligned}$$