Exercise 2.3.3

First note that

$$Z = \sum_{i=1}^{N} W_i,$$

where the W_i are i.i.d. with the same distribution as N. Hence,

$$\mathbb{E}[N] = \mathbb{E}[W_i] = \mu, \quad \mathbb{V}[N] = \mathbb{V}[W_i] = \sigma^2, \quad \forall i.$$

Applying eq. (2.30) gives

$$\mathbb{E}[Z] = \mu^2, \quad \mathbb{V}[Z] = \mu\sigma^2 + \mu^2\sigma^2.$$