1 Fluctuations in a Fermi gas

(K&K 7.11) Show for a single orbital of a fermion system that

$$\left\langle (\Delta N)^2 \right\rangle = \langle N \rangle \left(1 + \langle N \rangle\right) \tag{1}$$

if $\langle N \rangle$ is the average number of fermions in that orbital. Notice that the fluctuation vanishes for orbitals with energies far enough from the chemical potential μ so that $\langle N \rangle = 1$ or $\langle N \rangle = 0$.