Exercise 1 to section 4.8.

Show that ideal mixture defined by (4.437) is generally different from a simple mixture.

Try to answer before continuing reading.

The partial free energy of constituent α is independent of densities of other constituents in the mixture of simple fluids. This was demonstrated by equation (4.412) and its derivation:

$$g_\alpha = \hat{g}_\alpha(T, \rho_\alpha).$$

If (4.172) and (4.292) are introduced into the definition of ideal mixture we obtain:

$$g_\alpha M_\alpha = M_\alpha g_\alpha^\bullet(T, P) + RT \ln(M w_\alpha / M_\alpha).$$

Substitution from (4.187) gives

$$g_\alpha M_\alpha = M_\alpha g_\alpha^\bullet(T, P) + RT \ln[(M \rho_\alpha / \rho M_\alpha)].$$

Taking into account (4.187) we see that the resulting expression for g_α is not function $\hat{g}_\alpha(T, \rho_\alpha)$ – P_α is generally a function of ρ (and T) and ρ still remains in this expression.

Note. Some (other) demonstration was given also in Rem. 27 (p. 239).