Assignment 4

PROBLEM 1: THE DENSITY EXPANSION OF THE PY EQUATION

The Percus-Yevick equation is

$$y_{12} = 1 + \rho \int dr_3 f_{13} y_{13} h_{23},$$

where $y_{12} \equiv y(|\mathbf{r}_1 - \mathbf{r}_2|)$ and the same for the other functions. The function h is related to y by $y(r) = e^{-\beta u(r)} [h(r) + 1]$. You can use the expression for y_{12} to replace the functions y on the RHS of the equation. Repeating this procedure generates a serie expansion of y_{12} in powers of ρ (this is called a Neumann series). Only the last term in this series depends on y and for a small density you can truncate the series somewhere, which results in a closed approximate equation for y.

A)   Write down the series solution for y_{12} of the Percus-Yevick equation including the ρ^2 term and neglecting the the higher order term. Your result should be writen as integrals over f functions.

B)   Replace the f functions by the corresponding diagrams.

Because the result uses the PY-approximation you will not get all the diagrams for the order ρ^2 term that was shown in the lectures.