PHYS566: Problem Set 3

Problem 1: Show for the Lieb-Liniger model that $[H, Q] = 0$, and that $[H, P] = 0$, where $H = \int \mathrm{d}x \partial_x \Psi^\dagger(x) \partial_x \Psi(x) + c \int \mathrm{d}x \Psi^\dagger(x) \Psi^\dagger(x) \Psi(x) \Psi(x)$, $Q = \int \mathrm{d}x \Psi^\dagger(x) \Psi(x)$, and where $P = i \int \mathrm{d}x \Psi^\dagger(x) \partial_x \Psi(x)$.

Problem 2: Write a program (matlab, C++, fortran, etc.) which solves the Bethe ansatz equations either for the XXZ or the Lieb-Liniger model self-consistently. Obtain the spectral parameters and the ground state energy. (For hints and guidance see the article attached.)