Tfy-3.475 Computer Simulation Methods in Physics

Final exam 7.11.2006

1. Explain **briefly:**
   a) Wolff method
   b) Lanczos diagonalization
   c) Critical slowing down
   d) Multigrid method
   e) Variational quantum Monte Carlo
   f) Hellman-Feynman theorem

2. How to solve wave equation $\partial^2 p/\partial t^2 = c^2 \nabla^2 p$ using computer?

3. a) Derive Hartree-Fock (HF) equations for two electrons.
   c) Compare the two different spin states.
   c) Compare HF to density-functional theory.

4. A point charge is inside a tetrahedron (triangular base pyramid).
   a) How to calculate the average electric field on the tetrahedron surface by computer?
   b) How to calculate the electric flux through the surface?
   c) What are the computational difficulties in replacing tetrahedron by a general closed surface?

5. a) What is ballistic deposition (BD)?
   b) What is random deposition (RD)?
   c) What is surface roughness?
   d) Compare surface roughness of BD and RD.