Computational Quantum Physics

Spring 2021, Examiner: M. H. Fischer

1. **Summary:**
   Just had my exam:
   Numerov, short derivation, scattering problem, bound states
   Single particle time evolution (unitary, spectral, split-operator (complexity of FFT))
   larger problem: trotterization for XXZ model
   even larger: TEBD: area law, algorithm, error sources

Spring 2020, Examiner: T. Neupert, M. H. Fischer

1. **Summary:**
   Hi guys, I just had the cqp exam.
   Overall I would say the exam was quite nice. The setting is a classroom, you have a chalk board and both teachers are sitting in the back and are asking questions. Incomplete list of topics:
   Time evolution (unitary approximation)
   Split operator
   MPS
   DMRG
   TEBD
   Multiplying two spins to get a 4x4 Hamiltonian
   Spin Monte Carlo and cluster updates
   The exam was over before I knew it.
   About reaching the location: I took the tram to the "Universität Irchel" Stop, From there it's about 7 minutes walking to the building. Go immediately left and down when entering the campus, the building should be indicated with a sign (YI 1), then it's up one stair to the correct floor.

2. **Summary:**
   They asked me (about) the following topics/things:
   Can you write down the Heisenberg Hamiltonian for two spins?
   Can you write it in a matrix form?
   What does it mean for the matrix to be block diagonal?
   What would you do in case we have a spin chain of like 20, 30, 40 spins? (-> Lanczos)
   Can you explain what Lanczos algorithm does and how it works?
   If we consider even larger systems with 40+ spins, what would be the next preferred method to find the ground state?
   Can you explain how to construct an MPS?
   I was very surprised that in my exam these were the only topics covered (no DMRG, TEBD, (Q)MC, DFT, etc.), but I feel this differs a lot between the exams.
   Especially Titus is very encouraging during the exam by the way, which I found very nice ;).