Summary of course

Main topics

- Discretization + errors (truncation and round-off, loss of precision!)
- Num. differentiation
- Linear algebra
  - Solve eq. $A\bar{x} = \bar{b}$ [• Gauss elim • LU decomp • Iterative] — special focus on tridiag. matrices
  - Solve eigenval/eigenvec probs: $A\bar{x} = \lambda\bar{x}$
  - Matrix operations (diagonalization, LU decomp, ...)
- Ordinary differential eqs (ODEs)
  - Boundary value problems → Solve matrix eqs (Proj 1); → Solve eigenvals prob (Proj 2)
  - Initial value problems →
    - Euler's forward method
    - Euler-Cromer
    - verlet
    - Leapfrog
    - Predictor-Corrector
    - RK 4 → Proj 3
- Probability, random numbers, Monte Carlo methods
  - Meaning
  - pdfs
  - Random numbers
  - Sampling from pdfs → Markov Chain Monte Carlo → Proj. 4 (Ising model)
- Numerical integration
  - Deterministic algos for low dim. problems
  - MC integration for high dim. problems.
- Partial differential eqs. (PDEs)
  - Explicit (F.D.)
  - Implicit (B.D. and Crank-Nicolson) → Proj 5 (Simulate double-slit)

- Writing proper reports in TeX
- Basic git
- Basic C++
- Parallelization w/ OpenMP

} Potentially four points on your CV!

- C++
  - Compilation and linking
  - Program structure
  - Classes
  - Using external libraries (here: Armadillo)

Things I would have liked to cover

- Eigenvalue problems: Householder's method for tridiagonalization, QR algorithm for finding eigenvalues

- C++:
  - Pointers (incl. function pointers!)
  - Dynamic memory allocation
  - Polymorphism / inheritance
  - Parallelization w/ MPI

- More git

- Numerical optimization

- A useful library: The GNU Scientific Library (GSL)