

Physics 2200, Computational Physics

Fall Semester 2011

Academic Calendar and Homework Assignments

Week	Lecture No.	Date	Chapter/Exam	Homework
1	–	Mon, Aug 29	<i>in the aftermath of hurricane Irene classes are canceled</i>	
	1	Wed, Aug 31	Introduction to computational physics; course logistics; Correct programs – wrong results I: calculate π by evaluating the perimeter of a regular polygon.	
	2	Fri, Sep 2	Numerical integration; rectangle, trapezoid, Simpson's rules; Newton-Cotes formulas	
2	–	Mon, Sep 5	<i>Labor Day - No classes</i>	
	3	Wed, Sep 7	Programming languages; The choice of C as the programming language for the course; Adaptive integration.	HW1
	4	Fri, Sep 9	Correct programs – wrong results II: use recurrence to compute a family of integrals.	
3	5	Mon, Sep 12	Boundary value problem for ODE; Correct programs – wrong results III: Euler method; Kahan summation algorithm.	
	6	Wed, Sep 14	Computer representation of floating-point numbers. Machine ϵ .	
	–	Fri, Sep 16	No class – to be rescheduled. (Rescheduled for Oct 3)	
4	7	Mon, Sep 19	Analysis of "Correct programs – wrong results II: use recurrence to compute a family of integrals."	HW2
	8	Wed, Sep 21	Analysis of "Correct programs – wrong results I: calculate π by evaluating the perimeter of a regular polygon."	
	9	Fri, Sep 23	Analysis of "Correct programs – wrong results III: Euler method" and Kahan summation algorithm.	

5	–	Mon, Sep 26	No class – to be rescheduled (Rescheduled for Oct 31)	
	–	Wed, Sep 28	No class – to be rescheduled	
	10	Fri, Sep 30	Fibonacci numbers; recurrence relations vs. analytical solution.	
6	11	Mon, Oct 3	Midterm I take-home; Monte Carlo method I; calculate π using MC method; evaluation of integrals using MC method.	HW3
	12	Wed, Oct 5	Monte Carlo method II; evaluation of multi-dimensional integrals using MC method.	
	13	Fri, Oct 7	Random number generators (RNG): requirements; empirical tests; linear congruential generators.	
7	14	Mon, Oct 10	Lagged Fibonacci RNGs. Introduction to GNU scientific library (GSL).	HW4
	15	Wed, Oct 12	Generation of non-uniform random numbers.	
	16	Fri, Oct 14	Programming with GSL. Example: volume of n-dimensional sphere using Monte Carlo integration.	
8	17	Mon, Oct 17	Solving ODE with GSL: van der Pol oscillator.	HW5
	18	Wed, Oct 19	Solving ODE with GSL: 1D flame propagation. Stiff differential equations.	
	19	Fri, Oct 21	Restricted three body problem; “Planet Dancing With a Pair of Stars”.	
9	20	Mon, Oct 24	Restricted three body problem II.	
	21	Wed, Oct 26	Underwater sound propagation and geometric acoustics; SOFAR channel.	
	22	Fri, Oct 28	Boundary value problem for ODE. Shooting method.	
10	23	Mon, Oct 31	Midterm II take-home. 1D root-finding; bisection; Newton method.	

	24	Wed, Nov 2	1D minimization.
	25	Fri, Nov 4	Spinodal decomposition
11	26	Mon, Nov 7	Spinodal decomposition II: Cahn-Hilliard equation. HW6
	27	Wed, Nov 9	Numerical solution of partial differential equations (PDEs).
	28	Fri, Nov 11	Fast Fourier Transform (FFT); Using FFT for PDEs solution; Explicit and Implicit discretization.
12	29	Mon, Nov 14	Numerical solution of Schrodinger equation I: Numerov algorithm.
	30	Wed, Nov 16	Numerical solution of Schrodinger equation II. HW7
	31	Fri, Nov 18	Converting differential equations to dimensionless form.
13		Mon, Nov 21	<i>Thanksgiving recess</i>
		Wed, Nov 23	<i>Thanksgiving recess</i>
		Fri, Nov 25	<i>Thanksgiving recess</i>
14	32	Mon, Nov 28	Numerical solution of Schrodinger equation III.
	33	Wed, Nov 30	Algebraic eigenvalue problem. LAPACK – Linear Algebra PACKage. Mixed language programming.
	34	Fri, Dec 2	Generalized eigenvalue problem
15	35	Mon, Dec 4	Parallel programming; MPI
	36	Wed, Dec 7	Parallel programming; OpenMP
	37	Fri, Dec 9	GPU programming; CUDA
16		Mon, Dec 12	FINAL EXAM