PHY308/607: Science and Computers II

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Introduction

The goal of this course is to introduce students to computing as it is used in the physics research environment. During this course students should:

1. develop an adequate working knowledge of the UNIX operating system,
2. learn the C programming language,
3. present results graphically using the graph plotting package `gnuplot`,
4. become familiar with use of the GNU Scientific Library,
5. gain experience writing scientific reports.

You will use these skills to model physical systems on a computer and use numerical analysis to solve physical problems.

Recommended textbooks

Numerical Recipes, William H. Press, Saul A. Teukolsky, William T. Vetterling and Brian P. Flannery. This is the essential book for understanding numerical algorithms. It covers far more material than we have time for in this course. Although this is a valuable text and you will not regret the purchase if you continue in scientific computing, it is not strictly necessary.

We will mainly be following material on handouts given out in class, though you may find the resources below helpful.

The C Programming Language, Brian W. Kernighan and Dennis M. Ritchie (Prentice Hall). Presents a complete guide to C language programming written by the developers of C. Covers all aspects of the language and the C standard library. This is available from the University bookstore.

UNIX in 24 hours, Dave Taylor (Sams Publishing). If you prefer to get a textbook, rather than use an online tutorial, this is a very good introduction to the UNIX operating system. The book covers all the basics that you will need in this course.

GNU Scientific Library Reference Manual. Introduces the GNU Scientific Library, describes the library functions and contains example code. It is available from `http://www.gnu.org/software/gsl/manual/html_node/`

Class Schedule

The computing cluster in Room 115, Physics Building is reserved from 5:00pm–6:20pm on Tuesdays and Thursdays for this class. A large portion of this class involves independent study, during which time you will be writing your programs and reports. For the most part, classes will take the form of supervised lab sessions. If you would like additional help outside the supervised hours, please email me to set up an appointment.

Tuesday January 16	**Introduction to Project 1**
Thursday January 18	Supervised practical session
Tuesday January 23	Supervised practical session
Thursday January 25	Supervised practical session
Tuesday January 30	Supervised practical session
Thursday February 1	Supervised practical session
Tuesday February 6	Supervised practical session
Thursday February 8	Supervised practical session
Friday February 9	**Project 1 deadline**
Tuesday February 13	Supervised practical session
Thursday February 15	Supervised practical session
Tuesday February 20	Supervised practical session
Thursday February 22	Supervised practical session
Tuesday February 27	Supervised practical session
Thursday March 1	Supervised practical session
Tuesday March 6	Supervised practical session
Thursday March 8	Supervised practical session
Tuesday March 13	Spring Break
Thursday March 15	Spring Break
Tuesday March 20	Supervised practical session
Thursday March 22	Supervised practical session
Friday March 23	**Project 2 deadline**
Tuesday March 27	Supervised practical session
Thursday March 29	Supervised practical session
Tuesday April 3	Supervised practical session
Thursday April 5	Supervised practical session
Tuesday April 10	Supervised practical session
Thursday April 12	Supervised practical session
Tuesday April 17	Supervised practical session
Thursday April 19	Supervised practical session
Tuesday April 24	Supervised practical session
Thursday April 26	Supervised practical session
Tuesday May 1	Supervised practical session
Friday May 4	**Project 3 deadline**

Assessment

This course consists of supervised practical sessions and independent study. Your grade will be based on projects and exercises that you complete during the class (there are no exams). During the course you will be asked to complete three projects, each of which will count 30% towards your grade. You will also be asked to complete a set of exercises leading up to the projects. Note the due dates of the exercises. As you complete these you should show them to me (or the TA) to check them off before the due dates. The total set of checked off exercises will count 10% towards your grade. You are expected to write up a report describing each project and submit it (with any additional material requested) by the following deadlines:

- First Report: **4pm Friday February 9, 2018**
- Second Report: **4pm Friday March 23, 2018**
- Third Report: **4pm Friday May 4, 2018**

The deadlines are for your benefit to ensure an even workload throughout the semester. Reports should be submitted to my mailbox in Room 201, Physics Building or emailed to me. *Deadlines will be strictly enforced.* Work submitted after the deadline will receive a penalty of 5% for each day late. Note that work cannot be

submitted during the weekend, so you will receive a 15% penalty if you submit your report on the Monday following the deadline.

Grading

Reports will be graded out of 10 on the following scale:

10. Excellent report: all project material correctly completed with a thorough, well-written report. (You should not expect to receive a 10 unless your report is exceptional. You can get an A in the class with three nines.)

9. Very good report: all project material correctly completed. Some minor issues with the presentation of the report.

8. Good report: the majority of the project material has been completed correctly with minor issues with the results or presentation of the report.

7. Sound report: most of the project material has been correctly completed, however there may be several problems with the results or presentation of the report.

6. Poor report: the project material has been completed with significant gaps or there are substantial problems with the results or presentation of the report.

0–5. Substandard report: serious problems with the completion of project material or presentation.

Each exercise will be graded complete or incomplete. Your exercise grade will be the percentage of completed exercises throughout the semester.

Grades will be assigned based on your overall score for the three projects and the exercises as follows: $\geq 90\%$ A; $\geq 85\%$ A-; $\geq 80\%$ B+; $\geq 75\%$ B; $\geq 70\%$ B-; $\geq 65\%$ C+; $\geq 60\%$ C; $\geq 55\%$ C-; $\geq 50\%$ D; $< 50\%$ F. Raw scores will be used to compute grades; no curve will be applied to the class.

Preparation of your report

Credit will be given for the quality of your reports. Your report should be clearly structured, read in a coherent manner, and be grammatically correct. Project reports must be word-processed, although you may write equations in by hand, if you prefer. You should take care to label any figures and any computer printouts. Pages should be numbered. The best document preparation system for scientific reports is LaTeX, although you may use any word-processing software that you are familiar with.

Do not devote too much time to the computing at the expense of writing the report and performing whatever analysis is required. Your report should contain:

- details of what you have done,
- any special consideration you have given to solving a problem or producing code
- the answers to any questions posed in the project handouts
- enough data to support your conclusions,
- a detailed description of how you convinced yourself that the program was functioning correctly (e.g. hand checks, comparison with analytical results, correct behavior of errors, limiting forms for which solutions are known),
- whenever relevant, a summary of what you can learn from each project.

You should include suitably labeled listings of all the computer programs that you have written, either integrated into the report or as appendices. You should pay particular attention to the following points in your programs:

- **Overall structure.** Your program should be well written with sensible use of functions, variables and arrays.
- **Clarity.** You should include comments in your programs. Use sensible names for variables. Lay out your program with indentations and blank lines to show its structure.

In particular you should *avoid* the following:

- tables of data spanning many pages—your report should summarize the results, including sufficient data to answer the specific questions posed and to substantiate the conclusions that you make.
- too many graphs all showing similar effects—try to combine your data together to present it as succinctly as possible.

Some of the programs may generate very large data files. It is not necessary (or desirable) to submit print-outs of these.

Programming Help

If your program does not work, don't spend more than 30 minutes at the computer trying to fix it. Do something else for a while and then try again. Many stubborn problems have been known to fix themselves walking home! If you are still stuck after several attempts, seek help from me. Don't be afraid to ask questions during class. I am there to help!

Remember: do not leave writing your program and report to the week before it is due. Pace yourself throughout the semester to ensure that you meet the deadlines. Do not be afraid to seek help from me early if you are not making progress with a project.

Academic Integrity

In this course, students are allowed and encouraged to discuss their projects with each other, but all programs and reports must be the work of the individual student and may not be copied from another students work, the texts, or any other source, except for short quotations with proper attribution. Students who are found to be copying programs or results will receive an F for the course.

The Syracuse University Academic Integrity Policy holds students accountable for the integrity of the work they submit. Students should be familiar with the Policy and know that it is their responsibility to learn about instructor and general academic expectations with regard to proper citation of sources in written work. The policy also governs the integrity of work submitted in exams and assignments as well as the veracity of signatures on attendance sheets and other verifications of participation in class activities. Serious sanctions can result from academic dishonesty of any sort. For more information and the complete policy, see:

`http://subpolicies.syr.edu/ethics/acad_integrity.htm`

Disability Accommodation

If you believe that you need accommodations for a disability, please contact the Office of Disability Services (ODS), `http://disabilityservices.syr.edu`, located in Room 309 of 804 University Avenue, or call (315) 443-4498 for an appointment to discuss your needs and the process for requesting accommodations. ODS is responsible for coordinating disability-related accommodations and will issue students with documented disabilities Accommodation Authorization Letters, as appropriate. Since accommodations may require early planning and generally are not provided retroactively, please contact ODS as soon as possible.

Religious Observance Policy

SUs religious observances policy, found at `http://supolicies.syr.edu/emp_ben/religious_observance.htm`, recognizes the diversity of faiths represented among the campus community and protects the rights of students, faculty, and staff to observe religious holy days according to their tradition. Under the policy, students are provided an opportunity to make up any examination, study, or work requirements that may be missed due to a religious observance provided they notify their instructors before the end of the second week of classes. For fall and spring semesters, an online notification process is available through MySlice/Student Services/Enrollment/MyReligious Observances from the first day of class until the end of the second week of class.