Physics 202
Program Design
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As we tackle physics problems numerically were going to need to use a tried and true design process which will become natural in time. If you’ve programmed before you may be familiar with a design process. If not, then you’ve followed one without knowing it. Here we’ll make explicit what you’ve been doing all along. If you’ve never programmed before then this will give you a head start on students who’ve learned bad habits. As the problems we study get more difficult, the design process becomes more important.

Steps to Designing a Program

- **Analyze** the problem statement and express its essence abstractly with examples. An abstract representation may be a physical model or equation and should identify a numerical technique that is appropriate to the solution. Examples will identify input data, derived data, and test cases with known answers and plots that we want to examine.

- **Program** operations in precise language that ingest input data and create the derived data.

- **Evaluate** the programmed operations to execute the test cases.

- **Revise** any previous stages from what comes to light in the previous step.

Programs as short as an essay or as long as an encyclopedia require careful planning. The only difference between a small and a large computer program is the number of features that need to be designed and tested and the amount of effort that is put into supporting the design process. Most of us think of programming as “writing code” but the structure of the problem and assessment stages are essential too. Furthermore, experienced programmers all agree that the process isn’t linear but rather repeats until everything works correctly. No one can go top to bottom perfectly the first time. However, it will save you time if you carefully study the problem to figure out what approach to take and then determine what needs to be provided to the program, and what you want to get out of the program before you fire up Excel or Matlab. If a code is driving you crazy, check how the model was abstracted, what the program requirements were, and the expected outcomes.