Numerical Analysis on a Pocket Calculator

Terms 2-3, Deep Springs College, Prof. **Brian Hill**

Overview

Four subjects will emerge:

1. Operation and programming of a stack-based calculator, the Hewlett-Packard 25
2. General applications that were in the calculator's target market: games, finance, navigation, statistics, and surveying
3. Numerical analysis: root-finding, power series, integration
4. Statistics: linear regression, exponential, logarithmic, and power law curve fitting, standard deviations and correlation coefficients

There is a rich variety of background needed to deeply understand these subjects. Our classes will have a mix of developing the needed background and programming the Hewlett-Packard 25. In other words, we will constantly mix theory with concrete and pragmatic considerations.

The subjects are influenced by what Hewlett-Packard considered to be the HP-25's target market and by the capabilities of the calculator. This peculiar combination of constraints means that we will be taking a tour of a wide variety of subjects that mattered to practicing scientists and engineers in the mid-1970s. These subjects matter just as much today.

Daily Schedules

Detailed daily schedules will be kept retrospectively:

- **Daily Schedule Term 2**

Texts

There will be no text to purchase for the above subjects. Instead I will be preparing handouts. I will draw heavily from three books:

- The HP-25 Owner's Handbook
- HP-25 Applications Programs
- A book by an outstanding applied mathematician, Peter Henrici, *Computational Analysis with the HP-25 Pocket Calculator*, which is long since out-of-print (**on Amazon** copies of this 45-year-old book go for about $120)

As a question:

Would you want to purchase and read *Bill & Dave: How Hewlett and Packard Built the World's Greatest Company* as a way of rounding out our historical knowledge? It is readily arguable that Hewlett-Packard was the most influential company in what we now call Silicon Valley. We could also read the Walter Isaacson biography of Steve Jobs if you wanted to bring your Silicon Valley history more up-to-date. Understanding the technological landscape in which we live is almost impossible without understanding Hewlett-Packard and Apple. Microsoft and Intel are another entire empire which we would not have time to get into. Google and Facebook are yet more, and the bewildering list goes on, but Hewlett-Packard founded and represent the best of Silicon Valley culture, and although the company is a sad shadow of its former self, its influence carries on.

Resources

We will run the HP-25 app on smartphones. There is more than one developer offering these. They are inexpensive. I am not personally familiar with the Android offerings. We will investigate those together.

Grading

Five major areas:

- Active preparation for and engagement with the class: 15%
- Weekly problem sets involving both theory and programming (except during exam weeks and during the final project): 35%
- A midterm towards the end of Term 2: 20%
- A final exam towards the end of Term 3 (but before the final project): 20%
- A final project on a theory and programming problem of your choice: 10%

Miscellaneous Policies

There will be a lot of handouts. Get a three-ring binder to keep all the handouts and problem sets organized. When the first assignment was made, I requested that assignments be on 8 1/2 x 11 paper (and not torn out from a bound notebook), that multi-page assignments be stapled, and that corrections be erased (if done in pencil) or recopied (if done in pen). Points will be removed from assignment scores when these directions are not followed.

The College's general policies on absences and late work are applicable. There was an email from the Dean on this September 8. The policies below are consistent with that email:

Whereas missed coursework affects both your classmates and professors by lowering the thinking and understanding you bring to a given class, and interrupts the course schedule that has been set up and is adjusted on an ongoing basis with substantial care. The same is true for absences — whereas a handful of absences might be “normal” at colleges with large lectures or less serious academics, at Deep Springs we expect students to miss *no classes* save for legitimate health issues or emergencies requiring also missing labor and governance obligations.

For a student wishing to submit a course assignment past its required deadline, the student may request an extension on the assignment directly from the professor 48 hours in advance. Within 48 hours of the due date, the student must request an extension directly from the Dean. Exceptions will be granted by the Dean only if the student faces unforeseen and unforeseeable circumstances. A student who misses the deadline will be penalized a number of points that is roughly equivalent to a whole letter grade for each 24-hour period the assignment is late. Assignments cannot be turned in after solutions and graded assignments have been passed back, which generally happens 1-2 classes after they were turned in.