Hints for using EES effectively

1. Set up problem on paper before programming: sketch system/process, label state points, p-v, T-s, etc. Go through the methodology outlined in the textbook before sitting down at the computer.

2. Although the order of the equations is irrelevant to EES, organize your work according to the results of number 1 above.

3. Include many comments. Include many comments! Include many comments!!

4. Use variables and assignment statements for all known properties instead of simply entering numerical values for them in each equation. This will give you more flexibility to do “What if?” analysis, plotting, etc.

5. Use meaningful variable names: \( \text{Re} = \text{Reynolds number}, \rho = \text{density}, \) etc.

6. Use array variable. They make your output format nicer, allowing output to be more or less in the form of a state table. They also allow for easy plotting of processes and cycles.

7. Write programs with a block- or module-type logic. Check these blocks or modules individually (use the Solve command) before stringing together many lines of code. This will allow debugging on much smaller pieces of code. Learn to use the debug feature of EES.

8. When using EES, you will not necessarily need to find every property that you must find when solving by hand. As an example, by hand you must often solve for quality in order to find some other property. In EES, as long as you have two independent properties known at a given state, you can directly get any other property. You are not limited by interpolation methods in tables, so if quality is not specifically required for the problem, you need not find it.

9. For some substances (e.g., water, ethane), EES has more than one function to find properties. Know the differences in the various functions and choose appropriately.

10. Use some order-of-magnitude hand calculations to verify that you have not made any gross errors in your programming. Computers are very obliging about producing numerical answers even if the equations violate the laws of physics!

11. By hand, you typically work from one state point to the next state point. EES calculates all state points simultaneously, so the way you think about solving problems may be different. Practice will help you develop effective strategies for using EES.

12. While in theory two independent variables uniquely determine the state, be careful if gradients are either very high or almost zero. For example, liquids are almost incompressible, so using the volume and temperature of liquid water as independent variables will not yield reliable results for the pressure. Computer round-off and uncertainties could cause very large deviations in the unknown being determined.

13. If using EES for final output, format the solutions appropriately, watch significant figures, include dimensions/units, highlight important results, etc.

14. Due to the nature of numerical solutions, root finding routines, round-off error, etc., there are times when EES may fail to converge or actually give a wrong answer. As the engineer, it is your job to be aware of this possibility and watch for it. In particular, watch for steep property gradients (See item 11 above.) and the difference of two approximately equal numbers (Entropy production, \( \sigma \), is often a small value determined by the difference of two much larger numbers.). Rearranging the equations or using different property functions so unknowns are not the arguments of function calls may help remedy these problems. Also, you can change the limits and initial guess for each variable manually to constrain its value to a realistic range.