

ANALYTICAL CHEMISTRY 256

ROLE - PLAYING LAB

1998-1999 Academic Year

©Prof. John P. Walters

St. Olaf College

Northfield, MN 55057

Introduction to Role-Playing and Laboratory Computing
 Defining the Kinds of Role-Playing Responsibilities
 Round-Robin Certification of Laboratory Glassware
 Production Quality Control Lead Analysis
 Statistical/Chemical Evaluation of Lead Data
 Semi-Automated Weak Acid Titration
 Graphical Analysis of Weak Acid Titration
 Designing a Mock Robot Experiment

Executing the Mock Robot Experiment

The Incredible Edible Easter Egg Grass Advertising Dilemma

The Downsizing Dilemma

The Broken Pill Coating Machine Assembly Line Shutdown Dilemma

The Instrument Purchase Payment Release Dilemma

Closure

ROLES:

Manager:	Starting and Stopping the Mock Robot - Thinking
Chemist:	Preparing the Indicator Solutions to Feed Hardware
Software:	Giving Electrical and Verbal Commands to Hardware
Hardware:	Responding to Commands to Operate Spectrophotometer

OBJECTIVES:

The mock robot is operating in this part of the experiment. All staff making up the mock robot are restrained (except **Manager**) to certain bench positions, certain kinds of motor skills, and certain kinds of verbal communications. Only **Manager** may (in the conventional sense of the word) "think". The primary task of the mock robot is to record the isosbestic point of the acid/base indicator Brom-Cresol-Green. A complete success is indicated by turning the mock robot on only once, never turning it off, and ending up with a professionally pleasing graph of the isosbestic point. A complete failure is having to turn the mock robot on and off so many times that the isosbestic point is not recorded.

MANAGEMENT INTERVIEW:

The second part of the experiment is a presentation of the isosbestic point display, an evaluation of its quality, and a full discussion of the challenges and expected problems of incorporating a real robot in a clinical analytical ("hospital") laboratory. Especially important will be comments about why (if at all) the mock robot had to be turned off and restarted (which is not good) and how **Manager** expects this to reverberate into a real lab robot situation. As usual, the way in which staff communicated in the first part of the experiment to make this second part work is at issue.

Manager's Problem

From the outset, it is mandatory that **Manager** realize that once the mock robot is turned on, all interpretive thinking, reflexive adaptation, and judgmental responses on the part of **Chemist**, **Hardware**, and **Software** beyond what was discussed, designed, rehearsed, and practiced in the first part of the experiment is **totally and completely prohibited!**

If a crisis occurs, if a step is miscalculated, if a planned motor skill does not work, **Manager** has only two choices. The first is for **Manager** to think (!) and use the existing resources to make a fix on the problem. New resources cannot be invented unless they are on the bench already (i.e., new patterns of using existing resources). The second is to turn the mock robot off (admitting a failure to have the proper "programs" or other resources), create new resources, and turn the mock robot back on again. The grade for the Company will be lowered one level (A -> B, B -> C, etc.) each time the robot is turned off.

If the first part of the experiment has been done well, all motor skill steps that **Hardware** needs, all electrical control steps that **Software** needs, and all reagents and operations that **Chemist** needs **have been designed, supplied, and learned. Then, when the mock robot is turned on, all Manager** should have to do is sit at the executive terminal writing up the material to be used in the management interview.

If however, **Chemist** (say) discovers that he/she has not correctly estimated the proper dilution factor for the stock solution of BCG indicator he/she is using, he/she may want to ask **Manager** for help. **Manager** may get up, walk over to **Chemist's** side of the bench, and discuss what to do with **Chemist**, using the existing resources that **Chemist** has collected!. This does not require turning the mock robot off, since **Manager** is free to move around the bench, and is allowed interpretive thinking.

But (say) if in the above example, **Manager** and **Chemist** realize that the experiment cannot continue because **Manager** failed in the first part of the experiment to get a 2000 mL volumetric flask from the stockroom to make the dilution (a bit far fetched, but ...), then the existing resources would be inadequate. **Manager** is not free to leave the actual bench area to go to the stockroom without turning the robot off! This would be a "local systems shutdown", which in any professional situation is a failure, and it would have to detract from the "grade" that **Upper Management would give to the group**.

Of course, it is conceivable that **Manager** could be talented enough (and have the right resources before hand) to hire **Upper Management** as a billable consultant. But, even with that outside help, if more resources were needed, the mock robot would have to be turned off, and a local system shutdown result.

Other scenarios come to mind. For example, **Manager** may have decided in the first part of the experiment to have **Software** run the instrument electrically using LabVIEW, and to have **Hardware** do nothing except handle the cell parts tray operations. She may also have decided to handle all of the digital recorder operations herself (it's possible).

In all, there are a host of things that could come up that would require **Manager** to think and adapt the existing resources of the bench to an unplanned development. The only real problem that **Manager** has is to create solutions to local problems that do not require more than existing resources, and to avoid turning the robot off.

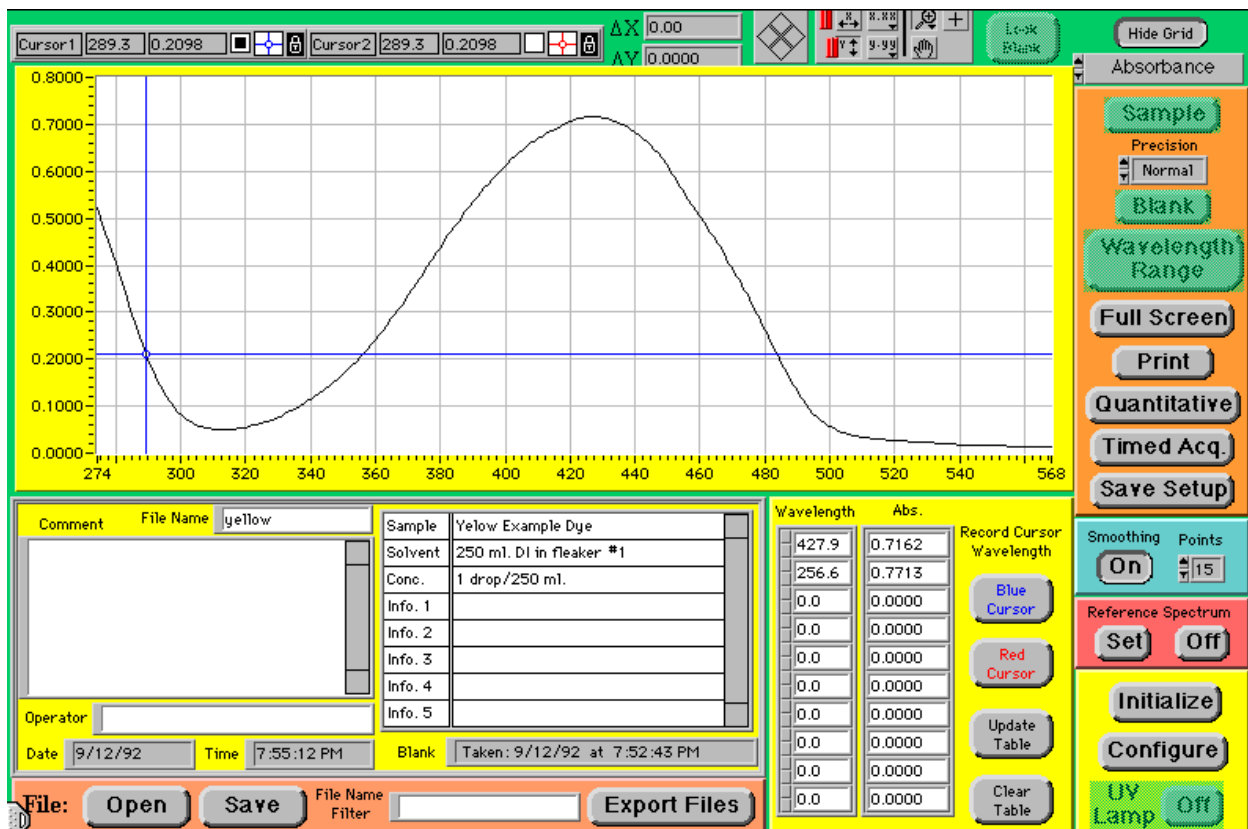
If the mock robot is turned off, the CCTV that operates when it is on must be turned off also, and all will notice the local systems shutdown. Then, new resources may be collected. When the mock robot is turned back on, and the CCTV is back on, the above rules are back in effect. If the period passes and the isosbestic point has not been recorded, there has been a "total systems failure". It is up to **Manager** to keep track of all the local systems shutdowns, and why they occurred.

Hardware's Cell Handling Language

Hardware has a set of selected "motor skill" tasks to be learned and executed in a perfect, rote, maliciously obedient manner! It is **Software** who calls the motor skill to be executed. **Hardware** can execute no independent effort, and in no way show judgement in responding to **Software's** commands. What can **Hardware** then do? Basically, just execute the pre-learned commands, in single "called" steps or in linked together sets, as many times as **Software** calls for them.

Software will need to know how to do the following tasks:

Using the CCD LabVIEW VI:



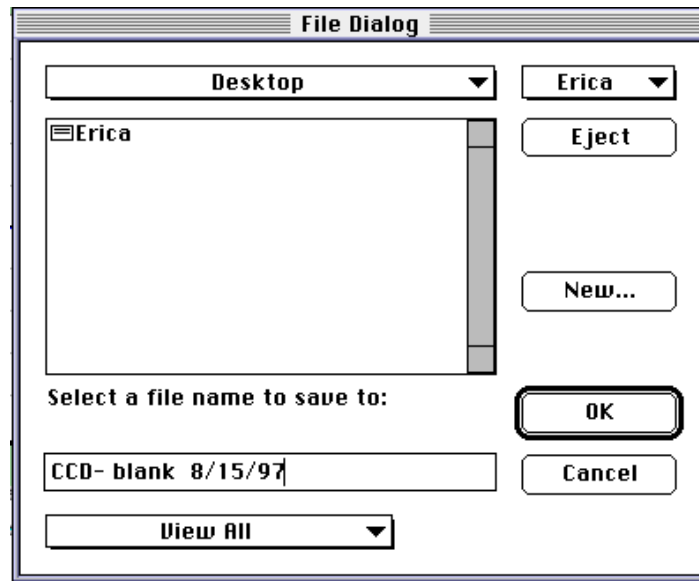
To save a file:

1. Hit the "save" button at the bottom of the LabVIEW vi.

?Do you want to create a new folder to hold your data?

YES-

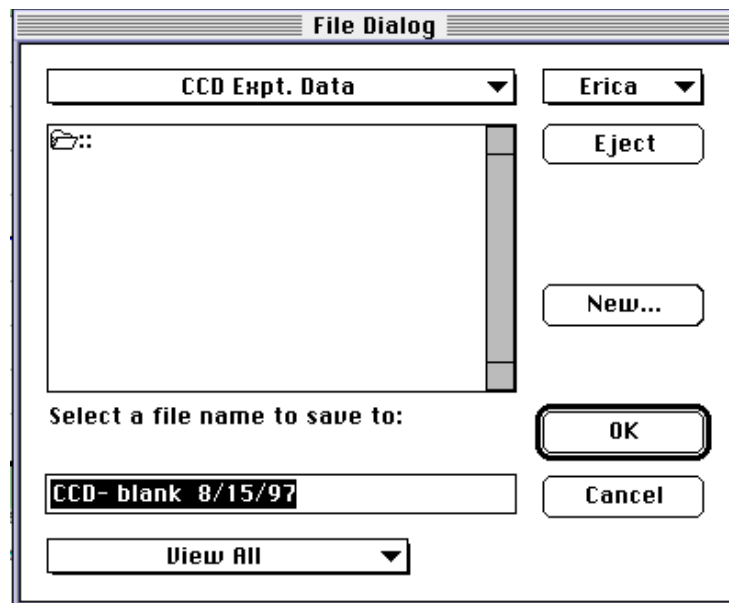
2. Using pull down menu at the top of the window, find the desired location of folder.
(The example on the next page shows the folder being placed on the desktop.)



3. Press the "new" button.
4. Input the desired new directory/ folder name and press the "directory" button - this creates the new folder.



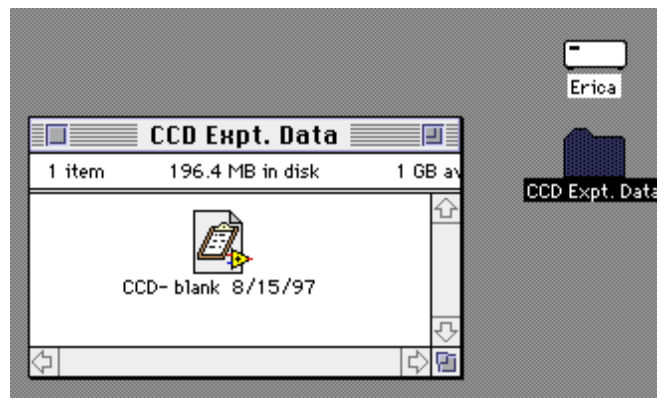
5. You can now save your file. Open the desired folder, type in the title of the file, and press "ok".



NO-

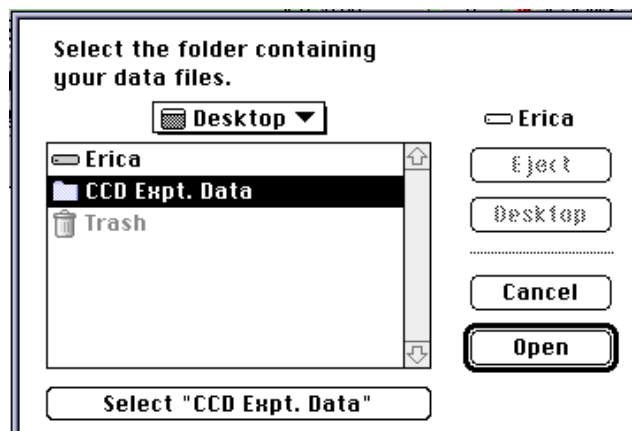
2. You can now save your file. Open the desired folder, type in the title of the file, and press “ok”.

The data file generated by the LabVIEW vi. has now been placed in the specified folder.

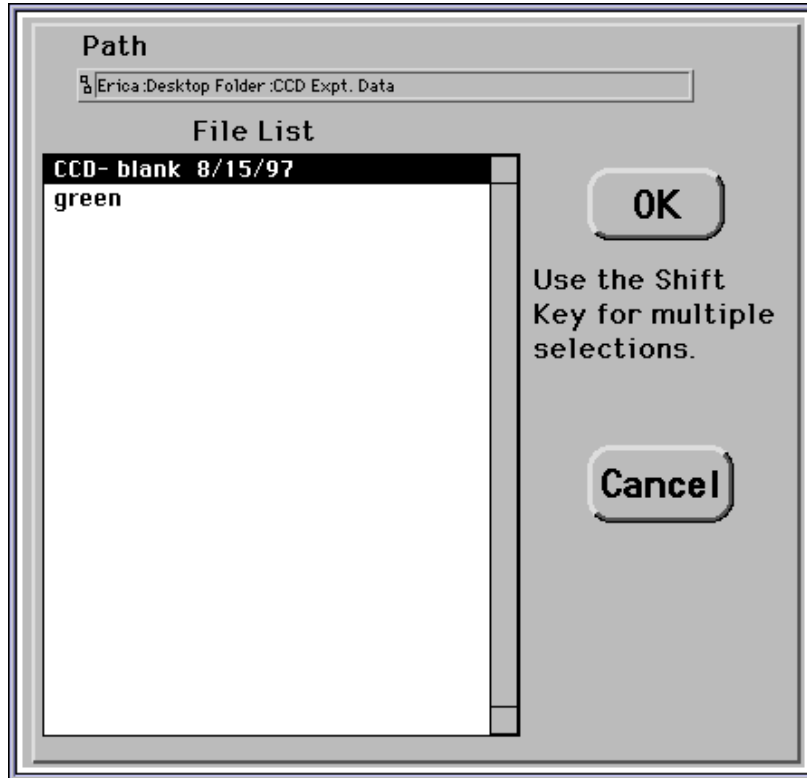


To export a file to Excel:

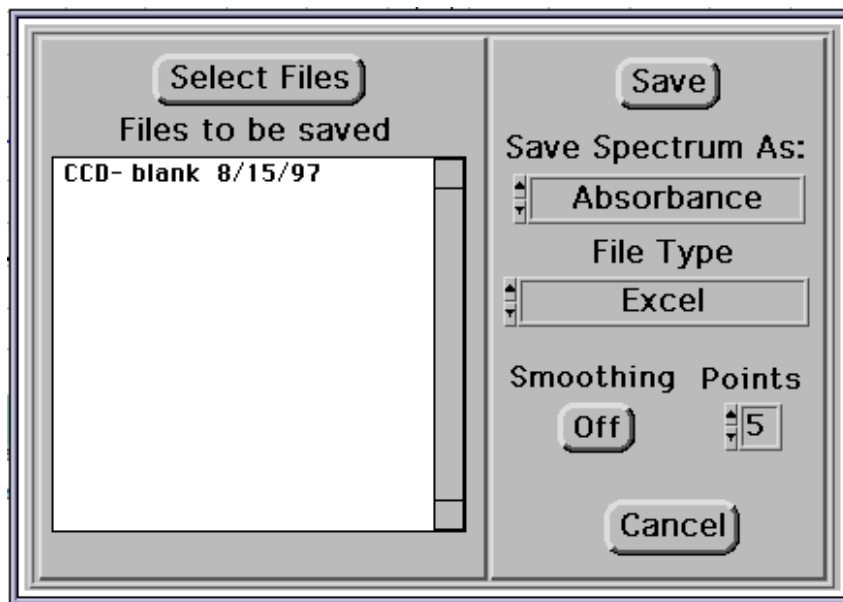
1. Hit the “export files” button at the bottom of the LabVIEW vi.
2. Open the folder that contains your saved data, using the pull down menu at the top of the window.
3. At the bottom of the window is a button reading “select your data folder name here”. Press this button.



4. At next window, select files you would like to convert to Excel and hit “ok”.



5. The next window allows you to:
- double check the names of the files being converted
 - select the spectrum display (absorbance, transmission, intensity)
 - convert to an Excel or text file
 - incorporate a smoothing routine into the data



6. When these parameters are set, hit the “save” button.

?Do you want to create a new folder to hold your converted data?

YES-

7. Choose where you want to create this new folder using the pull down menu at the top of this window.
8. Hit the “new” button.
9. Type in the name of the new folder and hit the “folder” button.

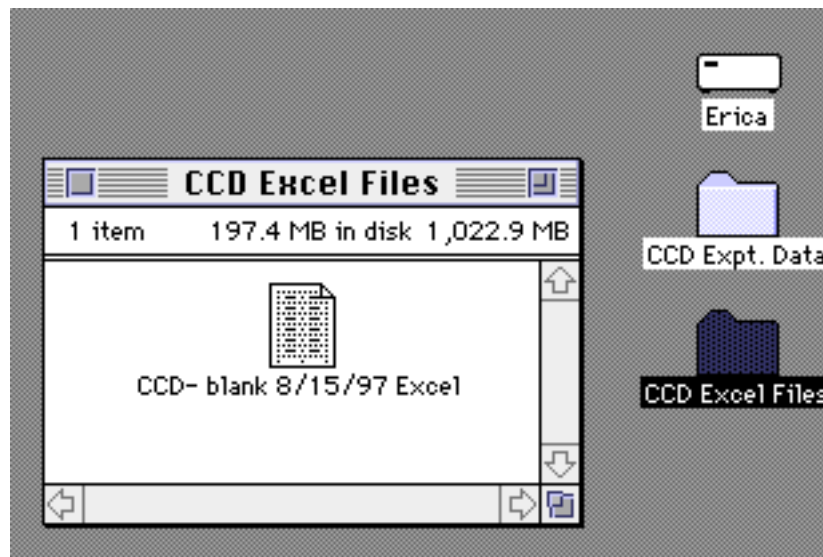


10. Using the pull down menu, open your newly created folder. It will be empty.
11. Press the “new” button.
12. Type in the name of your new file and press the “file” button.



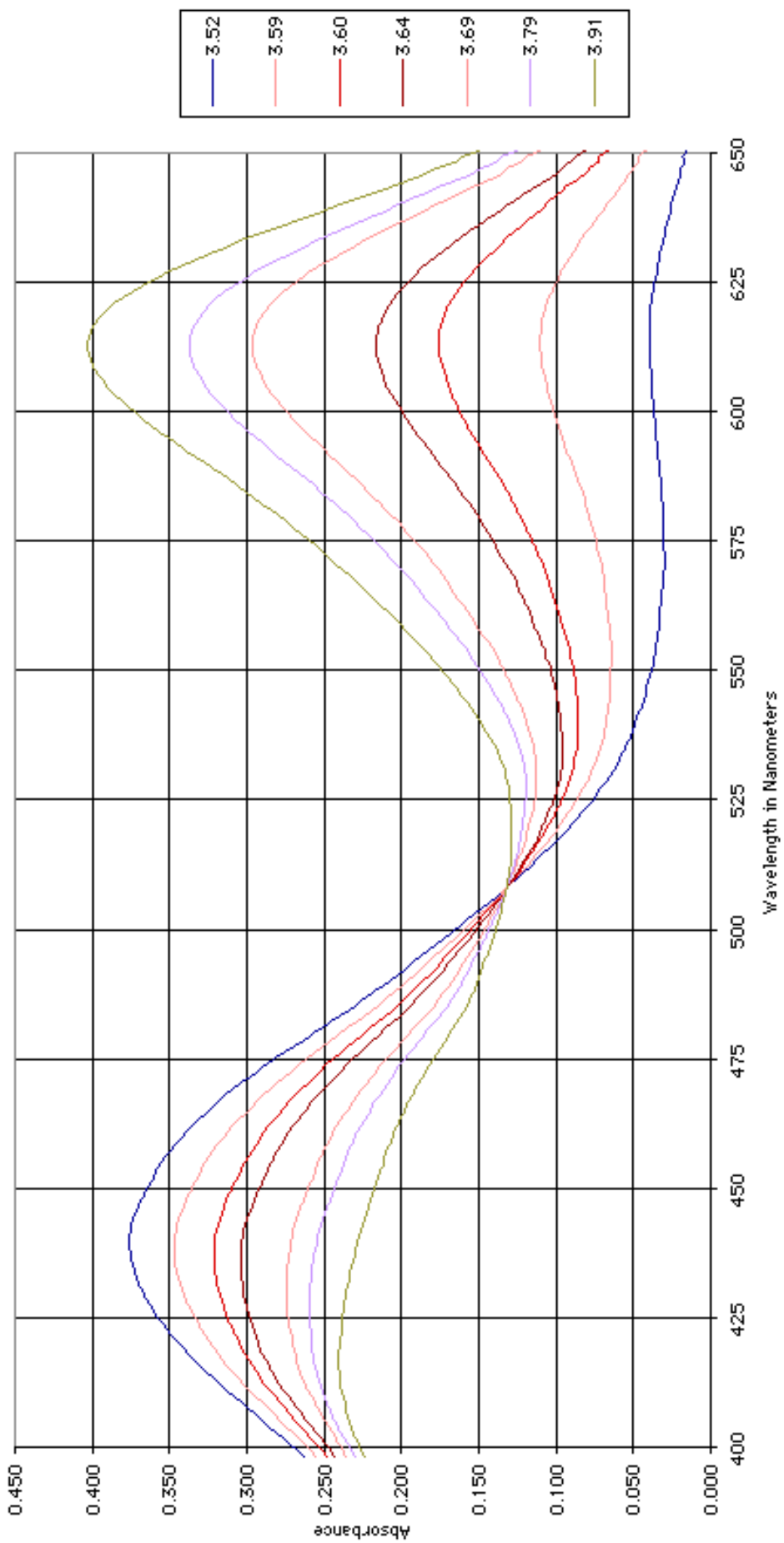
NO-

7. To save your converted files, select and open the desired folder, press the “new” button.
8. Type in the name of your new file and press the “file” button.

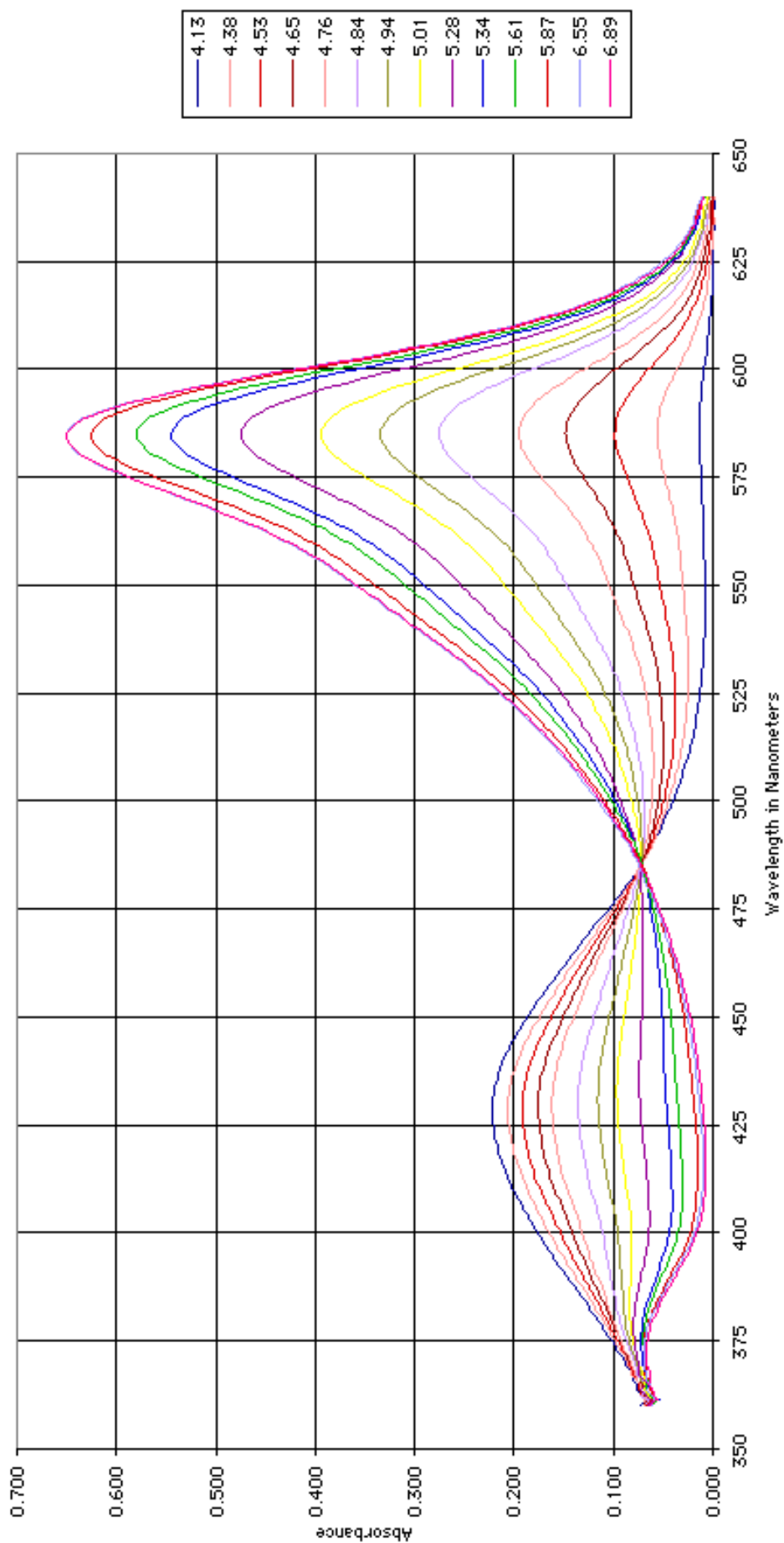


The converted files have now been as Excel documents in the specified folder.

Bromocresol Green Isosbestic Point - John P. Walters - 4/4/97 @ 13:57
SI400 CCD Spectrophotometer with Crossover λ at 380 NM



Bromocresol Purple Isobestic Point - John P. Walters - 4/4/97 @ 11:04
SI400 CCD Spectrophotometer with Crossover λ at 350 NM



Expanded Wavelength Recording of Isosbestic Points of Bromocresol Purple - John P. Walters - 4/4/97 @ 14:47
SI 400 CCD Spectrophotometer using 23 Point SG Smoothing of Data with Crossing Wavelength $\lambda = 460$ NM

