LECTURE FOUR: Laboratory Notebook and Proposals

Remark: In this lecture we emphasize the procedures that students must follow to record their daily activities pertaining to senior design projects. These activities should be regularly archived for a possible future need to support an intellectual property or patent application. Students are briefed on how to prepare proposals and memos in order to report their progress.

References:

[1] M. Eslami, *Analog and Digital Circuits, Theory and Experimentation.* Melbourne, FL: R.E. Krieger, 1987 (pp. 22-23).
[2] H.M. Kanare, *Writing the Laboratory Notebook.* Washington, DC: American Chemical Society, 1985.

Introduction

As much as we like to say all set and ready to carry out the technical assignment, we realize that there are many other procedural matters that must be learned before proceeding further. Students are briefed on the procedures, which they must follow to collect data and to structure their bookkeeping and logging of their activities and thoughts, in order to conform to the corresponding legal standard. This information collecting is followed by some suggestions on how to begin preparing proposals and memos to report their progress.

Laboratory Notebook

Generally speaking, the so-called laboratory notebook is a complete log or record of all work done by the experimenter. While there is no universal set of rules for keeping this notebook the following guidelines should be helpful. These suggestions on collecting data in laboratory are gathered from a textbook by this author [1], and more can be found in [2]. Subsequently, we refine these suggestions to include the logging of activities. In most cases a Laboratory Research Notebook, which is available at the Campus Bookstore may be used for this purpose. Although in many instances and as far as this course is concerned, this notebook can be replaced with a cheaper one that is marked by the student in the format described below. At the end of each session with your team member(s) you are required to pass a raw data sheet of your work to the other person(s) for his/her record. Thus, the issue of a medium to record activities and generated data is not cosmetic, but rather substantive, and by Laboratory Notebook we really mean a warehouse of information. You can build this warehouse on any medium where information can be *stored and retrieved,* in conjunction with a physical warehouse for your tangible records.

Having stated the above, we acknowledge that when we set our sight high and anticipate greatness – maybe a patent or an intellectual property down the road, we must invest time and follow a common-sense approach to archive our research and discovery as legal professionals advise us to do. For instance, when a patent examiner is reviewing an application, the actual ***date*** of one's discovery is the single most important factor in the final outcome. To establish ***when*** we had accomplished a discovery, we need to rely on our notebook, which often is challenged in the court of law by our competitors. Any irregularities in our bookkeeping system become red flags to our opposing parties. Many of us feel burdened by strict

bookkeeping practices and feel that is unnecessary. However, a solid system of bookkeeping saves us valuable time, not only to protect us in a legal setting against allegations of conflict of interest or research fraud, but also in many other instances of accidental fire and similar loss of data or other valuable information. In the following, and for the sake of discussion, we assume that our Laboratory Notebook is a bound professional type that is designed for this purpose. Perhaps we should clarify that by a ***laboratory session,*** we mean any gathering of a research group or technical team for the purpose of deliberating or any kind of work on the project. Also, any gathering of individual participants is called a laboratory session – sometimes this gathering may take place at the library or a conference room.

A. On Collecting Data

(1) ***Entries in the notebook should be in chronological order.*** Pages should ***not*** be skipped in the body of the notebook in order to be used at some later date. Each page of the notebook should be numbered. The experimenter's name, date, section, and the names of any team member(s) or collaborator(s) should appear on each page. The notebooks to be used, or constructed (check with your course instructor), in this course must have the pages pre-numbered. There should be no blank spaces (except margins) on a finished page, otherwise cross the unused portion of the page with an "X".

(2) All information should be recorded directly into the notebook as soon as it is obtained. Memory or scraps of paper should not be used for a primary recording medium. The risk of loss or error is too great. The experimenter should be in possession of his/her notebook whenever he/she is working in the laboratory. Rough calculation and initial conclusions, should be recorded directly in the notebook.

(3) Do not crowd entries. Notebook paper is undoubtedly the least expensive item in any experimental investigation. Leave ample margins at the top, bottom and sides of each page for reference notes, which may be added subsequently, and if so those additions must be initialed, dated, and witnessed. ***Entries should be in ink or ball point pen.*** If possible use the same pen throughout the day, in order to support the idea that entries were all made at the same time and not altered later. ***Never erase or obliterate.*** Cross through an entry if you must, but leave it legible. Only immediate errors of entry should be crossed through. Observations that are subsequently found to be in error should never be crossed out; the fact that they are in error will be recorded on a subsequent page and a margin reference to this page can be inserted. Finally, be sure that your writing and numerals are legible and understandable.

(4) There are some records that cannot conveniently be put into a Laboratory Notebook, such as long strips of recorder paper or a stack of Polaroid prints. Such records should be immediately marked with identification numbers and logged, together with information on their source, into the Laboratory Notebook. Identification systems need not be elaborate, but they must permit unequivocal access in both directions between the Laboratory Notebook and such separate records. The identification system must satisfy any labeling requirements for specimens or supplies. A beaker, bottle or box used in the experiment should either be empty or contain a label identifying its contents and recorded in the Notebook. Keep your Notebook in a safe and fireproof cabinet, and ask all those related to the project do the same.

B. On Logging Activities

These entries are also should be made in the same Notebook as above.

(1) Each entry should document all you have done in each laboratory session. You must also include all pre-laboratory work or any sort of preparation that was put into the meeting individually and as a group. All entries must be made in the form of a diary and not a memoir, by reporting things as they happen and not as they recall.

(2) All meetings should be reflected in every member's Notebook similarly. One meeting per week is a must. All decisions agreed upon must be reflected in each member's Notebook, with explicit defined and agreed assignments for each individual member. There must be a well-defined timetable as how these tasks are to be completed. If failed to meet the deadline, then describe why, and how that task is rescheduled. In other words, we want a clean operation.

(3) While conducting an experiment, whether testing a circuit or anything else, draw a clear schematic diagram of the work to be done, and provide an analysis of the experiment as appropriate. Leave room for some sorts of comparison as you advance in the course.

(4) A major part of your activities concern locating and discussing issues with people outside the company (here university). Always write the name and telephone number of the person you spoke with and the date of this conversation. Write the key issues that you spoke with the person. For instance, if you have contacted a vendor, write the name and description of the component or item that you have discussed and want to purchase. Get a confirmation by asking the outside person to send you an e-mail about the discussion. In many cases, they tell you that they are busy, so it is also a good idea to get the person's e-mail address and the Fax number, in order that you send him/her a confirmation note. You will be surprised how often people change their mind without telling you!

C. On Logging Thoughts

As stated before, a useful Notebook must look like a diary that reports what you are thinking and doing, and ***not a memoir***. It must display events as they occurred, and it must be easy to understand and reproduce. It must convey the evolving thoughts that are the cornerstone of research and future discovery. It must explain your planning, preparation, and expectation of the results. In other words, if it cannot be shown that there was a grand scheme to reach a goal, then the experimenter would have difficulty to prove his/her case in the court of law when seeking a patent or any other recognition. The description must be so lucid that years later someone with similar background can pick up the Notebook and understand what you were thinking and doing then.

The Laboratory Notebook or Journal as is called in the contemporary era must be a living and dynamic piece of work reflecting the thinking and effort which have been put into the project, and a complete awareness of the potential discovery from the project.

The Laboratory Notebook is also a barometer of how much time and effort has been put in a project, and therefore can serve as a reminder to us whether we are utilizing our resources wisely or not. Be aware that a documented life may also come to haunt us!

D. On Electronics Media

Many students would prefer to keep their records on their computers and produce daily or weekly journals. All we can add is that the burden of proof is on their shoulders. They must substantiate the originality and date of occurrence just as anyone else. One way to archive these notes is to have them on a disc or tape, with date, and ***mail*** that to an impartial party for safe keeping. Normally, the computers carry their own time stamping programs and automatically date the creation and editing of files, but still you need to prove.

E. On Archiving Laboratory Notebook

To verify the legitimacy of scientific claims made based on information recorded in a Laboratory Notebook, one must seek on a regular basis the witnessing and reviewing of an impartial or disinterested party. For instance, two colleagues who do not necessarily work on similar projects may review each other's work in confidence. The frequency of this verification depends on the nature of the work. For a fast breaking research this verification may occur on a weekly or even a daily basis, but the key issue is that the person who verifies must be trustworthy, and therefore must be reputable in the community at large. The nature of this verification may be both actual physical observation of the work done, as well as technical review of the outcome of the work. In case, the witness or reviewer suggests any correction or procedural improvement, that must be incorporated in future entries of the Notebook with a proper declaration of the reviewer's input. There is a fine line as how much a reviewer can play this role or becomes an active member of the team. If the reviewer crosses that line then becomes a participant in the project and must be replaced by another impartial party. Thus, select a reviewer who can do the job for the anticipated duration of the project and without any future problems. Team members cannot serve as each other's reviewer. An alternative to having a reviewer is to photocopy and videotape the research results with actual dating and ***mail*** that to an attorney for safe keeping. The mailing date of the package will stand when opened in court.

Whatever you write in your record book, in any shape and form, must display your thoughts and dreams and how you got the ideas and what you are looking for. It must be easy to read and easy to understand. Finally, it must be verifiable.

Preliminary Issues to Prepare Proposals and Memos

We will give details on this matter in our future lecture notes. Meanwhile, we want you to realize that a major part of your activity concerns literature search and review of published work in the area that you are concentrating. Equally important is browsing the web. When you are conducting these searches write down the key information about each such entry in your Laboratory Notebook. In this regard, include a brief description of the key issues as you see it. As you gain experience, you may not agree with these initial assessments, but that will be decided later. Now, as far as the citation is concerned, when you want to refer to an article that you had read in one of the IEEE Transactions, *per se,* you must follow the standard procedures described in the two attachments (one for the IEEE style, and the other for the ASME). Thus, write all the pertinent information for articles, books, URL's of web sites visited in the format selected by your course instructor before you forget. We pay special attentions to these efforts.

The following format for your ***intermediate proposals and memos*** should be observed.

(1) The total length should not exceed four double-spaced, typewritten, stapled pages.
(2) The allowable font size is 12 points.
(3) Upper and lower margins (includes gutters) should be 1.5 inches. Left and right margins should be 1.0 inches.
(4) The first page should start with an appropriate title. Each page should have your name in the upper right-hand corner. This may be included as a header.
(5) If this is a group memo, then everyone's name must be included.

Final Thought

We now have the essential tools to organize and document our work in a solid structure of academic and industrial settings, and in due time we elaborate on improving these matters as we proceed in our endeavors. The road ahead is certainly bumpy, but we have been there and done that!

Closure

The class is reminded of the pending progress reports from students due next week.

Essential thoughts in this lecture

Issues.	Applicability to your project, if any.
The importance of preparing a Laboratory Notebook and its role in this project oriented course with all details.	Just look at the illustrious picture of Mr. Kilby in Lecture One. The old saying that a picture worth a 1000 words could not be any more relevant than here.
Citation styles and formats for proposals and memos.	Obvious!

Appendix A:

Attached is a set of sample forms for citation styles, courtesy of friendly staff at Science Library of the University of California at Riverside a wonderful place to study.

IEEE Citation Style

In Text Citation

Citing in text is done with the [#] format. Punctuation occurs after the notation.

Example: A preliminary model was analyzed in a series of off-line computer simulations [1].

List of References

References are listed in the order that the articles appear in the text.

Journal Articles:
[#] Author's initials authors last name, other authors, "Article title," *Journal Name (typically abbreviated),* vol. #, no. #, pp. #-#, Date.

Example: [1] M. Rucci, G. Tononi, "Registration of neural maps through value-dependent learning," *J. Neurosci.*, vol. 17, no. 1, pp. 334-352, Jan. 1997.

Books:
[#] Author's initials last name, other authors, *Title of Book.* Place of publication: Publisher, date.

Example:
[2] D.O. Hebb, *The Organization of Behavior.* New York: Wiley, 1949.

Article in a collection:
A.J. Albrecht, "Measuring Application-Development Productivity," *Programmer Productivity Issues for the Eighties*, C. Jones, ed., IEEE Computer Soc. Press, Los Alamitos, Calif., 1981, pp. 34-43.

Article in a conference proceedings:
M. Weiser, "Program Slicing," *Proc. Int'l Conf. Software Eng.*, IEEE Computer Soc. Press, Los Alamitos, Calif., 1981, pp. 439-449.

Do not include the editor's name for a proceedings unless it is carefully edited and published as a regular book

Dissertation or thesis
B. Fagin, *A Parallel Execution Model for Prolog*, doctoral dissertation, Univ. of California, Berkeley, Dept. Computer Sciences, 1987.

Electronic publication
L.P. Burka, "A Hypertext History of Multiuser Dimensions," *MUD History*, http://www.ccs.neu.edu/home/home/lpb/mud-history.html (current Dec. 5, 1995).

Patent
M. Hoff, S. Mazor, and F. Faggin, *Memory System for Multi-Chip Digital Computer*, US patent 3,821,715, to Intel Corp., Patent and Trademark Office, Washington, D.C., 1974.

Technical report
C. Hoffman and J. Hopcroft, *Quadratic Blending Surfaces*, Tech. Report TR-85-674, Computer Science Dept., Cornell Univ., Ithaca, N.Y., 1985.

Technical or user manual
Unix System V Interface Definition, Issue 2, Vol. 2, AT&T, Murray Hill, N.J., 1986.

ASME Citation Style

In Text Citation - Within the text, references should be cited by giving the last name of the author(s) and the year of publication of the reference. The year should always be enclosed in parentheses; whether or not the name of the author(s) should be enclosed within the parentheses depends on the context. The two possibilities are illustrated below:
It was shown by Prusa (1983) that the width of the plume decreases under these conditions. or
It has been shown that the width of the plume decreases under these conditions (Prusa, 1983).

In the case of two authors, the last names of both authors should be included in the citation, as shown in the above examples, with the word "and" separating the two authors.

In the case of three or more authors, only the last name of the first author of the reference should be included, as shown in the above examples, with the other authors being denoted by "et al."

In the case of two or more references with the same author(s) and with the same year of publication, the references should be distinguished in the text by appending a lowercase letter "a" to the year of publication of the first cited, a letter "b" to the second cited, etc. The references should follow the examples shown above.

List of References - References to original sources for cited material should be listed together at the end of the paper; footnotes should not be used for this purpose. References should be arranged in alphabetical order according to the last name of the author, or the last name of the first-named author for papers with more than one author. Each reference should include the last name of each author followed by his initials.

(1) Reference to journal articles, papers in conference proceedings, or any other collection of works by numerous authors should include:
year of publication
full title of the cited article
full name of the publication in which it appeared
volume number (if any)
inclusive page numbers of the cited article

(2) Reference to textbooks, monographs, theses, and technical reports should include:
year of publication
full title of the publication
publisher
city of publication
inclusive page numbers of the work being cited

In all cases, titles of books, periodicals, and conference proceedings should be underlined or in italics. A sample list of references in which these forms are illustrated follows.

Sample References

Sparrow, E. M., 1980a, "Fluid-to-Fluid Conjugate Heat Transfer for a Vertical Pipe - Internal Forced Convection and External Natural Convection," *ASME Journal of Heat Transfer*, Vol. 102, pp. 402-407.

Bejan, A., *Heat transfer*. New York : John Wiley & Sons, Inc., c1993.

Tung, C. Y., 1982, "Evaporative Heat Transfer in the Contact Line of a Mixture," Ph.D. Thesis, Rensselaer Polytechnic Institute, Troy, NY.

Most of the information on this page was taken from:
(No date). References [Online]. ASME. Available: http://www.asme.org/pubs/authors/ [1999, April 9].

LECTURE FIVE: Proposals and Memos Continued

Remark: The purpose of this lecture note is to clarify issues that were explained before and that students are still having problems to implement. In this lecture we begin to ask students to describe their experience so far and share some of their concerns in class. For many of them, this is the first time they talk in front of a group.

Introduction

Students are briefed on some of the earlier issues, which were discussed in class such as the importance of the Laboratory Notebook and related topics. Students should be invited and indeed encouraged to talk about their projects and some of their experience, as a sign of what the rest of the class should expect soon for their mid-course oral presentations. At this time, there must be quite a few questions among students, which show that they are beginning to engage themselves in this course. Otherwise, there is something wrong and we must find what that is.

Proposals and Memos Continued

Based on some feedback from the class we should continue to emphasize the importance of a proper presentation of any document or project. Clearly, students are interacting with their technical faculty advisor and definitely have written a few memos or proposals about their projects. Although, we have not yet given any structure and style, they are ready to see the first structure for a technical document. In other words, they all have a story to tell, but do not know how. Here is our first attempt to structure these documents.

In this regard we expect that the students pay particular attention to the following issues. Each document must be easy to read, giving a brief introduction *without any acronym*. Then start explaining your problem by walking through ***each step*** and gradually presenting your overall goals. Do not give the "Big Picture" first, nor assume that people who read your document (proposal) are intimately familiar with your work. In fact they are not! Also, we elaborate on this "Big Picture" subsequently.

Now, going back to the preceding sentence, if you really have read it thoroughly, and understood the true meaning of ***"each step,"*** then we have nothing else to offer you! In other words, the course would have been over and we all could have called it off. However, with all due sensitivity and respect, we believe that, it will take decades for someone to appreciate the meaning of ***"each step,"*** and be able to sort out his/her thought in order to write that way. In other words, to compartmentalize a thought in several steps is a multi-year task. But that does not mean we should be discouraged, and do not even try, not at all. Sooner we start, sooner we learn how to write correctly and effectively, which not only describes an issue clearly. But also, it gives other subtle information, which is hidden to a novice, nevertheless is imbedded in the text of the document. We will be looking into some such writing as an exercise in class.

Finally, we all have heard that we must write such that we are understood. That is not enough in this class! We must write such that we are ***not*** misunderstood, and that is not too much to ask.

As a first step toward organizing your proposals, we suggest that in your writing you pay special attention to the following items.

A. Technical

(1) Block Diagram, can you use that to simplify your presentation?
(2) Parts List, put all that with the corresponding specifications into one group.
(3) Special Software, sort these out accordingly.
(4) Special Resources, this is also required to be looked at by each project separately.
(5) Test Plan, clearly you need to look at this issue very seriously.

B. Administrative

(1) Budget, you must address this issue.
(2) Personnel Assignments, each team member has specific job and that should be detailed.
(3) Schedules, you should give a time frame to complete the task in hand as you see it.
(4) Non-compliance, you must discuss about each and all that went wrong among you!

C. Lessons Learned

Things will go wrong more often than you think. Simply state your experience when any or all the above go wrong and write whatever you have learned from this experience. A project report without lessons learned is not believable and is considered weak.

Final Thought

This is the first structure for submitting your documents. We hope to help you sort your presentation out and work with you to improve your writing skill.

Closure

The class ends by emphasizing the importance of compartmentalization in any presentation.

Essential thoughts in this lecture

Issues.	Applicability to your project, if any.
Preliminary elements that should be included in each proposal.	Obvious!
Do you want to add anything else?	Please elaborate.