

Homework

1. By Wednesday, Jan. 25th, e-mail a message to the instructor (**Linden.McClure@Colorado.EDU**) with the subject line "**ESDS06 HW #1**". This will verify that the instructor has your correct e-mail address for class correspondence. The instructor will reply with a brief message so that you know your e-mail got to its destination. Answer the following questions in the body of your e-mail (**do not put your answers in an attachment**):
 - (a) If you have a job, what kind of work do you do for a living?
 - (b) Have you ever built an embedded system before? If yes, please list the microprocessor(s) and programming language(s) you used.
 - (c) What was your favorite technical course in college and why?
 - (d) In which technical class in college did you learn the most and why?
 - (e) In your opinion, what are the characteristics of a good professor?
 - (f) What made you interested in this course?
 - (g) What do you want to gain from taking this course?
 - (h) Do you have any concerns about this course? If so, please describe.
 - (i) Do you have any preferred times/days for TA office hours?
 - (j) Can you attend instructor office hours if they are offered on Saturdays from 11:30am-3:00pm?

The following tasks will not be checked off and your answers to the questions will not be collected.

2. If you do not already have one, obtain a Buff OneCard, needed for access to the laboratory. CAETE students not seeking a degree can obtain a guest card for \$5 for the semester.
3. Read the course syllabus and FAQ, available on the course web site.
4. Obtain a suitable lab notebook. Preferably, this should be a notebook with sewn-in pages. Put your name in the book. You should use this notebook for embedded system notes and designs during the semester. Document your work in ink and date each page as you use it. If you make mistakes, simply draw a line through the erroneous material and move on. Don't completely scratch out your mistakes—a simple line through the mistake is sufficient. Number the pages in your lab notebook from beginning to end. You may want to consider leaving the first page to use as a Table of Contents. You may find it helpful to tape photocopies of data sheets (including pinouts, etc.) in your notebook for later reference. During the course, document your discoveries and do your circuit designs and analysis work in the notebook. Your notebook does not have to be a work of art, but it does need to be legible. Capture ideas as you think of them—someday you may use your notebook to recall design details about your circuits. You may want to capture most of your notes on the right-hand pages, and use the left-hand pages for drawings, photocopies, etc. Your notebook is a good place to write down the URLs for web pages containing good embedded systems information.
5. Refer to <http://www.okindustries.com> (or http://www.cooperhandtools.com/brands/wire_wrap/) and learn about wire wrapping. Note that the wire connecting any two pins should have a small amount of slack, so that you can move the wire a little to aid in debugging if necessary; however, there shouldn't be too much slack, since it will make the circuit more electrically noisy and may be hard to debug. Note that when stripping wire wrap wire, at least 3/4" (about 2 cm) of bare wire should be showing.
6. Refer to <http://www.metcal.com/tips/sldrbase.html> and review the basics of soldering. There are various tech notes and hand soldering tips available at the <http://www.metcal.com> web site. Another interesting and detailed web site containing a basic soldering guide is: <http://www.epemag.wimborne.co.uk/solderfaq.htm>

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7. Read the specified pages in the course documentation (also available from the course web site):
 - "Siemens C501 Users Manual." Read sections 1–5. Skim the rest.
 - "Siemens C500 Architecture and Instruction Set." Read sections 1–3. Skim the rest.
 - "Siemens C501 Data Sheet." Skim pages 1–48.
 - C501 Errata sheet

Additional documents have been placed on the course web site:

<http://ece.colorado.edu/~mcclurel/index.html>

They contain similar information, but provide additional details you may find useful. Some of the Philips documents contain more detail and diagrams than the Siemens documents. Use them in addition to the above documents if you like.

- "Philips 80C51 Family...80C51 Family Architecture." pp. 1-15.
 - "Philips 80C51 8-bit Microcontroller Family Data Sheet." pp. 1–18, 22, 25, 26.
 - "Philips 80C51 Family...80C51 Family Hardware Description." pp. 1–24.
 - "Philips 80C51 Family...80C51 Family Programmer's Guide and Instruction Set." pp. 1–16.
8. If necessary, review your old course notes on digital logic, microprocessors, and circuits.
 9. What is the address space of the 8051?
 10. What is the purpose of the \overline{EA} pin on the 8051?
 11. What is the purpose of the ALE signal? How do you use this signal?
 12. What is the purpose of \overline{PSEN} ?
 13. In a system with external memory, for what purpose are ports P0 and P2 used?
 14. Does the stack grow toward higher or lower memory in the 8051?
 15. At what address is the reset vector located in the 8051? What constraint does this impose on the addition of external memory for an 8031 which does not have internal ROM?
 16. What interrupts are available on the 8051?
 17. What memory locations do the interrupt vectors occupy, and why do you think the vectors are spaced at 8-byte intervals?
 18. How many bytes of internal RAM are implemented in the 80C51? How about on the C501? Why is the inclusion of RAM on a microcontroller important?
 19. If the first instruction of my code was PUSH ACC (or PUSH A), what memory address would contain the pushed copy of the accumulator?
 20. For what purpose is DPTR used?
 21. If I wanted to combine the external program and external data memory into one addressing space, what would I have to do to the \overline{PSEN} and \overline{RD} control signals?
 22. In order to reset the processor, is it necessary to supply a logic high or a logic low voltage to the reset pin? Why is a reset signal required? What is the minimum voltage required on the RST pin to hold the processor in reset? What is the purpose of the diffused resistor inside the processor?
 23. Review RC circuits. Now design an appropriate power on reset circuit for the 8051. Be prepared to discuss the nuances of this circuit in depth. How does the threshold of the RST pin input impact your design? How do the tolerances of resistors and capacitors impact your design? How does the tolerance of the power supply impact your design?