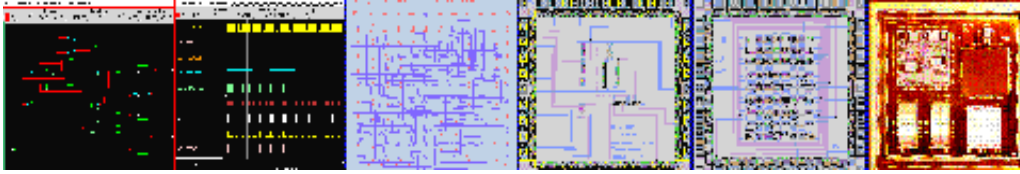


ECE 651 -- Computer-Aided Design of VLSI Systems I



ECE 651 (Section# 48040) meets Tues/Thurs 2:10-3:25 p.m. in 510 Ferris Hall

Note: You may register on-line without taking ECE 551 or ECE 552 by contacting Julia Elkins at (jelkins@utk.edu) to obtain "override" permission.

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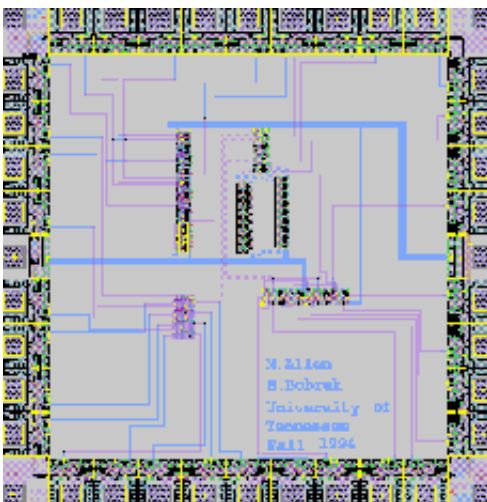
FAX: (865)-974-5483

Email: dbouldin@tennessee.edu

<http://www.eecs.utk.edu>

<http://www.eecs.utk.edu/people/faculty/emeritus/bouldin/>

<http://web.eecs.utk.edu/~bouldin/courses/651/overview.html>



Custom Layout

Projects will NOT be submitted to MOSIS for fabrication since this is now being done in ECE 433. This course

will present an introduction to the custom design of integrated circuits using computer-aided design software. Manual designs will be compared to those produced using [automated methods](#). Nanometer scale design issues including crosstalk and power will be discussed.

Goals of ECE 651:

- To understand the principles of hierarchical design of digital VLSI systems.
 - To utilize CAD tools to explore design alternatives and enhance productivity.
 - To experience the above goals through practical homework assignments implementing custom integrated circuits.
-

What's New ?

Accessing a Remote Host (Putty & Xming)

Syllabus

Students

PROTECTED WEBSITE

Our Text (Publisher)

Website for Our Text

Our CAD Tools Text (Publisher)

Course Overview (pdf)

Overview Slides (color pdf)

Overview Slides (handout b/w pdf)

Homework 1 - LOGIN, EMAIL and WEB PAGE

Homework 2 -- Custom Cell Layout

Homework 3 -- Designing an 8-bit Adder Datapath

Homework 4 -- Loading Effects and Sizing Transistors

[Homework 5 -- Design, Verification and Installation of a Standard-height Cell](#)

[Homework 6 -- Implementing a Macro](#)

[Homework 7 -- Designing a Custom Analog Circuit](#)

[Homework 8 -- Automatic Leafcell Generation](#)

[Homework 9 -- Floorplanning and Clock Tree Synthesis](#)

[Homework 10 -- Using Nanosim](#)

[Homework 11 -- Signal Integrity and Crosstalk Analysis](#)

[Homework Status](#)

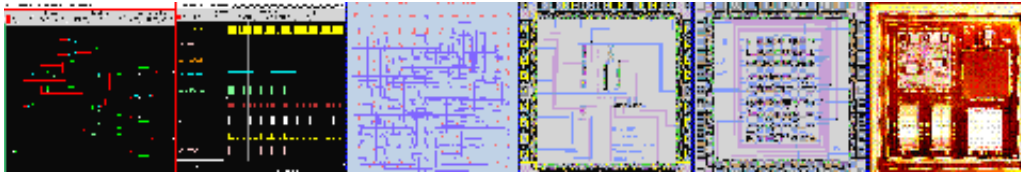
[Final Exam](#)

[Handouts](#)

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ECE 651 -- Syllabus -- Fall 2011

Revised 03/31/2011 by D. Bouldin



Tues/Thurs--2:10-3:25 p.m. in 510 FH

Session	Date	Topic
01	08/18/Thu	Introduction to VLSI Systems
02	08/23/Tue	HW1 ; CMOS Modeling; Harris#0 ; Harris#24
03	08/25/Thu	Basic Logic Circuits ; Harris#3
04	08/30/Tue	Custom Layout; HW2
05	09/01/Thu	Leaf Cell Design Flow
06	09/06/Tue	Pre-Layout & Post-Layout Simulation; Harris#8
07	09/08/Thu	Rules for Datapath Cells; HW3
08	09/13/Tue	Loading and Wiring Delays; Harris#5 ; Harris#6 HW4
09	09/15/Thu	Rules for Standard-height Cells; HW5
10	09/20/Tue	P&R; Soft Macros; Cell Characterization ; HW6
11	09/22/Thu	Leafcell Generators; HW8
12	09/27/Tue	No Class (miss# 1)
--	09/29/Thu	No Class (Fall Break)
13	10/04/Tue	Place & Route
14	10/06/Thu	Physical Synthesis
15	10/11/Tue	IP Patents
16	10/13/Thu	Domino Logic; Harris#10 ; Metastability
17	10/18/Tue	Staged Driving; Harris#6 ; Clock Tree Synthesis ; clock-tree ; HW9
18	10/20/Thu	Latchup and ESD
19	10/25/Tue	Using Nanosim ; HW10
20	10/27/Thu	Static Timing Analysis
21	11/01/Tue	Signal Integrity ; HW11
22	11/03/Thu	System-on-Chip Design ; SystemC ; SystemVerilog
23	11/08/Tue	Analog Design ; Analog Issues ; HW7
24	11/10/Thu	SeamlessCVE ; Platform Express ; Px ; Trusted ICs ; Kill Switch
25	11/15/Tue	IC Careers (Carson Fischer) ; Beyond Moore's Law ; CMP ; 45-nm fab

26	11/17/Thu	Chartered ; Global Foundries ; ITRS ; Variability ; DFY ; RAZOR
27	11/22/Tue	No Class (miss# 2)
--	11/24/Thu	No Class (Thanksgiving)
28	11/29/Tue	No Class (miss# 3); All Homework Due 12/1/Thu-noon
29	12/05/???	Final Exam (2:45-4:45 p.m.)-->12/08/Thu (12:30-2:30 p.m.)

Grading:

- 75 % -- Homework
- 25 % -- Final Exam

Final Exam

No reference material or scratch paper may be used during the final exam which will cover the topics discussed in class.

Homework:

Students may consult others about possible solutions but may not copy from one another directly.

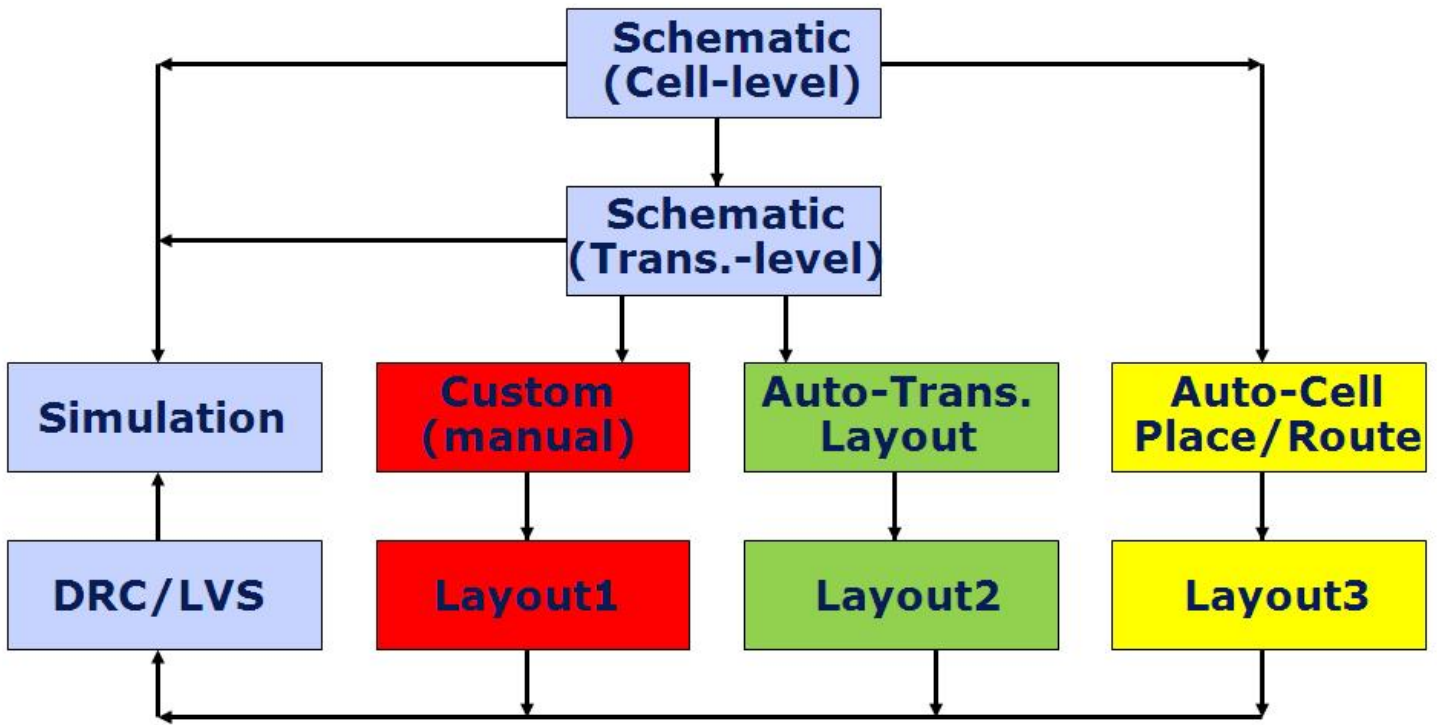
Late Work:

Each assignment is due at the beginning of class. Assigned work that is received late but within the subsequent 24 hours will be discounted 30%. Thereafter, each 24-hour period will necessitate an additional 10% penalty. Saturday and Sunday are considered one period. No work will be accepted after 12/01/Thursday at noon.

Incompletes:

I adhere strictly to this statement from the UTK catalog: "I" indicates that the student has done satisfactory work in the course, but because of circumstances beyond his control has been unable to finish all requirements. It is not to be given to enable a student to do additional work to bring up a deficient grade.

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Homework_1 - LOGIN, EMAIL and WEB PAGE

Revised 19 May 2011 by D. Bouldin



- Enter 501 Ferris and use your ECE login/passwd on one of the arc.eecs.utk.edu (0-19) machines or [setup your PC to login remotely](#).

Login to any of the following machines:

ada7.eecs.utk.edu
ada8.eecs.utk.edu
ada9.eecs.utk.edu

I. UNIX FUNDAMENTALS

- To change directory to an existing directory: *cd dir1*
- To change directory to the next level up the tree: *cd ..*
- To list the contents of the current directory: *ls*
- To make a new subdirectory: *mkdir dir3*
- To move an old filename to a new filename: *mv old_file new_file*
- To move file3 down into dir2: *mv file3 dir2*
- To move file3 up one level of the directory tree: *mv file3 ..*
- To copy file1 from directory /usr/cad to the current directory denoted by ".": *cp /usr/cad/file1 .*
- To remove a file: *rm file1*
- To remove a subdirectory and recursively everything below it in the tree: *rm -r dir2*
- To view more of a file one page at a time: *more file*

Press *spacebar* to continue to the next page.

Press *q* to quit.

Press *b* to go back a page.

Commonly Used UNIX Commands

II. E-MAIL FORWARDING & FUNDAMENTALS

I recommend you create a `.forward` file in your root directory to point to the machine you like to use to read your email.

For example,

```
.forward
```

```
dbouldin@utk.edu
```

III. EMAIL YOUR PARAGRAPH and CREATE a .PLAN FILE

- Use an editor (`gedit`, `vi` or `emacs`; not `WORD`) to write a 100-word paragraph on why you are taking this course and what you expect to gain from it.
- Email a typo-free version of your personal paragraph to "`dbouldin@tennessee.edu`".
- Use an editor to create a `".plan"` file that you can place in your root directory containing the following information.

Name:

Address:

Phone Number:

Course:

Anticipated Graduation Term:

M.S. or Ph.D. Thesis Topic:

M.S. or Ph.D. Thesis Advisor:

Assistantship:

Employer:

Then, whenever anyone types "`finger yourusername`", this information can be accessed. Try typing "`finger bouldin`".

IV. MAKE YOUR OWN WEB PAGES

First, go to your root directory and type:

```
mkdir webhome
```

```
cd webhome
```

```
cp ~/bouldin/webhome/551.html .
```


Then edit 551.html as required (note 551/651).

Your page should include items like those in your .plan file and in your Home work 1 paragraph on why you are taking this course. Please keep everything on this page formal. You may link your home page to other pages and then put whatever you wish.

Ask another student in the class to check what you have done by accessing:

<http://web.eecs.utk.edu/~username/551.html>

where "username" is your own.

For example:

<http://web.eecs.utk.edu/~bouldin/551.html>

Scott Fields

You should also create a protected website that requires a username and password to access. It is intended for material that only you and I need to see and not other students.

To create yours,

(1) Edit your public page to point to the private page

cd ~your_username/webhome

gedit 551.html

INSERT: a href="protected/551/index.html">PROTECTED WEBSITE

(2) Create a protected subdirectory and one below that for for the private material

mkdir protected

chmod 705 protected

cd protected

(3) In the protected subdirectory, create .htaccess and .htpasswd files

CONTENTS of .htaccess:

```
AuthType Basic
AuthName authorization
AuthUserFile /home/your_username/webhome/protected/.htpasswd
AuthGroupFile /dev/null
```

```
require user your_username
```

```
require user bouldin
```

CONTENTS of .htpasswd:

```
bouldin:byaShdv/TCtEE
your_username:goxLFUKzdrvsk
```

(4) Edit "your_username" to be your own and replace the temporary password I have for you with one of your choosing.

To generate a password, type:

```
perl -e 'print crypt("govolsgo","go");'
```

The following will be printed on the screen:

```
goxLFUKzdrvsk
```

**In general, you type: `perl -e 'print crypt("password","salt");'`
where password is obvious and salt is a 2 character string.**

```
mkdir 551
```

(5) Move to that subdirectory and create a index.html file

```
cd 551
```

```
gedit index.html
```

(6) Put restricted material in the subdirectory and add links in the index.html file.

(7) Test the access by using Firefox or Internet-Explorer.

Open the public page. Click on the PROTECTED link.

A pop-up dialog box should ask you for your username and password.

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