The Point

- Successful transition from UG to PhD or thesis MS student requires a fundamental attitude adjustment
  - In contrast: Course-based MS can largely be viewed as an extension of UG education
The Point Continued

- Undergrad degree is about learning known material
- Grad degree is about...
  - Learning how to create and communicate new knowledge
    - Dirty secret: We cannot directly teach either of these
  - Becoming an expert in your area
    - By halfway through you should be teaching your advisor new things
What is Research?

- Like pornography: Hard to define, but you know it when you see it
- Like a patented invention: Should be new, useful, non-obvious
- Characteristics of a research problem
  - Answer will advance the state of the art
  - Chance of failure
  - More than implementation
How to Fail in Grad School

- Focus only on course work
  - It worked as an undergrad, right?
- Totally blow off course work
- Use your brilliance as a crutch
  - The smarter you are, the later you learn how to work hard
  - Nobody gets a PhD without working hard
How to Fail in Grad School

- Don’t ask for help...
  - Assume people know what you’re doing
  - Assume you are expected to know everything already
- Don’t listen when people give you advice
- Do all your work from home
Succeeding in Grad School

- Attack problems like a two year old
  - Play with things fearlessly and relentlessly
  - Don’t worry about breaking them
  - Just do it – do not give up

- Find an advisor who’s right for you

- Learn basic science
  - Statistics and experiment design

- Pick up the necessary math and CS theory on the way
Succeeding in Grad School

◆ Balanced time management
  ➢ Research, classes, TAing, etc…

◆ Be present and engaged
  ➢ Be part of the grad student culture

◆ Be proactive and persistent
  ➢ 1% inspiration, 99% perspiration
  ➢ “You only need a good idea about every two years”
Succeeding in Grad School

◆ Read a lot
  Ø But not too much

◆ Write a lot
  Ø Write earlier rather than later
    Ø Writing kills bad ideas
    Ø Writing helps good ideas develop
  Ø Impossible to write too much
  Ø Sooner or later you’ll need to become a good technical writer
Finding an Advisor

- One of the most important decisions you’ll make here

- Questions
  - Are you interested in the research?
  - Are your styles compatible?
  - Do you want a new professor or an established one?
  - Do you want a big research group or a small one?
Finding an Advisor

◆ How to answer the questions?
  1. Surf the web, read papers
  2. Talk to students and professors
  3. Go to prospective advisors’ research meetings
    - Start now

◆ Should find an advisor this year
  - Preferably this Fall

◆ What if it doesn’t work out?
Changing Advisors

◆ Don’t be too stressed, it happens
◆ However:
  ➢ Make honest effort to explore all options before switching
  ➢ Communicate clearly with everyone involved
  ➢ Avoid burning bridges
  ➢ Should rarely happen more than once
The Implicit Contract

- Unwritten two-sided agreement that is the basis for all good student-advisor relationships

- Breach of contract – on either side – may be grounds for terminating the relationship
Your Advisor Must...

◆ Advise you
◆ Teach you how to do research in your area
◆ Teach you how to write papers
◆ Protect you from funding concerns (within reason)
◆ Help you find an interesting and relevant thesis topic
Your Advisor Must...

- Be your advocate to the department
- Eventually
  - Let you give conference talks
  - Introduce you to your research community
  - Write letters of recommendation for you
You Must...

◆ Be a good investment in terms of time and money
  ➢ Be present, visible, and willing to learn
  ➢ Learn and work independently
  ➢ Get stuff done
  ➢ Learn to publish results
  ➢ Support the group’s research

◆ Jump through some hoops
What is a Thesis?

- A statement that can be proved or disproved
- A document that does this
- You are here to produce these
What is NOT a Thesis?

- A question
- An algorithm
- A non-falsifiable statement
- A collection of experiments
- A program
- A piece of hardware
Finding a Thesis Topic

- Probably the hardest part of grad school

- Needs to be
  - A new idea (Ph.D.)
  - A good idea
  - Right level of difficulty
    - Doable by you
    - In the next 18 months (Ph.D.)

- Remember: It’s not your life’s work
Finding a Thesis Topic

- Should be a reasonably hot topic
  - You don’t want to give job talk based on stuff nobody is interested in, or thinks is important
  - Perfect topic: Area will be hotter in 5 years than it is now
- You better be excited about it when you start
  - You’ll be sick of it by the time you’re finished
Finding a Topic: Hamming’s Razor

- What are you working on?
- What’s the most important open problem in your area?
- Why aren’t they the same? (Ouch!)
What is a Dissertation?

- Existence proof that you can do research
- $2 \pm 0.5$ years of hard work
  - Necessary but not sufficient
- Whatever you can get five professors to sign
- Like getting a driver’s license:
  - If you pass the exam nobody cares what your score was
Time Management

- Research – this is what you’re primarily here for
- Classes – can’t screw these up
- TA duties – can’t screw these up
- Service to your group
  - Think of it as a tax
- Service to the department
  - Somewhat optional
Coding in Grad School

- Code only to support a research goal
  - Except for classes or for fun
- Don’t tune for performance unless it really matters
- Don’t act like a professional programmer – you’re not being paid enough
Coding in Grad School

- Do learn a language that supports rapid prototyping
  - Perl, Python, Scheme, or whatever

- Do learn professional paranoia
  - Code producing numbers for publication better not be wrong
    - Understand the algorithms
    - Test code creatively: Use code reviews, unit tests, test harnesses, randomized testing, etc.
Reading List

- *The Dream Machine* – Waldrop
- *The Mythical Man Month* – Brooks
- *Hackers* – Levy
- *Elements of Style* – Strunk and White
- *The Visual Display of Quantitative Information* – Tufte
Conclusion

◆ You arrive as a student, leave as a colleague
◆ Many people enjoy grad school
  ➢ Try to be one of them
  ➢ SLC has unparalleled access to outdoor recreation