MS vs. PhD

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• From: St. Thomas, USVI
• Education:
  • BS Carnegie Mellon
  • PhD Princeton
• Now: Associate Professor, Northwestern
• Research:
  • Computer Architecture (Power/Reliability Aware Systems)
• Fun:
  • Running (Nine Marathons)
  • Golf
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• Originally from Chile
• Current role
  • Distinguished Researcher, Senior Manager
    IBM TJ Watson Research Center, NY
  • Recent completed project: IBM Summit and Sierra supercomputers
    (#1, #2 in Top500)
  • Current focus: Cloud Infrastructure
• Previously (although long ago ..)
  • Faculty Member, University of Concepcion, Chile
• Computer Science, PhD, MS, UCLA
• Electrical Engineer, University of Concepcion, Chile
INTRODUCTION
Who is in the audience?

• How many currently in Master Degree program?
  • Course or Thesis program?
• How many currently in PhD program?
• What type of University?
  • **Research Universities:** PhD program – emphasize research, but teaching and service important
  • **Colleges/Universities:** MS program – emphasize teaching, research and service also important
  • **Selective Liberal Arts Colleges:** BS program -- emphasize teaching with research a close second, but service important
  • **Teaching-Oriented Colleges:** BS program – emphasize teaching and service but research can be expected
Revisiting Career Choices

Nearing the end of your first year of graduate school, you may have some questions to ask yourself:

• Are you in the best program for you?
• You’ve had a year under your belt, ask yourself:
  • What do I want from the graduate school experience?
    • Likes?
    • Dislikes?
  • What do you want as a future career path?

• If not, then how do you get to your preferred track?
  • An opportunity to course correct
Exercise: Turn And Talk To Your Neighbor

A. What is your plan? MS or PhD?

B. What do you want from the graduate school experience?
   - Likes?
   - Dislikes?

C. What do you want as your future career path?
CAREER PATHS FOR MS AND PHD
Graduate School Paths

**MS Course-based**

- Job: Industry Development/Business/Lab/Startup/…

**MS Thesis Project**

- Choose Advisor
- Thesis Proposal
- Qualifying Exams
- Submit Papers
- Write Dissertation
- Job Hunt

**PhD coursework**

- To Dissertation

**PhD is development of new knowledge**
- At end of PhD, you are the expert in your dissertation topic area!

**All choices are valid**

- MS is practice of new knowledge
- PhD is development of new knowledge
Program Comparison

<table>
<thead>
<tr>
<th>Educational Goals</th>
<th>Course-based MS</th>
<th>Research MS</th>
<th>PhD</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>• Acquire knowledge via coursework and internships</td>
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</tr>
<tr>
<td></td>
<td></td>
<td>• Acquire research skills (thesis) • Get taste of research or advanced development</td>
<td>• Do original research • Achieve expert-level knowledge</td>
</tr>
<tr>
<td>Program</td>
<td>• Short duration • Courses deeper than undergraduate</td>
<td>• Short duration • Courses deeper than undergraduate</td>
<td>• Long process • Become capable of doing independent research</td>
</tr>
<tr>
<td></td>
<td>• Become capable of technology and/or business development</td>
<td>• Become capable of technology and/or business development</td>
<td>• Expected to publish in conferences and journals</td>
</tr>
<tr>
<td></td>
<td></td>
<td>• Introduction to research or advanced development</td>
<td></td>
</tr>
</tbody>
</table>
# Professional Ladder – Entry Level

<table>
<thead>
<tr>
<th>Entry Level</th>
<th>Contribution and Impact</th>
<th>Expertise</th>
</tr>
</thead>
<tbody>
<tr>
<td>PhD</td>
<td>Assistant Professor</td>
<td>Teaching undergrad and graduate Join other faculty on research projects Develop own research line</td>
</tr>
<tr>
<td>PhD</td>
<td>Research Scientist</td>
<td>Team Member / Leader in advanced research project or product</td>
</tr>
<tr>
<td>MS</td>
<td>Advisory Engineer</td>
<td>Team Member / Leader in a product/project</td>
</tr>
<tr>
<td>BS</td>
<td>Engineer</td>
<td>Team Member in a product/project</td>
</tr>
</tbody>
</table>
### Entry-Level Career Opportunities

#### MS Degree
- **Types of Jobs**
  - Operations and IT type jobs
  - Product or application development
  - Research support (contribute to prototyping and publications)
- **Employers**
  - Information Technology (IT) companies
  - Companies in other industries
  - Startup companies
  - Universities and Labs (support roles)

#### PhD Degree
- **Types of Jobs**
  - Academic research and teaching in a university as a professor
  - Research or advanced development in industrial research labs
  - Development leadership roles in industry
  - Technical project management/leadership
- **Employers**
  - Same as MS employers
MS Opportunities: Course-based vs. Research-based

**Course-based MS**
- Team member in development project
  - Industry, laboratory, start-up
- May also qualify for marketing, project management roles
  - If that is of interest, beneficial to take some business classes!

**Research MS**
- Team member in development project
  - Industry, laboratory, start-up
- MS project may qualify you for more interesting development roles
- More attractive for a research lab position
- Thesis should help with publications
# Professional Ladder – Long Term

<table>
<thead>
<tr>
<th>Career Level</th>
<th>Contribution</th>
<th>Expertise/Impact</th>
</tr>
</thead>
<tbody>
<tr>
<td>Associate Professor</td>
<td>Teaching undergrad and graduate&lt;br&gt;Lead own research line&lt;br&gt;Strong publication record</td>
<td>Leader in academic community&lt;br&gt;Expert in area of contribution</td>
</tr>
<tr>
<td>Full Professor</td>
<td>Beyond Associate Professor</td>
<td>Leader in broad community&lt;br&gt;Renowned leader in area of expertise</td>
</tr>
<tr>
<td>Senior Researcher or Engineer</td>
<td>Leader in development projects (research or technology)</td>
<td>Project-wise expert&lt;br&gt;Impacts a project or product</td>
</tr>
<tr>
<td>Distinguished Researcher or Engineer</td>
<td>Leader in developing large successful projects (research or technology)</td>
<td>Technical authority, impacts a large project or new product</td>
</tr>
<tr>
<td>Fellow, Senior Fellow</td>
<td>Leader in developing successful product lines or technologies</td>
<td>Top technical leader in broad industry&lt;br&gt;Technical visionary</td>
</tr>
<tr>
<td>Director of Product or Business Development</td>
<td>Develop new or drive existing business lines</td>
<td>Product or Business expert&lt;br&gt;Impacts business lines</td>
</tr>
<tr>
<td>VP of Product or Business Development</td>
<td>Strategic direction for new or existing business lines</td>
<td>Product or Business expert&lt;br&gt;Impacts broad business lines</td>
</tr>
<tr>
<td>CEO/CTO</td>
<td>Business or technical leader, strategic decision maker</td>
<td>Business and technical strategy, visionary</td>
</tr>
<tr>
<td></td>
<td>Industry</td>
<td>Academia</td>
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</table>
| **Research** | • Engage in scientific discovery, collaborate with peers, seek funding for research (but typically later in career, possibly internal funding)  
               • May involve university faculty and students  
               • Develop creative thinking about technical solutions to problems | • Engage in scientific discovery, involve graduate and undergraduate students  
               • Secure funding for research                                                      |
| **Tech Transfer** | • Contribute to company’s products, client engagement, open source, intellectual property (patents)  
                           • Develop new products  
                           • Demonstrate strong problem-solving skill  
                           • Publish work and engage with academia | • Active teaching, mentoring, advising  
                           • Consultants to industry                                                               |
| **Service**   | • Departmental, Company–wide committees: hiring, engagement, promotion, mentoring, ..  
                           • Professional: conference committees, organizations | • Departmental, University-wide  
                           • Professional: conference committees, organizations                                   |
FINANCIAL ASPECTS
Financing Your Degree

**MS: Generally self-supported**
- Most programs: student finances studies
- Other options:
  - Fellowships (internal/external), student loans
  - Employer sponsorship (full/partial)

**PhD: Generally fully funded by university**
- Support for students in “good academic standing”
  - Maintain GPA, Find advisor, Pass qualifying exams, Make research progress
- Mixture of fellowship (internal/external), research assistantship (grants), teaching assistantship (departmental)
Financial support for PhD program

Research Assistantship: Work on research project (hopefully aligned with your thesis), funded by external agency...need to show results!

Teaching Assistantship: Work as teaching staff (grade, help students, occasionally lecture), funded by department/university...need to juggle teaching with your own work.

Fellowship (Internal/External): Recognition of your academic potential (research/courses)...no other commitments, although used by industry to identify candidates

Most students will use a mixture of these funding sources at various points
PhD Fellowships

• Even if advisor has plenty of research funding, should apply for fellowships whenever possible:
  • Gives more freedom (choose advisor or topic)
  • Exposes you to people in the funding agency
  • Upgrades your Resume
  • May come with other perks (e.g. internship)

• Where to apply? Look high and low:
  • Government: National Science Foundation (NSF), Department of Energy (DOE), …
  • Major corporations: Google, Facebook, IBM, Intel, Microsoft, …
  • Others: Ford Foundation, GEM, Hertz, …
PERSPECTIVES ON MASTER PROGRAM
The Gartner Hype Cycle for New Products

- Peak of Inflated Expectations
- Plateau of Productivity
- Slope of Enlightenment
- Trough of Disillusionment
- Technology Trigger
The MS Cycle

- Graduation time – “I’m at the top”
- Reached level of professional satisfaction
  Now is time to move up and grow !!
- Being here for a little while, this is cool..!!
- Still without a job, or not the job wished for

Joined MS program

TIME

CRA-WP
Computing Research Association
Widening Participation
PERSPECTIVES ON PHD PROGRAM
Experience of the PhD

Pick Advisor and move into doing research

Hold on!

First paper submission

Qualifying exams

Ups and Downs
- Thesis research
- Submit papers
- Write dissertation
- Job hunt
Lessons from the PhD Roller Coaster

• The ride is similar for most people
  • You are qualified for the ride. It’s scary for everyone!
  • You aren’t alone. Share your experiences!

• It takes externally applied energy for the uphills
  • Your advisor will be a key person (later session on this)
  • Seek support from many sources (technical, emotional)

• There are a lot of downhill sections
  • Frustration and doubt are guaranteed...
  • Things can/will go wrong!

• Momentum is important
  • Keep moving forward!
  • No side trips to distract!
Academic Career Ladder

• Professorial Ranks
  • Assistant: Tenure-track, 5-7 years
  • Associate: Usually with tenure (life-time appointment)
  • Full: University-level service expected
  • Chaired Professor: Endowed

• Administrative Ranks
  • Department Chair, Dean, Provost, President

• Instructor – teaching and service

• Postdoctoral/Research Associate – research
What can I do to prepare for a PhD job in industry?

• Complete a project(s)
  • Industry has shifted considerably to applied research

• Get an internship(s)
  • Try out a corporate culture, job type, industry
  • Find mentors/supporters of your career
  • Publish your work with co-authors

• Acquire key skills
  • Build your professional network, communications, negotiation, making yourself visible

• Check your competition
  • Who is graduating soon in your field from other (top) schools?
  • Who works at this company?
What can I do now to prepare for an academic job?

• Research
  • Apprenticeship: learn from advisor, doing it, and others
  • Excel in research (especially if you want to land at R1 university)
  • Grant writing (ask your advisor for old proposals)
  • Corporate connections for funding, student job placement
  • Take Post-doc position (more apprenticeship while you build your CV)

• Teaching
  • Teaching experience, teaching assistantship, teach some even if you don’t have to
  • Professor-in-training programs, course

• Service
  • Engage in student organization/support groups
  • Working on department committees
  • Volunteering at conferences
Moving Between Industry and Academia

From University to Industry

• Experience in developing IT systems, solutions, applications, etc.

• Visibility and knowledge throughout industry

From Industry to University

• Strong publications record

• Visibility in research community

• Leader of recognized projects or products

• Experience in securing external funding, managing large projects