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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Jaime H Moreno – jhmoreno@us.ibm.com

- 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

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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

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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

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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?

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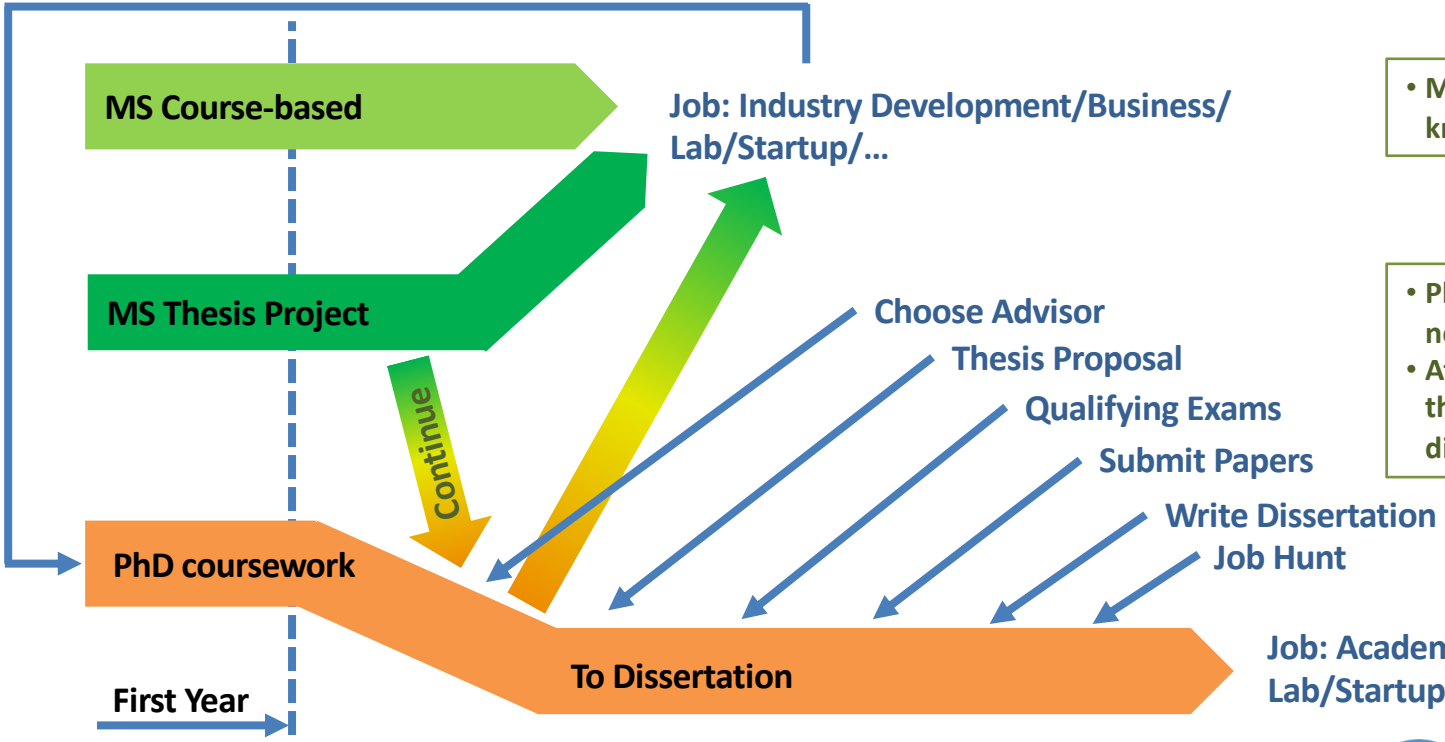
CAREER PATHS FOR MS AND PHD

Graduate School Paths



- MS is practice of new knowledge

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

All choices are valid

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Program Comparison

	Course-based MS	Research MS	PhD
Educational Goals	• Acquire knowledge via coursework and internships	• Acquire knowledge via coursework and internships • Acquire research skills (thesis) • Get taste of research or advanced development	• Acquire knowledge via coursework and internships • Do original research • Achieve expert-level knowledge
Program	• Short duration • Courses deeper than undergraduate • Become capable of technology and/or business development	• Short duration • Courses deeper than undergraduate • Become capable of technology and/or business development • Introduction to research or advanced development	• Long process • Become capable of doing independent research • Expected to publish in conferences and journals

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Professional Ladder – Entry Level

	Entry Level	Contribution and Impact	Expertise
PhD	Assistant Professor	Teaching undergrad and graduate Join other faculty on research projects Develop own research line	Expert in area of contribution
PhD	Research Scientist	Team Member / Leader in advanced research project or product	Expert in area of contribution
MS	Advisory Engineer	Team Member / Leader in a product/project	Advanced knowledge and development skills in one area of contribution
BS	Engineer	Team Member in a product/project	Working knowledge and development skills in one area of contribution

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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

	Career Level	Contribution	Expertise/Impact
PhD	Associate Professor	Teaching undergrad and graduate Lead own research line Strong publication record	Leader in academic community Expert in area of contribution
PhD	Full Professor	Beyond Associate Professor	Leader in broad community Renowned leader in area of expertise
PhD, MS	Senior Researcher or Engineer	Leader in development projects (research or technology)	Project-wise expert Impacts a project or product
PhD, MS	Distinguished Researcher or Engineer	Leader in developing large successful projects (research or technology)	Technical authority, impacts a large project or new product
PhD, MS	Fellow, Senior Fellow	Leader in developing successful product lines or technologies	Top technical leader in broad industry Technical visionary
PhD, MS	Director of Product or Business Development	Develop new or drive existing business lines	Product or Business expert Impacts business lines
PhD, MS	VP of Product or Business Development	Strategic direction for new or existing business lines	Product or Business expert Impacts broad business lines
PhD, MS	CEO/CTO	Business or technical leader, strategic decision maker	Business and technical strategy, visionary

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Research and Academia Impact

	Industry	Academia
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

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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

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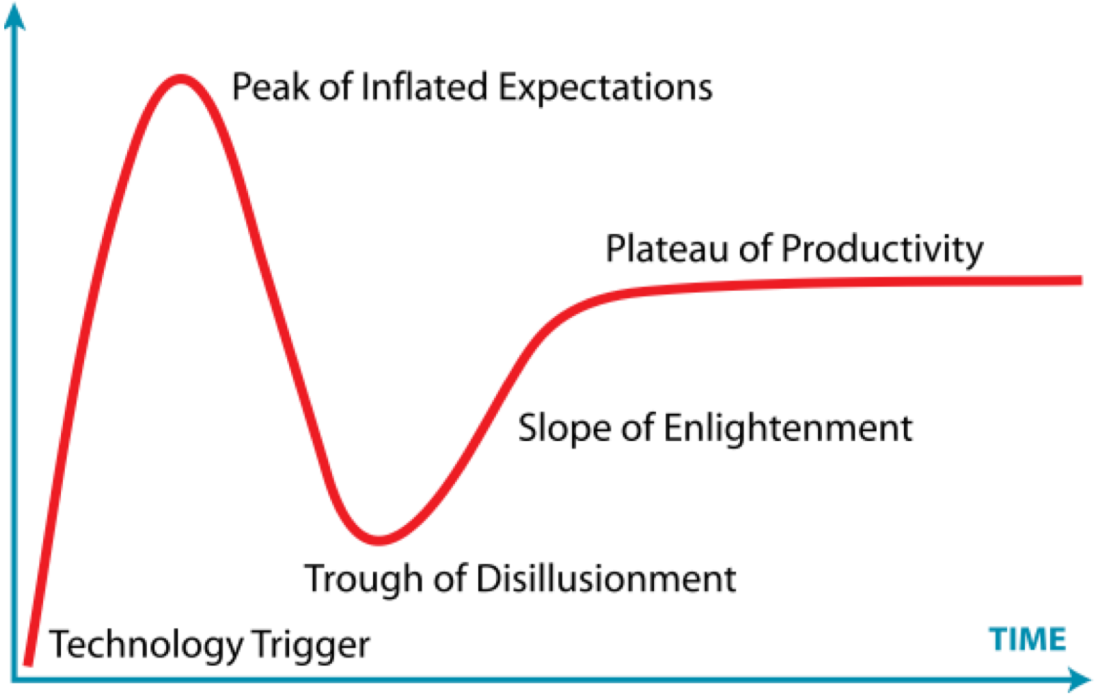
PhD Fellowships

- 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



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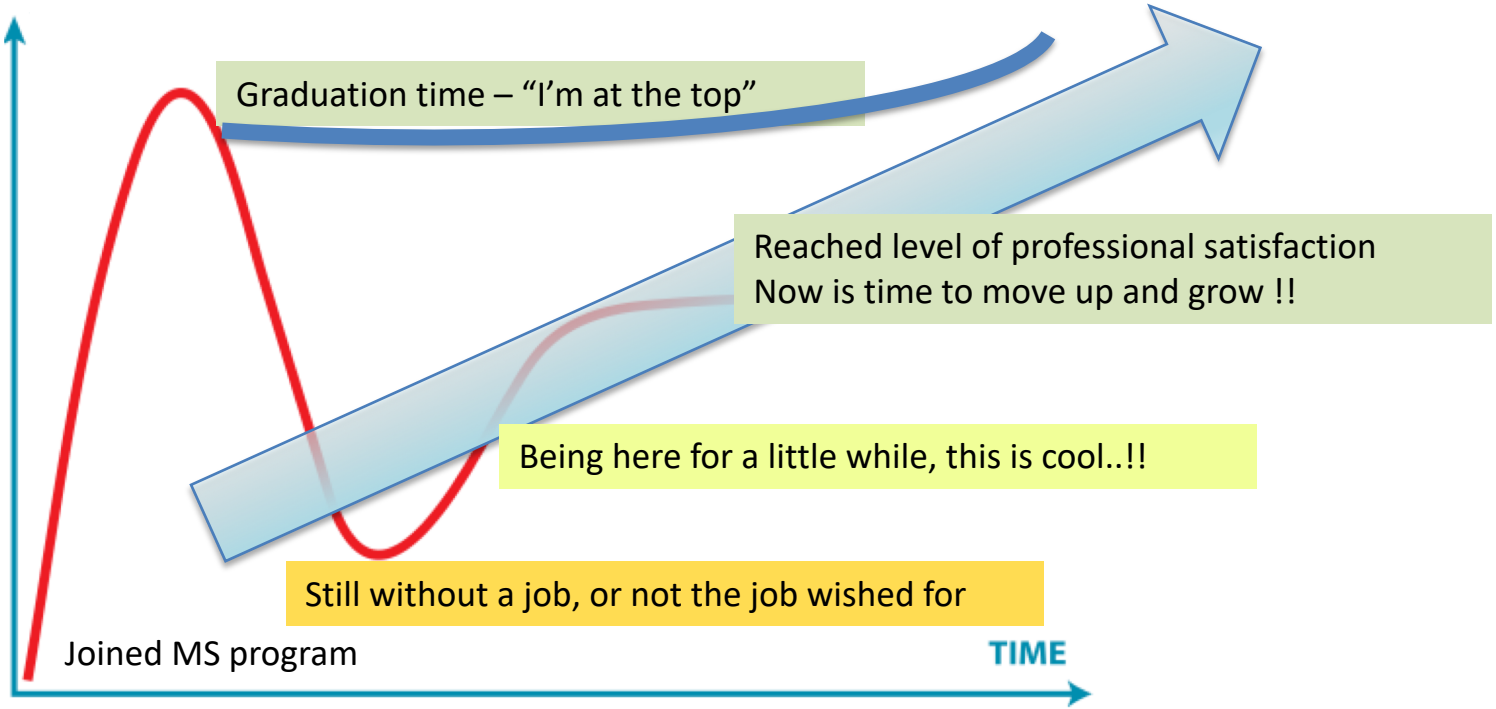
The MS Cycle



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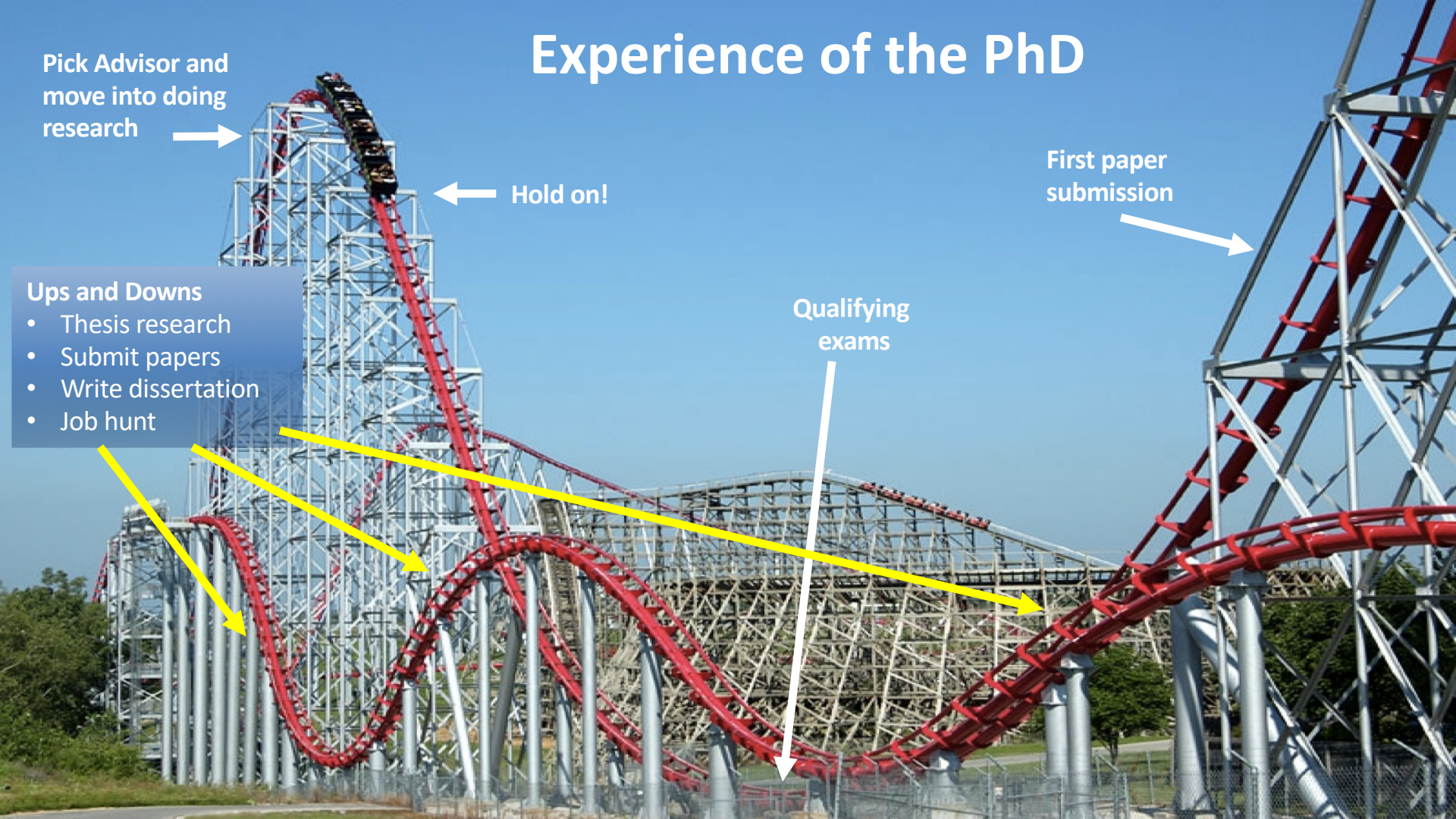
PERSPECTIVES ON PHD PROGRAM

Experience of the PhD



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!

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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?

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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

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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

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