Masters vs. PhD

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2019 CRA URMD Grad Cohort Workshop

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Who am I?

Russ Joseph

From: St. Thomas, USVI

Education:

- BS Carnegie Mellon
- PhD Princeton

Now: Associate Professor, Northwestern

Research:

- Computer Architecture (Power/Reliability Aware Systems)

Fun:

- Running (Eight Marathons)
- Golf

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Revisiting Choices

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

- Am I in the best program for me?
- You've had a year under your belt, ask yourself:
  - What do I want from the graduate school experience?
    - Likes?
    - Dislikes?
  - What do I want as a future career path?
- If not, then how do I get to my 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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Who's in the audience?

How many currently in master's programs?

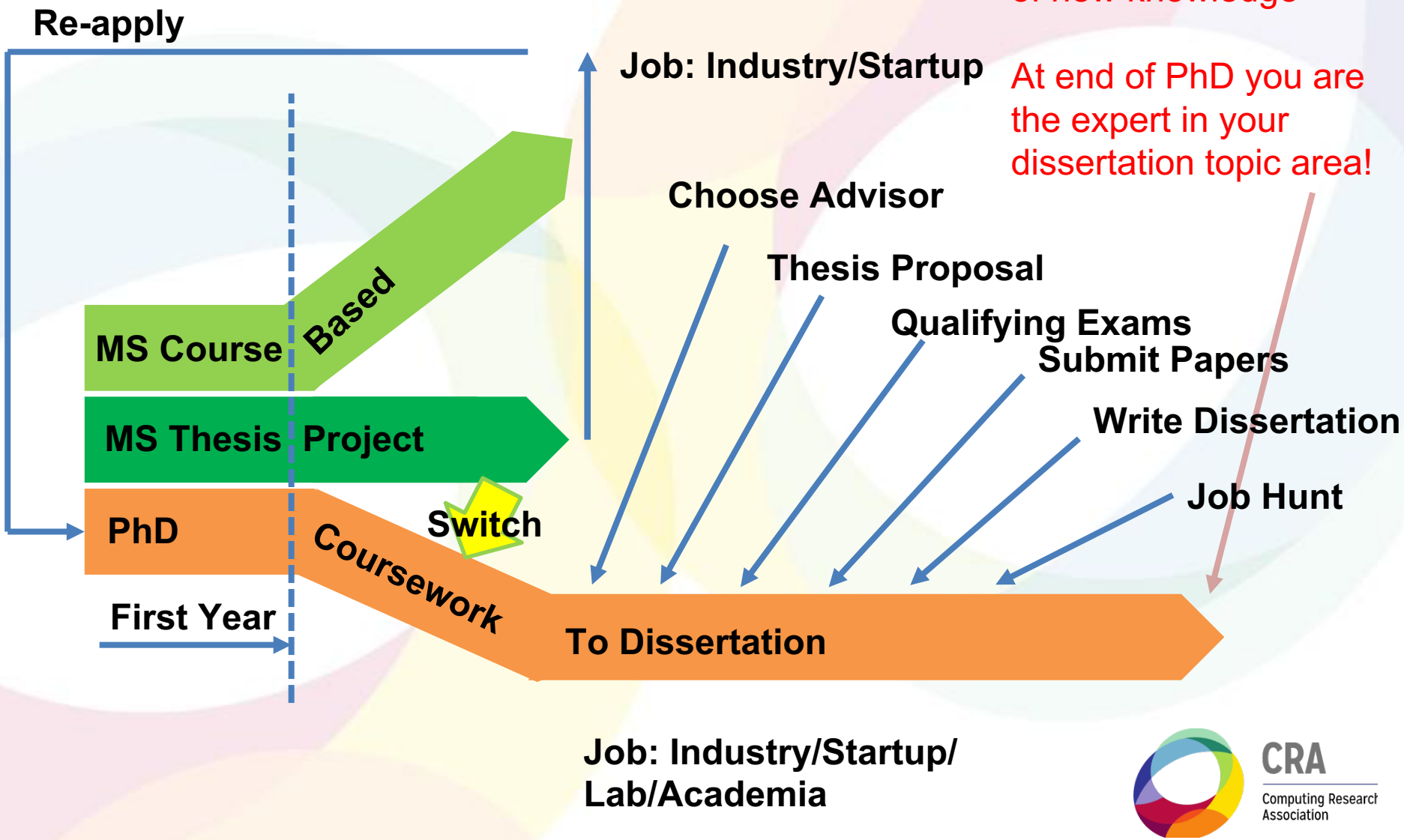
- Course masters?
- Thesis masters?

How many in PhD programs?

Grad School Paths

Research is production of new knowledge

At end of PhD you are the expert in your dissertation topic area!



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Program Comparison

	Course Based MS	Research MS	PhD
Educational Goals	• Acquire knowledge via coursework	• Acquire depth & project skills (thesis) • Get taste of research	• Do original high-impact research • Learn skills for more research • Expert-level knowledge
Program	• Courses are more deep • Short time (job hunt) • Networking opportunities	• Research is not as deep as PhD • Shorter commitment • Less publications/impact	• Long process

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Paying For Your Degree

PhD: Generally fully funded by university

- Support for students in “good academic standing”
  - Maintain GPA, Find advisor, Pass quals, Make research progress
- Mixture of fellowship (internal/external), research assistantship (grants), teaching assistantship (departmental)

MS: Generally student supported

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

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Financial support mechanisms

Research Assistantship: Work on research project (hopefully contributes to 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): Focus on your academics (research/courses)…no other commitments.

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Fellowships

- Even if your advisor has plenty of research funding…
- Apply for fellowships whenever you can:
  - Gives you more freedom
  - Upgrades your CV
  - 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, …
  - Other: Ford Foundation, GEM, Hertz

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MS: Course vs. Research

Course Masters

- Breadth of knowledge may qualify you for marketing, project management roles
- If that's what you want, take some business classes!
- Lack of major project may be handicap for development roles

Research Masters

- Deep project may qualify you for more interesting development roles
- Much more attractive for a research lab position
- Thesis will help with publications

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MS Career Opportunities

- Types of Jobs
  - Operations and IT type jobs (non-tech industry)
  - Product or application development
  - Research support (Contribute to prototyping and publications)
- Employers
  - Information Technology (IT) companies
  - Companies in other industries
  - Universities (Typically in support roles)

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PhD Career Opportunities

- Research or advanced development in industrial research labs
- Development leadership roles in industry
- Technical project management/leadership
- Academic research and teaching in a university as a professor

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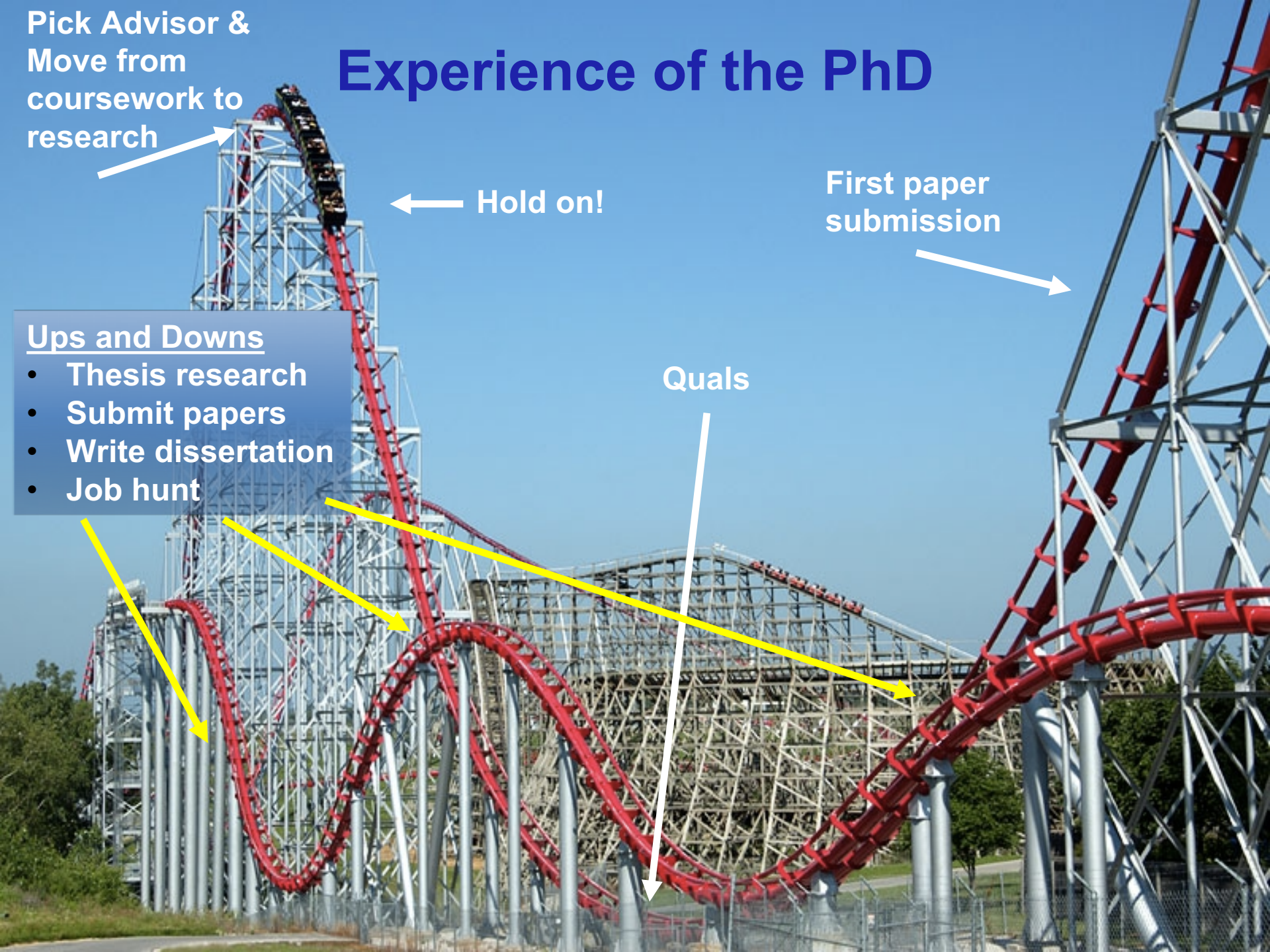
Pick Advisor & Move from coursework to research
Experience of the PhD
Hold on!
First paper submission
Ups and Downs
• Thesis research
• Submit papers
• Write dissertation
• Job hunt
Quals

Lessons from the 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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Technical Ladder Example

	Example Title	Contribution and Impact	Expertise
	Fellow/Senior Fellow	Multiple product lines or technologies	Top tech leadership impacts the industry
	Principal Engineer/Senior PE	Group product line or technology	Technical authority, impacts a business
	Senior Staff Engineer	Multiple products	Project-wise expert, Impacts a product
PhD →	Research Scientist	Product, Project Methods	Expert in area of contribution
MS →	Senior Engineer	Portion of a Product/Project	Working knowledge in one area of contribution
BS →	Engineer	Portion of a Product/Project	Working knowledge in one area of contribution

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Industry Career: Research and Industry Impact

- Research
  - Engage in scientific discovery, collaborate with peers, fund research (but typically later in career, possibly internal funding)
  - May involve university faculty and students
  - Develop creative thinking about technical solutions to problems
- Technology Transfer
  - Contribute to company's products, client engagement, open source, intellectual property…
  - Demonstrate strong problem-solving skills
  - Publish work and engage with academia
- Service
  - Departmental (hiring committee)
  - Company–wide (promotion review board)
  - Professional

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Academic Career: Research, Teaching, and Service

- Research
  - Engage in scientific discovery, involve graduate and undergraduate students, fund research
- Teaching
  - Active teaching, mentoring, advising
- Service
  - Departmental, University, Professional (External)

Expected to do all three well!

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Different Types of Colleges

- **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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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

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What can I do now to prepare for a 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
  - Grant writing
  - Corporate connections for funding, student job placement
- Teaching
  - Teaching experience, teaching assistantship, teach some evene if you don’t have to
  - Professor-in-training programs, course
- Service
  - Organizing student organization/support groups
  - Working on department committees
  - Volunteering at conferences

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Moving Between Research Lab and Academia

From University to Industry

- Must build real systems
- Establish visibility and knowledge in industry

From Industry to University

- Must continue publishing
- Establish visibility in research community

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The B. Algorithm!

```
if (I.LoveLoveLoveProgramming)
    PursueMasters(); // industry, entrepreneurship
    else (I.LikeProgramming && I.WantMoneyBefore30) {
     if (rand(0, 1.0) < 0.6)
          FinishBachelors();
    else
          PursueMasters();
    }
else if (I.LikeProgramming && I.BelieveTheTruthIsOutThere)
       PursuePhD(); /* research, tenure track, teaching,
    industry, labs, entrepreneurship */
else if (I.DontLikeProgramming) {
      FinishBachelors();
      BecomeASurfer();
}
```

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All Choices Are Valid

- People move in all sorts of directions

- Start PhD program – exit after Masters
- Masters – continue to PhD

- Figure out what you want and then get it!

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