

# How to Succeed as a Research-track Graduate Student

Cliff Shaffer

Department of Computer Science  
Virginia Tech  
Blacksburg, Virginia

Updated for Spring 2023

Updated for Spring 2023 1 / 22

Research-track Graduate Student

2022-11-25 CS 5014

How to Succeed  
as a Research-track Graduate Student  
Cliff Shaffer  
Department of Computer Science  
Virginia Tech  
Blacksburg, Virginia  
Updated for Spring 2023

## Title page

Who are you?

- First year
- Second year
- Been here more than 2 years

Do you plan to get a PhD degree from CS@VT?

2022-11-25 CS 5014

Why are YOU here?  
Certification  
Knowledge/expertise in content areas  
Other work skills  
Get what you need for certain types of jobs  
[Delay employment?]  
Do it in a timely manner

## └ Why are YOU here?

Each individual grad student has their own mix of reasons for being in grad school.

Updated for Spring 2023 2 / 22

Research-track Graduate Student

## Why are YOU here?

Certification

Knowledge/expertise in content areas

Other work skills

Get what you need for certain types of jobs

[Delay employment?]

Do it in a timely manner

2022-11-25 CS 5014

Why Virginia Tech?  
(Or similar "research" Department)?

## └ Why Virginia Tech?

Every PhD student takes their own idiosyncratic that to completion.

Completing the MS (with thesis) is always a sprint. So the path to success is more homogeneous.

Updated for Spring 2023 3 / 22

Research-track Graduate Student

## Why Virginia Tech?

(Or similar "research" Department)?

2022-11-25 CS 5014

Why do Research?  
Learn a set of work skills that you can't get from classes  
• Significant writing task  
• Independent/unstructured work task  
• Do something "real"  
It's the only way to get a PhD

## └ Why do Research?

At the Master's level, you do have a major choice: Coursework-only (for us, the Master of Engineering degree) vs. thesis track. Generally, the more background you have (i.e., CS undergraduate degree), the less that yet-more classes do for you and so the more that the soft skills learned from doing a thesis benefit you.

Updated for Spring 2023 4 / 22

Research-track Graduate Student

## Why do Research?

Learn a set of work skills that you can't get from classes

- Significant writing task
- Independent/unstructured work task
- Do something "real"

It's the only way to get a PhD

# What do CS PhDs do?

- 58% Industry
- 10% Other (Government, etc.)
- 32% Academia

- 58% Industry
- 10% Other (Government, etc.)
- 32% Academia

## └─What do CS PhDs do?

Unlike in some disciplines, PhDs have a broad set of career paths.

# What is Your Most Important Job in Graduate School?

GRADUATE!!

A key concern with doing a research degree:

- When will it end?

GRADUATE!!

A key concern with doing a research degree:

- When will it end?

## └─What is Your Most Important Job in Graduate School?

no notes

# Faculty Effects on Timely Graduation

Faculty do **not** want to keep you here as a perpetual slaves.

Faculty **do** have many conflicting demands on their time that might make them inattentive to your progress.

Faculty do **not** necessarily have good management skills.

Students should be proactive in fostering good management practice by their supervising faculty.

- Frequent meetings
- Make progress through a series of short-term milestones
- Clear schedules, clear responsibilities and goals

Faculty do **not** want to keep you here as a perpetual slaves.

Faculty **do** have many conflicting demands on their time that might make them inattentive to your progress.

Faculty do **not** necessarily have good management skills.

Students should be proactive in fostering good management practice by their supervising faculty.

- Frequent meetings
- Make progress through a series of short-term milestones
- Clear schedules, clear responsibilities and goals

## └─Faculty Effects on Timely Graduation

no notes

# Graduate Research

Steps to a degree:

- Take a bunch of classes
- Find an advisor
- Pick a topic
- Do the work
- Write it up

WRONG! WRONG! WRONG!

This is how to delay (or kill) getting a degree.

Steps to a degree:

- Take a bunch of classes
- Find an advisor
- Pick a topic
- Do the work
- Write it up

WRONG! WRONG! WRONG!

This is how to delay (or kill) getting a degree.

## └─Graduate Research

You can only compress research so much. 40 hours per week probably won't accomplish twice as much as 20 hours per week (even if you could manage that level of discipline, which most people cannot do). Since your research is the primary bottleneck to graduation, you want to be spreading this out over time, and interleaving with the more mechanical tasks like taking classes. This lets you think about things other than your research project during every waking hour, which is what the "get everything else out of the way first" approach leads you to.

# Grad Research: How to Succeed (1)

Initially:

- Don't just take classes – interact with faculty and their students (research groups)
- Attend talks, read papers

Get PhD qualifier (or equivalent) out of the way early.

Identify an advisor early, and get involved in research

- GRA, Independent Study, or volunteer
- Research topic often comes from the work, not work from the topic.

Set deadlines or milestones... And keep them!

## Grad Research: How to Succeed (1)

**Grad Research: How to Succeed (1)**

Initially:

- Don't just take classes – interact with faculty and their students (research groups)
- Attend talks, read papers

Get PhD qualifier (or equivalent) out of the way early

Identify an advisor early, and get involved in research

- GRA, Independent Study, or volunteer
- Research topic often comes from the work, not work from the topic.

Set deadlines or milestones... And keep them!

Need to balance classes with advancing the research work.

Median CS@VT MS/PhD GPA: 3.78. 25% percentile: 3.33. You don't want to be below this, but above 3.5 it doesn't really matter what your GPA is.

Taking classes is not likely to be your bottleneck to graduation. So, taking courses does not get you graduated. Don't think that taking extra courses in your first year in any way makes up for not making progress on research. It doesn't.

# Grad Research: How to Succeed (2)

Intersperse writing with working

- Documenting literature review is an ongoing process
- Constantly write progress reports
- Publish if possible

Learn how to write!

## Grad Research: How to Succeed (2)

**Grad Research: How to Succeed (2)**

Intersperse writing with working

- Documenting literature review is an ongoing process
- Constantly write progress reports
- Publish if possible

Learn how to write!

Speaking and writing skills make or break any professional career (technical expertise a bonus). Remember: Everyone who graduates from Virginia Tech is technically proficient. Its those communications skills that differentiate the best graduates.

# Milestones: MS Students

- Semester 1 (or before): Contact lots of faculty, figure out who you want to work with
- Semester 2:
  - ▶ Settle who you will work with, and ideally get started on a project.
  - ▶ By end of this semester, know your thesis topic and make some progress.
  - ▶ Plan of Study due by end of this semester.
- Semester 3: Do the bulk of the thesis work, start writing thesis (at least the intro/explanation, literature review)
- Semester 4: Finish work, complete thesis, graduate

## Milestones: MS Students

**Milestones: MS Students**

- Semester 1 (or before): Contact lots of faculty, figure out who you want to work with
- Semester 2:
  - ▶ Settle who you will work with, and ideally get started on a project
  - ▶ By end of this semester, know your thesis topic and make some progress
  - ▶ Plan of Study due by end of the semester
- Semester 3: Do the bulk of the thesis work, start writing thesis (at least the intro/explanation, literature review)
- Semester 4: Finish work, complete thesis, graduate

The MS degree can feel like a sprint. There is not a lot of time. It is important to work out your timing fairly early in the process, because you have to expect that it will take about 12 months to complete the thesis. And, you lose most of the last two months of your final semester due to the mechanics of the process. So there is not a lot of room for delay in getting started.

# Milestones: PhD Students (1)

- Year 1 (or before):
  - ▶ Start by contacting lots of faculty/labs. Primary job in first year is settling who you will work with, and hopefully getting started.
  - ▶ If you came with an MS degree, perhaps you can take qualifier exam in first January. [Rarely, your publication record is enough to qualify you outright.]
- Year 2:
  - ▶ Be working actively with a research group.
  - ▶ Take the PhD Qualifier exam in January.
  - ▶ Your Plan of Study is due at the end of the 3rd semester in the program.
  - ▶ Your PhD Qualifier should be completed by the end of the second year.

## Milestones: PhD Students (1)

**Milestones: PhD Students (1)**

- Year 1 (or before):
  - ▶ Start by contacting lots of faculty/labs. Primary job in first year is settling who you will work with, and hopefully getting started.
  - ▶ If you came with an MS degree, perhaps you can take qualifier exam in first January. [Rarely, your publication record is enough to qualify you outright.]
- Year 2:
  - ▶ Be working actively with a research group
  - ▶ Take the PhD Qualifier exam in January
  - ▶ Your Plan of Study is due at the end of the 3rd semester in the program
  - ▶ Your PhD Qualifier should be completed by the end of the second year

About contacting faculty: Faculty get a lot of emails from potential students asking to work with them. Your initial contact email needs to clearly explain what you are asking for, and most importantly it needs to explain to the advisor why you are contacting them in particular. This means doing your homework. If your email looks like a form letter, it will probably be ignored.

Take the PhD qualifier exam in first or second January If you came with a MS thesis and publications already, talk with grad program director about possibly skipping exam.

## Milestones: PhD Students (2)

- Year 3: Determine your Dissertation topic. Hopefully you have been working with a research group for awhile now, and can properly define your dissertation and be actively working toward it. Ideally, do prelim at end of Year 3
- Year 4: Prelim at beginning of they year if not already done. Expect that your disseration will take about 2 years to complete post prelim.
- Year 5: Research Defense, Final Defense.

Updated for Spring 2023 13 / 22

Research-track Graduate Student

## Picking an Advisor

How *not* to be successful:

- Pick advisor on one criteria: support, topic, personality.

How to succeed: Pick best compromise (for YOU!)

- Research area
- Support opportunity
- Physical environment for getting work done
- Intellectual environment for getting work done
- Peer support system (research group)
- Personality: Interaction at a personal level
- Personality: Management style (hands on vs. hands off)
- Level of attention
- Track record on timely graduation
- Professional advancement

Updated for Spring 2023 14 / 22

Research-track Graduate Student

## Working with an Advisor

The most important thing is frequent interaction

- Meet often
- Document your progress (in writing)
- Have short and long-term milestones

Know what “on track” means (plan the major milestones)

Be mindful of the calendar

Review the departmental Advising Compact:

<https://gpc.cs.vt.edu/resources/CSCompact.pdf>.

Updated for Spring 2023 15 / 22

Research-track Graduate Student

## Student Activity Reports (SAR)

Each year, we do a summary evaluation for each graduate student in the program.

- The process is sometimes known as “Green Thursday”
- Based off of the Student Activity Report (SAR)
- SAR is also used to generate data to track health of grad program
- Modeled after how faculty are given annual evaluations
- Adviser(s) give evaluations (to students and to GPC)
- GPC head gives a committee evaluation
- 0-3 rating, this affects GTA support, “good standing”, award consideration

Updated for Spring 2023 16 / 22

Research-track Graduate Student

CS 5014

2022-11-25

## Milestones: PhD Students (2)

Milestones: PhD Students (2)

- Year 3: Determine your Dissertation topic. Hopefully you have been working with a research group for awhile now, and can properly define your dissertation and be actively working toward it. Ideally, do prelim at end of Year 3
- Year 4: Prelim at beginning of they year if not already done. Expect that your disseration will take about 2 years to complete post prelim.
- Year 5: Research Defense, Final Defense.

Your prelim should be viewed as a chance to plan the dissertation work (and get buy-in from your committee). If it is done too late, then you don't get that benefit. Doing prelim also gives you Candidacy status, which reduces tuition cost.

CS 5014

2022-11-25

## Picking an Advisor

Picking an Advisor

- How not to be successful:
  - Pick advisor on one criteria: support, topic, personality
- How to succeed: Pick best compromise (for YOU!)
  - Research area
  - Support opportunity
  - Physical environment for getting work done
  - Intellectual environment for getting work done
  - Peer support system (research group)
  - Personality: Interaction at a personal level
  - Personality: Management style (hands on vs. hands off)
  - Level of attention
  - Track record on timely graduation
  - Professional advancement

Picking an advisor is the most important decision for a PhD student (lesser so but still important for an MS student.).

It is a balancing act. Think about both the pros and cons of any given advisor, or compare the pros/cons if you have a choice between advisors.

CS 5014

2022-11-25

## Working with an Advisor

Working with an Advisor

- The most important thing is frequent interaction
  - Meet often
  - Document your progress (in writing)
  - Have short and long-term milestones
- Know what “on track” means (plan the major milestones)
- Be mindful of the calendar
- Review the departmental Advising Compact: <https://gpc.cs.vt.edu/resources/CSCompact.pdf>.

no notes

CS 5014

2022-11-25

## Student Activity Reports (SAR)

Student Activity Reports (SAR)

- Each year, we do a summary evaluation for each graduate student in the program.
  - The process is sometimes known as “Green Thursday”
  - Based off of the Student Activity Report (SAR)
  - SAR is also used to generate data to track health of grad program
  - Modeled after how faculty are given annual evaluations
  - Adviser(s) give evaluations (to students and to GPC)
  - GPC head gives a committee evaluation
  - 0-3 rating, this affects GTA support, “good standing”, award consideration

Take this seriously! It is meant to help you stay on track (and recognize if you are or are not). And it affects things like GTA offers and award opportunities.

# Does the Research Experience Meet Your Goals?

As a part of the degree process:

- Make sure your writing improves!
- Make sure you learn how to schedule and pace.
- Make sure you get experience at independent/unstructured problem solving.
- Publish, become known.
- Become an expert in something you “own.”

Updated for Spring 2023 17 / 22

Research-track Graduate Student

# A Note about Finishing

It takes a couple months to get through the process:

- Schedule defense
- Getting the thesis or dissertation to committee TWO WEEKS before defense
- Hold defense and receive input on revisions/corrections
- Make those revisions and corrections
- Submit ETD
- Make grad school-mandated corrections
- Get ETD approved

MS Thesis students in particular: This means that you need to have finished your Thesis by early March.

Updated for Spring 2023 18 / 22

Research-track Graduate Student

# Advice on Classes to Take

In general, you learn the most from hard classes.

- In particular, taking something that you don't have the discipline to learn on your own.
- Things like algorithms, maybe machine learning, compilers, numerical analysis, systems

Taking a lot of classes in one area will soon reach diminishing returns on what you learn.

Looking back, the classes that were most useful to me are ones that taught me something about “not my area”, since that is pretty much all that I know about those areas now.

Updated for Spring 2023 19 / 22

Research-track Graduate Student

# Conflict Resolution (1)

Not all grad students have conflicts with faculty... but some do. It's a big department.

Be informed.

- Sometimes the student is objectively not performing to expectation (GTA, research, degree progress)
- Sometimes, the faculty member is being unfair, or has unrealistic expectations, or is simply abusive.
- Knowing the expectations (both for students and for faculty) is a big part of avoiding conflict in the first place. See the Advising Compact, for example.

Updated for Spring 2023 20 / 22

Research-track Graduate Student

CS 5014

2022-11-25

## Does the Research Experience Meet Your Goals?

Does the Research Experience Meet Your Goals?

- As a part of the degree process:
- Make sure your writing improves!
  - Make sure you learn how to schedule and pace.
  - Make sure you get experience at independent/unstructured problem solving.
  - Publish, become known.
  - Become an expert in something you “own.”

no notes

CS 5014

2022-11-25

## A Note about Finishing

A Note about Finishing

- It takes a couple months to get through the process:
- Schedule defense
  - Getting the thesis or dissertation to committee TWO WEEKS before defense
  - Hold defense and receive input on revisions/corrections
  - Make those revisions and corrections
  - Submit ETD
  - Make grad school-mandated corrections
  - Get ETD approved
- MS Thesis students in particular: This means that you need to have finished your Thesis by early March.

no notes

CS 5014

2022-11-25

## Advice on Classes to Take

Advice on Classes to Take

- In general, you learn the most from hard classes.
- In particular, taking something that you don't have the discipline to learn on your own.
  - Things like algorithms, maybe machine learning, compilers, numerical analysis, systems
- Taking a lot of classes in one area will soon reach diminishing returns on what you learn.
- Looking back, the classes that were most useful to me are ones that taught me something about “not my area”, since that is pretty much all that I know about those areas now.

no notes

CS 5014

2022-11-25

## Conflict Resolution (1)

Conflict Resolution (1)

- Not all grad students have conflicts with faculty... but some do. It's a big department.
- Be informed.
- Sometimes the student is objectively not performing to expectation (GTA, research, degree progress)
  - Sometimes, the faculty member is being unfair, or has unrealistic expectations, or is simply abusive.
  - Knowing the expectations (both for students and for faculty) is a big part of avoiding conflict in the first place. See the Advising Compact, for example.

no notes

## Conflict Resolution (2)

Know where to get help.

- In department: Grad coordinators, Dr. Shaffer, Dr. Hooshangi, Dr. Mayo, Mr. McPhearson. It is our job to help.
- Grad School Ombuds: Bryan Hanson

Updated for Spring 2023 21 / 22

Research-track Graduate Student

2022-11-25 CS 5014

Conflict Resolution (2)

2022-11-25

Conflict Resolution (2)

Know where to get help.  
● In department: Grad coordinators, Dr. Shaffer, Dr. Hooshangi, Dr. Mayo, Mr. McPhearson. It is our job to help.  
● Grad School Ombuds: Bryan Hanson

no notes

## Get Involved!

Be an active participant in the life of the Department. This is your best way to network.

- GTA
- Teaching Track: GrATE, Future Professorate Certificate; Be an instructor
- Join Grad Council
- Volunteer
- Join professional organizations (ACM, IEEE)
- Join groups on Campus

Updated for Spring 2023 22 / 22

Research-track Graduate Student

2022-11-25 CS 5014

Get Involved!

2022-11-25

Get Involved!

Be an active participant in the life of the Department. This is your best way to network.  
● GTA  
● Teaching Track: GrATE, Future Professorate Certificate; Be an instructor  
● Join Grad Council  
● Volunteer  
● Join professional organizations (ACM, IEEE)  
● Join groups on Campus

no notes