

Graduate School in Computer Science: Is It For Me?

**William Turkett
(turketwh@wfu.edu)**

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Why a Graduate Degree in CS?

- My most straightforward answers:
 - Improved understanding of the field of Computer Science
 - Increased exposure to sub-areas
 - Deeper understanding of topics
 - Training in research
 - Improvement in earning and advancement potential

Increased Understanding

- Improved understanding of the field of computer science
 - Usually 10-15 more courses
 - Core (algorithms, architecture/systems, and theory)
 - Electives
 - Nearly all you take is Computer Science, so often can tailor courses to your interests

Research Training

- In-depth analysis of a particular area of computer science
- Understanding of scientific method and how to do research
- Self-motivated study
- One-on-one mentoring with your advisor
- Collaboration with like-minded researchers

Increased Earnings (Average Starting Salaries)

Natl. Association of
Colleges and Employers
September 2016
Survey:

Bachelors
\$71,534
(Employee Reported)

Natl. Association of
Colleges and Employers
January 2016
Survey:

Masters
\$72,080
(Employer Projected)

Taulbee Survey:
2014

Mean 9-Month
Assistant Professor
\$96,055

<http://www.naceweb.org/uploadedfiles/files/2016/publications/executive-summary/2016-nace-salary-survey-fall-executive-summary.pdf>

<http://www.naceweb.org/about-us/press/2016/projected-salaries-masters-doctoral-class-of-2016.aspx>

<http://archive2.cra.org/uploads/documents/resources/crndocs/2014-Taulbee-Survey.pdf>

Does not take into account the money you could make by spinning off your research, such as Larry Page and Sergey Brin did

Graduate School Options

- Two major routes:
 - M.S. – Master of Science
 - 2-3 years
 - Significant coursework
 - Intermediate research
 - Ph.D. – Doctor of Philosophy
 - M.S. +
 - 3-5 years
 - Coursework relevant to research area
 - Advanced research

Graduate School Options

- Outcomes:
 - M.S. – Master of Science
 - Team leads
 - Managers
 - Software Designers
 - Research Associates
 - Instructors/Lecturers/Professors at smaller universities
 - Ph.D. – Doctor of Philosophy
 - Tenure-track academic positions
 - Researcher/Research Head
 - CIO
 - Elite corporate research (Google, Microsoft, ...)

Admissions

- Bachelors degree in Computer Science
 - Or a related field with significant CS experience
- GRE General Test
- Statement of interest
- Recommendations
 - Preferably from faculty
- Evidence of research capability

GRE: Graduate Record Exam

- Computer-based, Very much like the SAT
- Verbal, Quantitative, Writing/Analytical
- Revised in August 2011
- Scoring system:
 - 130-170 in V/M (1 point increments)
 - 0-6 in writing (0.5 point increments)

GRE

- <http://www.gre.{com,org}>
- You see verbal, quantitative scores immediately; schools receive in 10-15 days.
- Pay study courses, local preparation...

- As a CS/Mathematics focused person, your GRE quantitative should be high

Evidence of Research Capability

- Summer undergraduate projects
- Independent study
- Senior thesis
- Juniors: Research Experience for Undergraduates program
 - Nice introduction to research
 - Introduction to different type of school
 - A decent paycheck!

Admission Deadlines

- Late Fall (mid December)/Early Spring semester for Fall admission
- Mid Fall semester for Spring admission
- Some schools have rolling deadlines
- Most schools primarily recruit for the Fall

Admissions

- Broad range of students you will be competing against for admission:
 - Many more international students
 - Non-traditional students
 - Executive students
 - Non-CS majors

How to Finance

- Graduate school in the sciences is often a great deal (unlike in other fields)
 - Very often, you get paid to go to graduate school!
- Most admitted applicants receive
 - Tuition reduction
 - Assistantship

How to Finance

- Tuition Reduction:
 - A scholarship that pays some significant portion of tuition for you
- Assistantships
 - Teaching assistantships
 - Labs, grading → full blown courses
 - Research assistantships
 - Typically later years of graduate school
 - Systems assistantships
 - Information systems/technical engineering support

How to Finance

- Fellowships:
 - School/federal/philanthropic
 - Awarded to highly talented students
 - Pay tuition and stipend beyond assistantship
- Loans:
 - Federal loans allow \$20,500 a year to be borrowed, with no more than \$138,500 cumulative (undergraduate + graduate) loan debt

<http://studentaid.ed.gov/PORTALSWebApp/students/english/studentloans.jsp>

How to Finance

- Can be (but not usually) difficult to get funding if you enroll at a Ph.D.-granting school as a M.S.-only student
- “Executive” degrees:
 - Many businesses will support/pay for you to get a masters
 - Some businesses (& the govt.) will pay for you to get a Ph.D.
 - May come with expectations for ‘paying’ business back – years of service

How to Finance

- Assistantships range from \$12-25k, depending on:
 - Cost of living
 - M.S. or Ph.D.
 - Type of job you are doing
 - RAs usually pay a little more than TAs
- Livable, but not a luxury lifestyle
 - Better than peers outside of science

When to Attend

- Should you go to graduate school immediately after college?
 - Arguments for Yes:
 - Material is most clear
 - Not used to living too extravagantly
 - Fewest external obligations
 - Arguments for No:
 - More focused
 - More motivated

M.S. Options

- Degree Options:
 - Thesis
 - Most important for going onto Ph.D. program
 - Contribution to the field
 - Project
 - Large scale, software engineering driven
 - Coursework-Only
- Timeline
 - First year: Coursework; Teaching assistantship
 - Second year: Ramp up thesis or project in summer, coursework and thesis in Fall, light coursework and writing in Spring; Teaching or Research Assistantship

M.S. Options

- Many schools offer specialized masters or certificate programs:
 - Univ. of South Carolina: Certificate in Information Assurance
 - Wake Forest Univ.: Structural and Computational Biology Certificate
 - Obtain M.S. in CS, as well as this certificate
- Much more defined coursework, thesis routes

Choosing an M.S. School

- Reasons to choose one school over another:
 - Location
 - Contacts you'll make (internships, faculty, etc)
 - Size
 - Interaction with faculty, other students
 - Particular area of interest
 - Databases, networking, ...
 - M.S.-only?
 - Focus of graduate program
 - Ensure there are multiple people you would be interested in working with
 - Need a fallback – person you thought was great becomes problematic, goes on sabbatical, can't take on anymore students, ...
 - Look at interdisciplinary programs

Ph.D. Options

- Degree Options – there is only one:
 - Dissertation: **Significant** contribution to field
 - You become the expert in the topic you choose to work in
- Timeline
 - M.S. work
 - Additional coursework and qualifying exam (breadth)
 - Proposal, dissertation, defense (depth)
 - Often picked up as research assistant by advisor

Ph.D. Options

- It is not a requirement that you obtain a M.S. before obtaining a Ph.D.
- Some schools award a course-only type M.S. when become a Ph.D. candidate (after qualifying exam, proposal)

Ph.D. Outcomes

- Postdoc
- Industrial Research Labs
- Government Research Labs
- Teaching Universities
- Research Universities

Choosing a Ph.D. School

- Reasons to choose one school over another:
 - Align schools research focus with your interests
 - What you will likely be doing for the next 10+ years
 - Ensure there are multiple people you would be interested in working with
 - Need a fallback – person you thought was great becomes problematic, goes on sabbatical, can't take on anymore students, ...
 - Look at interdisciplinary programs and departments where crosstalk among programs, schools, institutes is significant
 - Reputation is very important, so aim high! Look at US News rankings, CRA rankings, talk to faculty in related areas
 - Different schools have different strengths – best school in robotics is not the best school in graphics, which is not the best school in theory...
 - Rankings by publication output: <http://csranks.org/>

Routes One Can Take

- With a Computer Science bachelor's degree, potential graduate programs could include:
 - Computer Science
 - Informatics
 - Analytics
 - Computer Engineering
 - Mathematics
 - Biochemistry/Physics/etc .. if you can show strengths

Anecdotes/Other Resources

- <http://archive.cra.org/reports/why.cs.phd.pdf>
- Videos: <http://cra.org/crae/activities/videos-computing-research/>
- Google:
 - ‘choosing graduate school in Computer Science’
 - ‘advice on CS graduate school’
- phds.org
- www.phdcomics.com (‘Piled Higher and Deeper’)
- Ask faculty about their experiences and about recent students who went to graduate school:
 - Berkeley, MIT, Harvard (3x), George Mason, WUSTL, Georgia Tech, Umass Amherst, UC Davis, ...