Mehmet Sinan Toktay
2012 Computer Engineering Graduate
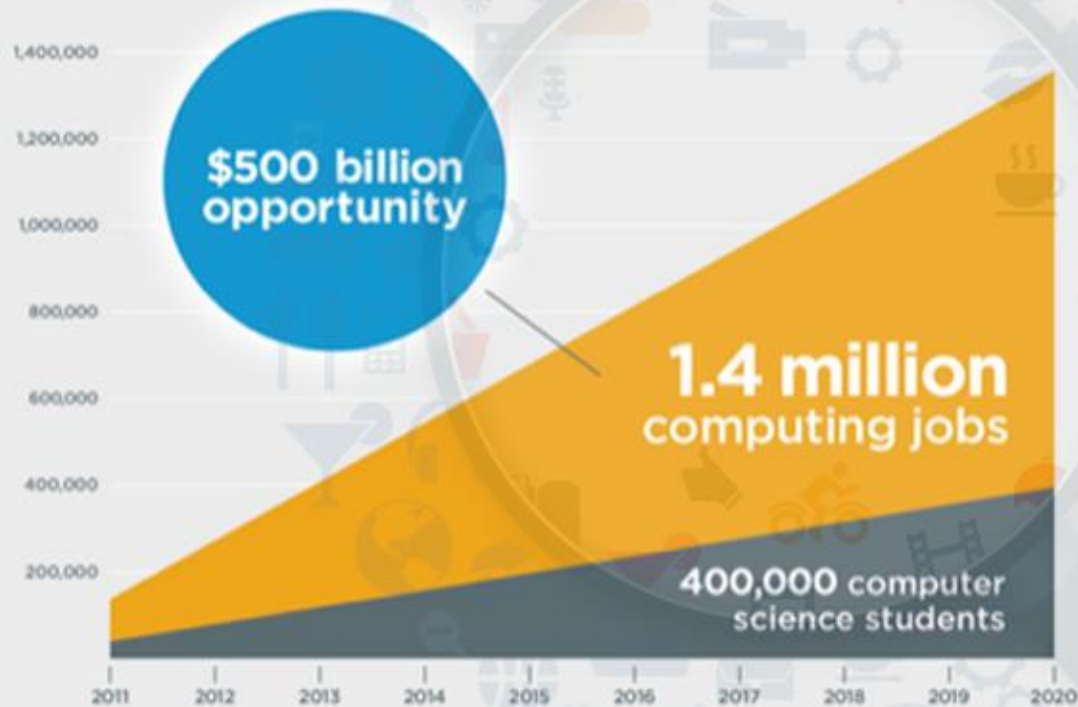
Right Choice

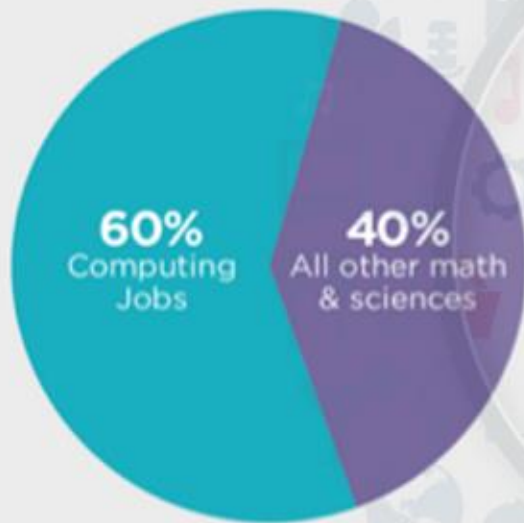# Right Choice

The job/student gap in computer science

Jobs
- 60% Computing Jobs
- 40% All other math & sciences
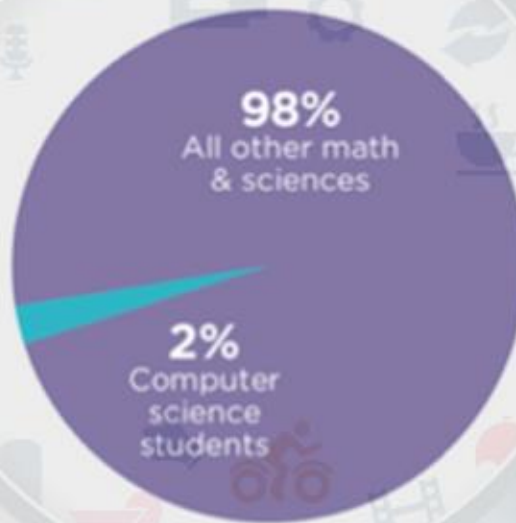
Students
- 98% All other math & sciences
- 2% Computer science students

Less than 2.4% of college students graduate with a degree in computer science. And the **numbers have dropped since** last decade.

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Computing is part of everything we do!

In fact, over 70 percent of computing occupations are outside of the IT industry

information technology

manufacturing

healthcare

retail

weather forecasting

the arts

financial services

Most Importantly

Computer Science teaches you how to think

http://youtu.be/7s_w_4EuIBw

Old vs. New

| Company	Turkish Airlines	Whatsapp
Founded in	1933	2009
No. of employees	23,160	55
Market cap	$4.3B	$19B
Assets	Planes	Servers
Function	Sends people	Sends messages

From Erhan Erkut's presentation

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I wish

- Talk to Professor more often outside of classroom

- Try to Engage one of Professor's projects

- Min. 1 corporate and Min. to startup internships

- Attend hackathons

- Create a product (Web , Mobile, Hardware, something)

- Find your future colleagues, do more team work

Startup vs. Corporate

41 percent of Stanford's computer science graduates go to work for a startup after graduation

http://youtu.be/4Mqd17YYs2s
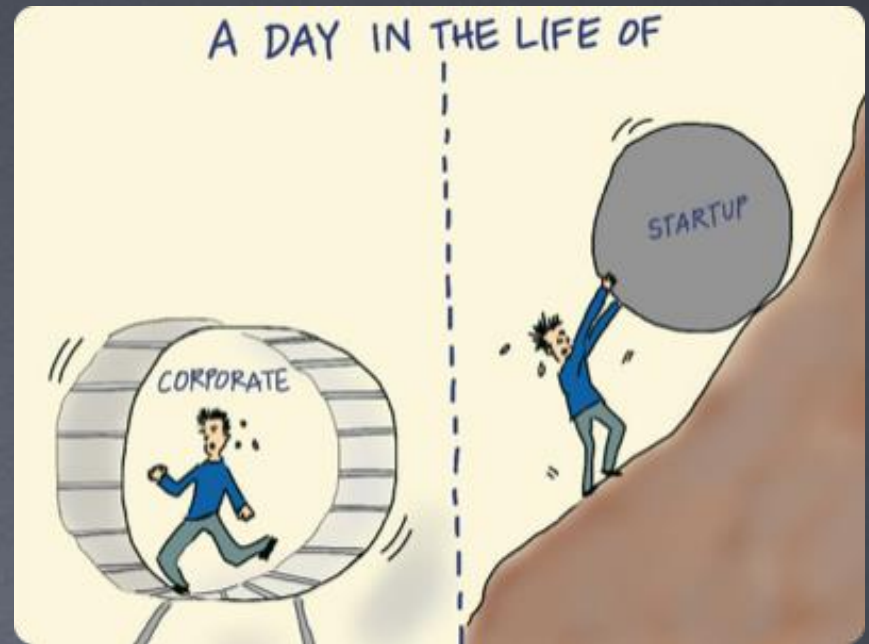
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References

Summary of source data for Code.org infographic

1mm more jobs than students in computing, $500B over 10 years:

From the 2010 - 2012 report from the Bureau of Labor Statistics, http://www.bls.gov/, across all industries we are adding 136,620 jobs per year in computing. Subtract 40,000 annual computer science graduates (see NSF data below) and you get roughly a gap of 100,000 jobs.
100,000 jobs adds up over 10 years to 1mm jobs, with an average salary of $80,000 (the average salary in computing), that results in:
first year: 100,000 x $80,000
2nd year: 200,000 x $80,000
3rd year: 300,000 x $80,000
10th year: 1,000,000 x $80,000
TOTAL SALARIES = $440,000,000,000 ($440 billion)
This is slightly below $500b, but it doesn't account for inflation over the next 10 years. on top of that, there are many studies that show that each new software job results in many more jobs in the neighborhood. The latest such study suggested a 4.3x multiplier in terms of generating supporting/neighborhood jobs. With a 4.3x multiplier, we'd be talking about 5.3mm jobs over 10 years, and much more than $440b, so to be conservative we just rounded up to $500b. Here's a very rough back of envelope analysis that suggests that the total opportunity size in this space may actually be closer to $1T in 10 years.

Note: We use the following BLS categories represent computing occupations:
· Computer and Information Research Scientists   (15-1111)
· Computer and Information Systems Managers (11-3021)
· Computer Hardware Engineers (17-2061)
· Computer Occupations, All Other (15-1199)
· Computer Programmers (15-1131)
· Computer Support Specialists (15-1150)
· Computer Systems Analysts (15-1121)
· Database Administrators (15-1141)
· Database and Systems Administrators and Network Architects (15-1140)
· Information Security Analysts, Web Developers, and Computer Network Architects (15-1179)
· Network and Computer Systems Administrators (15-1142)
· Software Developers and Programmers (15-1130)
· Software Developers, Applications (15-1132)
· Software Developers, Systems Software (15-1133)

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References

All of these positions benefit from basic exposure to computer science. The latest outlook for all these occupational categories is available at http://www.bls.gov/ooh/ and most of the list above is here:http://www.bls.gov/ooh/computer-and-information-technology/home.htm. Those pages have detailed data and the most current BLS projections.

According the Conference Board, In October 2013 there were 570,000 computing job openings in the United States, making these jobs the highest demand in the US -- about 4 times more than the US average. Note that this isn't about "shortages", this is about demand and opportunity … and demand for these jobs is quite significant in every single state.

Computer science is the highest paid college degree

See http://www.forbes.com/pictures/mkl45kkeg/1-carnegie-mellon-school-of-computer-science/ The single best-paying degree in the USA in 2013 is a Computer Science degree from Carnegie Mellon College. Depending on what you measure or how broadly you define it, Computer Science degrees vie for the #1 spot across all universities, although in the 2013 batch of graduates they were in the #2 spot according to the NACE survey.

The Job/Student gap in Computer Science

The source for the job data comes from the Bureau of Labor Statistics, http://www.bls.gov/. Projections for job openings and replacements in computing jobs is 1,366,200 jobs from 2010 - 2020. Projections for all other STEM jobs combined (engineering, life sciences, physical sciences, social sciences) is 908,700 jobs over the same period. This is a 60:40 ratio of jobs in Computing vs the rest of STEM. The source for the students data comes from the College Board, surveying 2012 AP examination participation (see http://research.collegeboard.org/programs/ap/data/participation/2013), shows that of the 1,379,585 AP math and science exams taken by US high school students in 2013, only 29,555 were computer science exams. This is a 2:98 ratio of students in computer science vs the rest of STEM

Less than 2.4 % of college students graduate with a degree in computer science

National Science Foundation data on graduation rates from college, ie 2.38% of college students graduate with a degree in computer science. Source data: spreadsheet: http://www.nsf.gov/statistics/seind12/append/c2/at02-18.xls, which comes from this web page: http://www.nsf.gov/statistics/seind12/appendix.htm.   In the most recent years, the average number of CS graduates. If you look at the last three years of data, annually 40,005 students graduated with CS degrees on average, out of 1,580,382 total graduates, which is 2.5%. The numbers peaked in 2004, a decade ago. They decline steadily until 2009. We are pretty certain that the number has climbed since 2009 but not yet reached the 2004 peak. To the best of our knowledge the NSF data has not been updated since 2009. CRA surveys show a clear growth in CS majors subsequently, they are based on surveys and not cumulative totals.

High school AP enrollment in 2012

The data about enrollment in computer science compared to other fields, and participation by women, African Americans, and Hispanic Americans all come from this page: collegeboard.com/student/testing/ap/exgrd_sum/2012.html

57% of bachelors degrees are earned by women, but only 12% of CS degrees

National Science Foundation 2009 source data: http://www.nsf.gov/statistics/seind12/append/c2/at02-18.xls, which comes from this web page: http://www.nsf.gov/statistics/seind12/appendix.htm shows that 57% of bachelors degrees are earned by women. The same data shows that only 18% of CS degrees are earned by women. A more recent 2012-13 CRA survey shows the CS degrees by women at an even smaller 12%:http://cra.org/uploads/documents/resources/taulbee/CRA_Taulbee_CS_Degrees_and_Enrollment_2011-12.pdf

9 out of 10 US K-12 schools don't offer computer programming classes

Source: Code.org database of local computer programming schools, sourced by a combination of data from the College Board, the Computer Science Teachers Association, and individual teacher submissions. Code.org database is here: http://code.org/learn/local. (Note that the Computer Science Teachers Association claims a membership of 13,000 internationally, compared to more than 130,000 K-12 schools in the US.

Note: this data is NOT yet counting the thousands of schools who are offering new Computer Science instruction based on the Code.org online K-8 Intro to Computer Science course that was released in Dec 2013.

In X out of 50 states computer science doesn't count towards high school graduation credit

The original source of this data was the ACM Running on Empty report: http://www.acm.org/runningonempty/. However, thanks to the advocacy efforts by Code.org and sister organization Computing in the Core, the list of states that allow computer science to count towards graduation credit has increased monthly, and at this point Code.org is the definitive source of the data.

67% of Computing jobs are outside the tech sector:

This statistic was included in the MSFT National Talent Strategy document and taken from a Georgetown University Center for Education and the Workforce Report on STEM (October 2011) by Anthony Carnevale, Nicole Smith, and Michelle Melton - see http://cew.georgetown.edu/stem/. The relevant quote "Computer occupations are the most widely represented across industries. For example, 9 percent are in Information Services, 12 percent are in Financial Services, 36 percent are in Professional and Business Services, 7 percent are in Government and Public Education Services, and 12 percent are in Manufacturing". (12 + 36 + 7 + 12 = 67%)

References

Per-state Jobs and Students and Schools data

The number of open computing jobs in each state comes from the The Conference Board's Help Wanted OnLine®service (click here for more information about HWOL and their data collection methods). It represents the number of open jobs in the previous month (seasonally adjusted) for Bureau of Labor Statistics' (BLS) Category SOC "15-0000 Computer and Mathematical Occupations"). This is a conservative estimate of the number of computing occupations as it excludes two BLS categories that include computing occupations: Computer and Information Systems Managers 11-3021 and Computer Hardware Engineers 17-2061. (This is due to limitations with our agreement with the Conference Board.) This data is cross-sector.

The growth rate vs. state average is comparing the job demand (% open jobs/of existing jobs determined in the May 2012 BLS' OES survey) in computing occupations vs the state average.

The data on computer science students in each state comes from the National Science Foundation's webcaspar service, and combines annual Bachelors, Masters and PhD degrees in Computer Science at all public and private non-profit institutions in the United States (by state), but not Associates degrees. The year based on the latest available survey from the webcaspar service.

The data on schools in each state comes from Code.org's database of schools that teach CS, and includes elementary, middle and high schools that teach a full computer science class, AP computer science, or integrate computer science into other classes - this data comes from the Computer Science Teachers Association, the College Board, and self-reported submissions from teachers.