Why work with companies?
- Money (esp stuff that's hard to get funding for --- conferences, equipment)
- Insight into research questions, problems, new technologies
- Access to data, computation and storage resources, technology transfer
- Training for students --- internships, jobs, etc.

Why gifts?
- Unrestricted ---- anything that's a legitimate research expense (in contrast, fed programs are more restrictive)
- Company gets to write it off as a donation
- University doesn't take as much of the $$
- Can be a no-strings-attached thank-you gift, but more commonly you write a proposal and get a gift to pursue that
-
Relationship with department budget
- Grant $$ goes to university and some comes back --- does this set or affect the department budget?

Gifts serve as safety nets
- Keep as a rainy day fund for excellent students etc
- Being a prof is like running a tiny company
- The "law of large numbers" doesn't work --- might have multiple students one year, undergraduates who want to stay etc.

Varies a lot by area
- Networking and other applied areas have more companies who are involved in supporting
- But, say, theory research has more funding from foundations but much less from corporations
- And smaller even than at, say, Stanford

How do you ensure that the questions you're working on are research questions? E.g. not sending students
- Super important for sending grad students to work places and evaluating the quality of the projects they'll be working on
- It helps to have a personal relationship
- I don't send grad students to work with people I don't know, who don't publish etc. --- sometimes you need to take a leap of faith, but I'm pretty conservative
- Fortunately, several of these companies are really active in publishing at conferences
- Many of the people are grad students, former professors, etc
- Makes it easier to have common ground with expectations
- Bad example: grad student required to spend a year at a company without knowing about the project ahead of time

Endowed professorships?
- At least at Princeton, doesn't entail as much close contact / influence with the endow-er
- Yahoo chair
    - Problems of perception

Google lab in Princeton
- Worries that people perceive that even profs not involved in lab might not be independent in their criticism of Google's competitors
- But no $$ changes hands
- Even still, perception is important

How do we work with companies?
- Research collaborations
- Multi-university programs
- Joint employments --- people might be part-time at a company and part-time at the university
    - This is new
- Consulting
    - Princeton allows 20% of time consulting with other companies, which is $$ in your own pocket
- Taking a sabbatical at a company
- Technical advising for startups
- Some faculty members have startups

Is this new?
- The joint employments are relatively new
    - Seung at samsung ai labs, elad hazan at google, flatiron institute, institute for advanced study
    - These are more common now because a lot of companies have access to data adn computation that's needed for this kind of work
    - Universities want to retain people, adn there's a lot of money / demand for ML people
    - Companies want to hire everyone they can get in ML, but also don't want to "eat their seed corn" --- need people to do open research and training
    - So, instead of hiring everyone they can, they do this hybrid thing
- Also more common at peer institutions

Requirements
- Needs to be local(ish) to Princeton
- Needs to be a research appointment, which is creating open research (lab)
- Needs to pay dividends to university // the field
    - Esp data access for university and for their students

- 3 years max with ability to renew, contingent on the person's continual engagement at the university

Challenges
- Spending time on campus --- good for building community
- Conflicts arising out of people spending a lot of time on other projects
- Ability to work remotely can generally impede community-building

Want to make sure they're getting what they pay for
- Google lab
    - Terms are pretty open --- intellectual property doesn't stay Google's
        - Other than
    - Pretty liberal, even moreso than other forms of collab with industry
- In contrast, Google has offered to both advise PhDs and fund research
    - Their logic: you can admit more if there's more advising and funding capacity
    - That seems beyond our comfort zone --- the resources seem nice but we think that every student should have a Princeton advisor
    - Everyone has to draw their line somewhere, but that's one that makes me say "hmm"

Capitaloskeptical

Cool diagram

Different funding orgs
- NSF is 85%
    - To some extent, the NSF is us --- when they start to invest in an area, it's a grassroots effort to convince them that a certain area is a needed one for research
- Computing Community Consortium or something
- Interest in CS is growing, but NSF budget hasn't grown
    - ONe of the challenges is to find alternate sources of research funding
        - Otherwise, we hire all these junior faculty and grad students who can't find funding
    - Joint programs between companeis and NSF
        - Company provides the funding + the focus area, but NSF reviews teh grants and allocates the funding
        - Cool hybrid model --- it grows the pie
- These funding relationships between cos and funding agencies are also great for helping researchers at smaller schools / without preexisting relationships to get funding from industry
What's the incentive?
- Having a centralized way to gather proposals, get researchers together etc are all good

- Create a research community rather than a piecemeal set of projects
- Also, some sense of obligation --- they've been benefitting from computer science research for decades
- Recruiting benefit
    - Goodwill / name recog from phd students, as well as giving them the promise of staying in touch with research community
- Open source / commodity software product that many companies benefit from the existence of
    - Companies often want to talk to each other, to researchers etc as these solutions are developed

Ethics of funding
- Often, funding is for research closer to the tech side --- much less likely to run into political concerns
- Those doing research closer to the political side often decline to take funding
    - Those were the people more worried about the google lab, because didn't want to be undermined by relationship between princeton and google

Relationship between monopoly and research
- 9 years at AT&T
- Tax on a monopoly form meant that open research was very possible
- Industrial research lab --- part of the beauty is the unfair advantage of having data, equipment, etc
- And a golden age because wanted to justify their existence
- Two stable modes:
    - Research lab that some institutions have and some don't
    - But in very competitive markets, it's hard to focus on the long-term
- Not a good example of technology transfer
- Not a good example of research being possible without a monopoly, though I'd like to believe it's possible

Growth and size of department
- Industry engagement has likely grown --- the companies are hiring like crazy, teh salaries are great, adn a lot of the problems are totally interesting
    - Access to data, problems, and smart people
- We're in an environment where industry jobs are exciting, interesting, and have long-term growth potential
- See PhDs and even faculty making the same choice, realizing that it's a chance to have another kind of impact
    - A kind of exuberance that wasn't possible
- 19 tenured faculty in last 4 years
    - Just crazy talk by Princeton standards
- 13% of people major in CS

- 10% do the certifacte
- What's the future like?
    - Maybe more people will major in other things, combining with a second passion
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