Administrivia

• Final exam next Tuesday in this room at 2:30pm

• No notes or devices

• Comprehensive with at most 9 problems
  – core is 5 problems on reasoning & testing
  – other problems on generics, subtypes, TypeScript
  – small problems on anything else
# US News CS Rankings

<table>
<thead>
<tr>
<th>Rank</th>
<th>University</th>
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<tbody>
<tr>
<td>1</td>
<td>MIT</td>
</tr>
<tr>
<td>2</td>
<td>CMU</td>
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<tr>
<td>3</td>
<td>UC Berkley</td>
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<tr>
<td>4</td>
<td>Stanford</td>
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<tr>
<td>5</td>
<td>UIUC</td>
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<td>6</td>
<td>UW</td>
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<td></td>
<td>Cornell</td>
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<td>Georgia Tech</td>
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## Last Year in Startups

<table>
<thead>
<tr>
<th></th>
<th>UW</th>
<th>Stanford</th>
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<tbody>
<tr>
<td>Funded Startups</td>
<td>70</td>
<td>465</td>
</tr>
<tr>
<td>Dedicated VC Funds</td>
<td>1</td>
<td>3</td>
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CSE 331
Software Design & Implementation

James Wilcox & Kevin Zatloukal
Fall 2023
Startups
Not Just Business Majors

Some prominent counterexamples…

- Microsoft: Bill Gates & Paul Allen
- Apple: Steve Jobs
- Google: Sergey Brin & Larry Page
- Meta: Mark Zuckerberg
- NVIDIA: Jensen Huang
- TSMC: Morris Chang
You Can Do This

YC’s Essential Advice for Startups:

• build something people want
• launch fast & iterate
• write code & talk to users
• find 10-100 users who love it

Could become a profit or non-profit

(Write your code to be easily changeable!)
Startups are Important

• Startups are a critical part of the economy
  – responsible for nearly all net job growth
  – young companies perform the majority of R&D

• Obvious examples of world-changing impact
  – PCs, ecommerce, ride hailing, EVs, cheap space flight, etc.

• Most startups fail
  – about 2/3rd lose all or most money invested
  – others must increase 5-10x to get normal investment returns

• “Expected to fail” path is not as scary as it sounds…
Founders Take Little Risk

• Startups are corporations (C corps)

• Corporations have “limited liability”

• In the event of bankruptcy
  – creditors split up the corporation’s assets
  – creditors do not get founder’s personal assets

• You can only lose the money you put in
Founders Take Little Risk

• “Founder of X” looks great on a resume
  – even when the company failed
  – demonstrates grit, risk-taking, leadership, etc.
  – requires you to learn a lot of different skills

• “Founder of X, Acquired by Y” looks even better
  – but the first part is already good

• A personal example…
Founders Take Little Risk

• Asymmetric risk/reward
  – cannot lose more than you put in
  – can make a lot more than that
    • money, respect of peers, impact on world, etc.

• Forming a startup looks great on a resume

• Joining an existing startup also has benefits
  – more learning
  – more opportunity for rapid advancement
  – (this was my path after UW)
Next Steps

Suppose you built something that people want

Now, you want to
• work on it full time
• hire other people to help
• buy necessary equipment / services

Then, you will need to raise money
Places to Raise Money

1. Friends & Family (when possible)
   - no one will give you better terms

2. Grants
   - UW has CoMotion (and other programs)
   - particularly available to those where #1 does not apply

3. Users
   - if they love it, they’ll often pay for / donate to it
   - paying customers are proof that users love it

4. Investors…
Need Funding Until Profitable

Revenue \text{ money earned} \quad \text{Top Line}

- \text{Expenses}

= \text{Income} \quad \text{Bottom Line} \quad \text{profit}

- Almost every company loses money initially
  - new companies ("startups") need to raise money

- Once you are profitable, you control your own destiny
  - non-profits usually raise money forever
Funding Rounds

Pre-seed  angels / accelerators
Series Seed  + VC firms
Series A  + institutions
Series B  ...
...  ...
IPO  public market investors
Debt  banks / investors

• Each stage is less risky than previous
Company Stages (a16z)

Pre-seed
Series Seed
Series A
Series B
...
IPO
Debt

Product stage
– finding product / market fit

Growth stage
– taking market share

Operations stage
– improving margins & efficiency
Company Stages (a16z)

Pre-seed
Series Seed
Series A
...

Product stage
- finding product / market fit

• Founders of businesses raising Series A/B rounds…
  - will typically be millionaires on paper
  - will have lots of help from their investors

• Let’s just focus on the product stage
Series A/B Funding

- Established clear “product / market” fit (PMF)
  - lots of paying customers
    - e.g., $1m in annual recurring revenue
  - core group of customers that love the product
    - high engagement

- Raising money to switch into growth mode
  - hire more people to expand the product
  - spend on advertising and marketing
  - capture market share before bigger competitors arrive
# Pre-Seed & Seed Funding

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<tr>
<th></th>
<th>Pre-seed</th>
<th>Seed</th>
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<tbody>
<tr>
<td><strong>Funding amount</strong></td>
<td>Typically between $500k – $1m</td>
<td>Typically between $2m – $5m depending on industry.</td>
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</table>
| **What you've shown** | - You’ve created a minimally-viable product that works in some way.  
- You’ve identified a clear market and a pathway to that market with your product. | - You’ve demonstrated some kind of product-market fit and traction.  
- You’ve assembled a high-quality team to build out the company. |
| **Normal valuation** | Typically $1M - $3M, depending on industry. | Typically $5M - $15M, depending on industry. |
| **Target runway** | 3 to 9 months                               | 12 to 18 months                               |
| **Typical investors** | Friends and family, accelerators            | Angel and institutional investors             |

From brex.com (numbers updated for 2022)
Steps in the Product Stage

• Minimally-viable product
  – can raise pre-seed funding

• Some evidence of PMF / traction
  – can raise seed funding

• Clear evidence of PMF (e.g., $1m in ARR)
  – can raise series A/B funding

• Various forms of evidence of PMF
  – paying customers, waiting lists, letters of intent, etc.
Raising Money

• Each funding round is to help get to the next round
  – have a plan for how the money will accomplish that

• External funding can start with pre-seed round
  – if you can wait longer, you should

• Expect to sell 20-30% of the company in each round
  – “dilution” of earlier investors
  – each round usually includes an option pool
    • used to hire & replenish the founders’ stake
Funding Rounds Sizes (Median)

- Pre-seed: hundreds of thousands
- Series Seed: low single-digit millions
- Series A: high single-digit millions
- Series B: tens of millions

• What if you’re not comfortable raising such amounts?
  – there are ways to raise smaller amounts (more later)
  – you also might be misunderstanding the relationship between founders and investors
Raising Money

• An old saying in finance:
  When you owe the bank $100, that’s your problem.
  When you owe the bank $100m, that’s the bank’s problem.

• The bigger the check, the more they work for you
  – they don’t want to lose the money invested
  – they don’t want a bad result on their investment record
  • “an investment is an endorsement of that company as the winner in this space” — Secrets of Sand Hill Road

• VCs can connect you with customers, potential hires, potential new investors, etc.
Raising Money

Steps involved in pre-seed funding:

1. find a problem worth solving
2. build a minimum viable solution
3. find customers who love it
4. form a C corporation
5. prepare a pitch to describe your product / business vision
6. find investors who want to back you
7. agree on funding terms with a “SAFE”
   – 5 pages, just two numbers to agree on
Pre-seed Pitch

- Can be live or recorded

- Questions from potential investors:
  1. Can you **ship**?
     - need to finish building the product
  2. Can you **sell**?
     - need customers who want to buy the product
  3. Can you **hire**?
     - need more than a few people to build most products
Pre-seed Pitch

1. Can you ship?
   - need to finish building the product

- We spent the whole quarter talking about this!
  - writing high quality code
  - tools, inspection, and testing

- Pitch includes a demo that shows what you can do
  - you've just seen one!

- You also need product ideas & design
  - must ship a product that people want
2. Can you **sell**?
   - need more customers who want to buy the product
   - what *evidence* do you have that they exist?

- Get feedback
  - talk to potential customers & investors
  - code must work (correctness)

- Hard to get it right the first time
  - iterate! (changeability)

- How will you find paying customers?
  - have a plan to use the money for this
Pre-seed Pitch

3. Can you hire?
   - need more than a few people to build most products
   - do you have a story to convince others to join

• You are asking employees to bet on the company also
  - need to sell to them just as much as investors

• You will need more programmers (& designers etc.)
  - must contribute quickly (understandability, modularity)
  - have a plan to use the money for this
Preparing to Pitch

• Expect to hear a lot of “no”s
  – angel investors may pass on 24 out of 25 pitches
  – successful companies have had 100 “no”s before a yes
  – thousands of angel investors… only takes one “yes”

• Hard to know what a particular VC is going to think
  – a16z: “we invest in good ideas that sounds like bad ideas”
  – may like the team but not the idea or vice versa

• Why back this team going after this idea?
  – what is your personal connection to the problem solved?
More Help

• UW CoMotion
  – startup training
  – connections and mentoring
  – office space (part of their startup incubator)
  – grants based on impact and financial need

• CSE 599: Entrepreneurship (offered winter quarter)
  – co-taught by Greg Gottesman from PSL
  – PSL is a local startup incubator

• VC in Founder’s Hall (Pack Ventures)
  – angel investors in Gates & Allen
Think About It

• Never been easier to do a startup. Vs 40 years ago:
  – 100x more funding available
  – 100x less money required

• Startup / venture community
  – (naïvely) optimistic
  – supportive
  – VCs are happy to talk & help before you are ready to pitch

• Still many opportunities
  – one obvious area…
    • new business ideas any time expensive things become cheap
    • connectivity, wireless, parallel computing… now AI