Administrivia

- Course evaluations due by Sunday
  - would like to see 50+% participation
- Final exam next Tuesday in KNE 220
  - section B at 2:30 – 4:20
  - section A at 4:30 – 6:20
- No notes or devices
- Midterm was 50 minutes and had 5 problems
- Final is 110 minutes, so…

Administrivia

- At most 9 problems
- 5 problems on reasoning & testing
  - primary focus, as promised
  - three categories of reasoning problems discussed before
- Other large problems on:
  - generics
  - subtypes, overloading vs overriding
  - TypeScript
- Small problems on anything else (comprehensive)

US News CS Rankings

1	MIT
2	CMU
	UC Berkley
	Stanford
5	UIUC
6	UW
	Cornell
	Georgia Tech

CSE 331
Software Design & Implementation

Kevin Zatloukal

Spring 2023

Startups

Why Startups?

- 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…

Myth #1: You'll Go Bankrupt

- 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

Myth #2: You'll Ruin Your Career

- "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…

Realities

- 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)

Basic Corporation Finances

Revenue	money earned	Top Line
– Expenses		
= Income	profit	Bottom Line

- 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

Sources of Funding

Two sources of funding

1. **Debt**: a loan
   - low up-side (fixed percentage)
   - debt holders have low risk tolerance
     - frequently want collateral to limit downside

2. **Equity**: exchange for part of all future profits
   - unlimited up-side
   - equity investors have high risk tolerance

Angel Investors

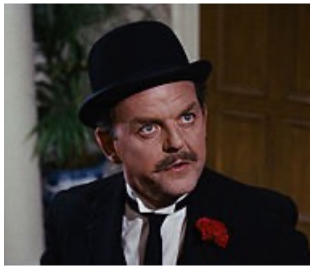
- Most risk-tolerant investors are “angels”
  - they invest when no one else will

- Thomas Edison’s story is widely known
  - invented the light bulb and electric lighting
  - took years of hard work
  - who paid for it?

- He had an angel investor
  - found more money each time Edison ran out
  - that part of the story is often left out

Funding Rounds

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



- Each stage is less risky than previous

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

- 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

- **Recall**: only need funding when revenue < expenses
  - paying customers reduce the need for more funding
    - also shows that you’re building the right product
  - can “self-fund” if expenses are low enough
    - friends & family are sometimes an option
    - some startups have skipped early rounds (e.g., Calendly)

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

	Pre-seed	Seed
Funding amount	Typically between $500k – $1m	Typically between $2m – $5m depending on industry.
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.

Steps in the Product Stage

- 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

- Steps involved in pre-seed funding:
  1. find a problem worth solving
  2. identify customers willing to use minimal solution
  3. form a C corporation
  4. prepare a pitch to describe your product / business vision
  5. find investors who want to back you
  6. 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

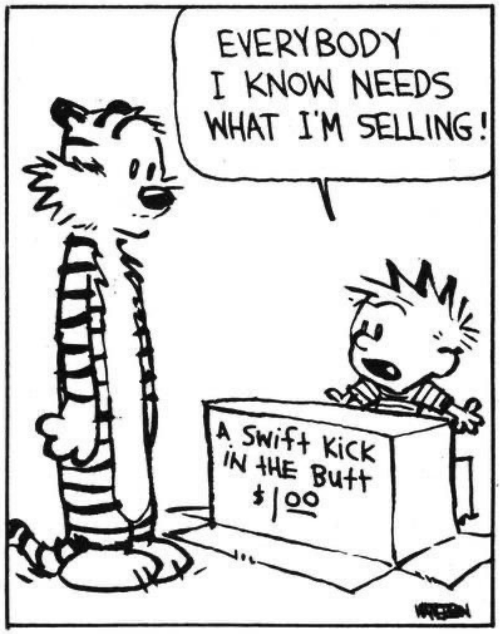
1. Can you **ship**?
   – need to finish <u>building</u> the product

- 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

Pre-seed Pitch

2. Can you **sell**?
   - need 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 <u>story</u> to convince others to join

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

- 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
- Angel investors in Gates & Allen
  - VCs down the street (e.g., Pack Ventures)

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**