

Pillar: Risk | Complete before class

### What You Should Already Know

**DeFi** – Financial services on public blockchains without traditional intermediaries | **Wallet** – Software that stores your private keys and lets you interact with the blockchain | **Liquidity pool** – Tokens locked in a smart contract for others to trade against | **Token swap** – Exchanging one token for another via a decentralized exchange | **Slippage** – The price change caused by your own trade's impact on the pool

**Key Terms Preview** **Over-collateralization** (Depositing more value than you borrow) | **LTV** (Loan-to-Value ratio, e.g. 75% for ETH on Aave) | **Health factor** (Below 1.0 = liquidation) | **Liquidation** (Forced sale of collateral when loan becomes unsafe) | **Oracle** (External price feed for smart contracts) | **Flash loan** (Borrow and repay in one transaction) | **Interest rate model** (Algorithmic rates based on supply/demand)

### The Problem

You own 10 ETH and believe the price will rise. You need cash NOW but do not want to sell. A pawn shop would work – but pawn shops have business hours, require ID, and charge 25% interest. Is there a 24/7 automated pawn shop?

**How can you borrow money without a bank, a credit score, or even revealing your identity?**

*Aave holds \$57B in TVL – more deposits than many mid-sized banks – with zero employees processing loan applications.*

### Warm-Up

When you apply for a bank loan, what does the bank check before approving you? List at least 3 things.

Your answer: \_\_\_\_\_

### Discovery Questions

**Q1.** A pawn shop lends you cash if you leave your watch. How is DeFi lending similar? How is it different?

*Hint: What happens if your watch's value drops below the loan?*

Your answer: \_\_\_\_\_

**Q2.** Why does DeFi require MORE collateral than you borrow? Traditional banks lend MORE than your deposit – why can DeFi not do the same?

*Hint: Can a smart contract check your credit score or sue you?*

Your answer: \_\_\_\_\_

**Q3.** Your health factor is 1.05. ETH drops 5%. What happens next?

*Hint: Health factor = (collateral × threshold) / debt. Below 1.0 means liquidation.*

Your answer: \_\_\_\_\_

**Q4.** Who tells the smart contract what ETH costs in dollars? What if that information is wrong?

*Hint: Smart contracts cannot browse the internet. They need a messenger.*

Your answer: \_\_\_\_\_

### Cryptoeconomics Challenge

Black Thursday (Mar 12, 2020): ETH crashed 43%, causing \$8.32M in MakerDAO losses. The code worked as designed. Is this a failure of the protocol or a failure of the market? Who should bear the loss?

### After-Class Reflection

*After the lecture, calculate your own health factor scenario: pick a collateral amount, a borrow amount, and figure out how far the price must drop before you get liquidated.*

## Solutions

Complete answers to all discovery questions.

### Warm-Up Answer

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**Banks check:** (1) credit score/history, (2) income/employment, (3) existing debts, (4) collateral value (for secured loans), (5) identity verification (KYC). DeFi skips all of these – the only “check” is whether your collateral exceeds the required ratio. No credit score, no income verification, no identity.

### Answers

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**Q1:** Both are collateral-based: you leave an asset, you get a loan. If you fail to repay, the asset is sold. Key differences: (1) DeFi is 24/7, a pawn shop has hours; (2) DeFi liquidation is automatic and instant – no negotiation; (3) DeFi requires over-collateralization (you leave more than you borrow); (4) DeFi has no human to assess your collateral’s sentimental value. In DeFi, if your collateral drops below the threshold, a liquidation bot sells it within seconds.

**Q2:** Banks can lend more than your deposit because they use credit scores, employment verification, and legal enforcement (courts, debt collectors) to manage risk. A smart contract cannot check your credit history, cannot verify your income, and cannot sue you if you default. Over-collateralization is the only tool DeFi has – the extra collateral (e.g., deposit \$10,000, borrow \$7,500) acts as a safety buffer against price drops.

**Q3:** With a health factor of 1.05, a 5% ETH drop pushes the health factor below 1.0 (approximately to 0.998). This triggers liquidation: anyone can call the liquidation function on the smart contract, repay part of your debt, and claim your collateral at a 5% discount (the liquidation penalty). You lose your collateral plus the penalty. This happens automatically – no warning call from a bank manager.

**Q4:** Oracles (like Chainlink, which has 63% market share) feed real-world price data to smart contracts. If the oracle reports a wrong price, the consequences are severe: collateral could be liquidated unfairly (price reported too low) or loans could become undercollateralized without liquidation (price reported too high). The Mango Markets attack (\$117M, Oct 2022) exploited exactly this – the attacker manipulated the oracle’s price source.

### Cryptoeconomics Answer

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This is both a market failure and a protocol design limitation. The code worked as written – liquidations were triggered correctly. But the market crash overwhelmed the system: network congestion prevented liquidation bots from executing, and some vaults were liquidated at \$0 (winning bids of zero). The \$8.32M loss reveals that “code is law” has limits when external conditions exceed design parameters. The loss fell on MakerDAO (protocol treasury) and individual vault holders. A well-designed system needs circuit breakers for extreme conditions.