

Bitcoin: Programming the Future of Money

Topics in Computer Science - ITCS 4010/5010, Spring 2025

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Lecture 2

History and Function of Money



Your Questionnaire

WHAT CAUGHT YOUR INTEREST IN THIS CLASS?

- Heard about / fascinated by Bitcoin (III):
“Most popular topic in the world”
- Programming & economics
- Little previous knowledge about topic
- Confusion about the technology
- Interest in what makes it valuable
- Interest in cryptography and consensus
- Want to learn where it comes from
- Interdisciplinary topic
- Needed elective (III)

WHAT DO YOU KNOW ABOUT BITCOIN?

- Most popular/valuable cryptocurrency (||||)
- Not controlled/regulated by governments
- Volatile / value fluctuates a lot (II)
- Like other currency, but higher price per unit
- A digital currency, can be used to buy things (II)
- Decentralized system
- Something to invest in
- Made and lost money with it, passive income investment
- Can be used for illicit activities
- Can replace the gold standard

WHAT ARE YOU MOST INTERESTED IN?

- **Cryptography (III)**
- Decentralized networks (IIII)
- **History/ socioeconomic effects (IIIIII)**
- **What makes BTC valuable/popular? (IIII)**
- **How does BTC work? Math behind it? (IIIIII)**
- Can bitcoin be used to stabilize the US dollar? (II)
- Ethical implications of bitcoin (II)
- **Role of miners and bitcoin nodes?**
- **BTC vs. other cryptocurrencies (IIII)**
- How to trade it
- “Layer 1” vs “Layer 2” technologies
- **How programming relates to it (IIIIII)**
- **Mining/ how to create bitcoin (III)**
- Relationship with AI
- Game theory behind it
- Anonymous ways to use bitcoin
- Python (II)
- Impact on economy (II)
- **What is money?**
- **How many BTC are available? (II)**

SOME QUESTIONS THAT CAME UP

- How is BTC different from stocks?
- What is next after Bitcoin?
- Why can't it be copied?
- What does decentralization mean?
- Is a "physical" bitcoin possible?

FIRST TIME ENCOUNTER WITH BITCOIN

- Parents like it
- Hyped during Covid-19 years
- Heard it is a way to a rich life
- Major application of cryptography ideas
- High school
- When it was worth \$1000
- Heard online many people trade it
- Was considered a joke in middle school

History of Money

PRE-HISTORICAL AND ANCIENT MONEYS



Beads made from shells of the pea-sized snail *Nassarius kraussianus*, that lived in a nearby estuary.
Blombos Cave, South Africa, 75,000 B.P. [B04]



Ostrich-eggshell beads, Kenya Rift Valley, 40,000 B.P. (Courtesy Stanley Ambrose)



Detail of necklace from a burial at Sungir, Russia, 28,000 BP. Interlocking and interchangeable beads.
Each mammoth ivory bead may have required one to two hours of labor to manufacture. [W97]

MONEY AS SOLUTION FOR THE PROBLEM OF BARTER

Adam Smith (1776), Carl Menger “On the Origin of Money” (1892):

- Most salable good emerges (typically a commodity) emerges to facilitate trade
- Invented as more efficient way to trade than through barter

Problems of barter:

- Requires coincidence of interest
 - Requires maybe middlemen
 - **Measurement problem:** How many apples for how many pecans?
-
- Barter economy with n goods: n^2 prices
 - Money economy with n goods: n prices

-> Efficiency gains

PROTO-MONEY AS A STORE OF WEALTH ACROSS TIME

Nick Szabo's “Shelling Out - The Origins of Money” (2002):

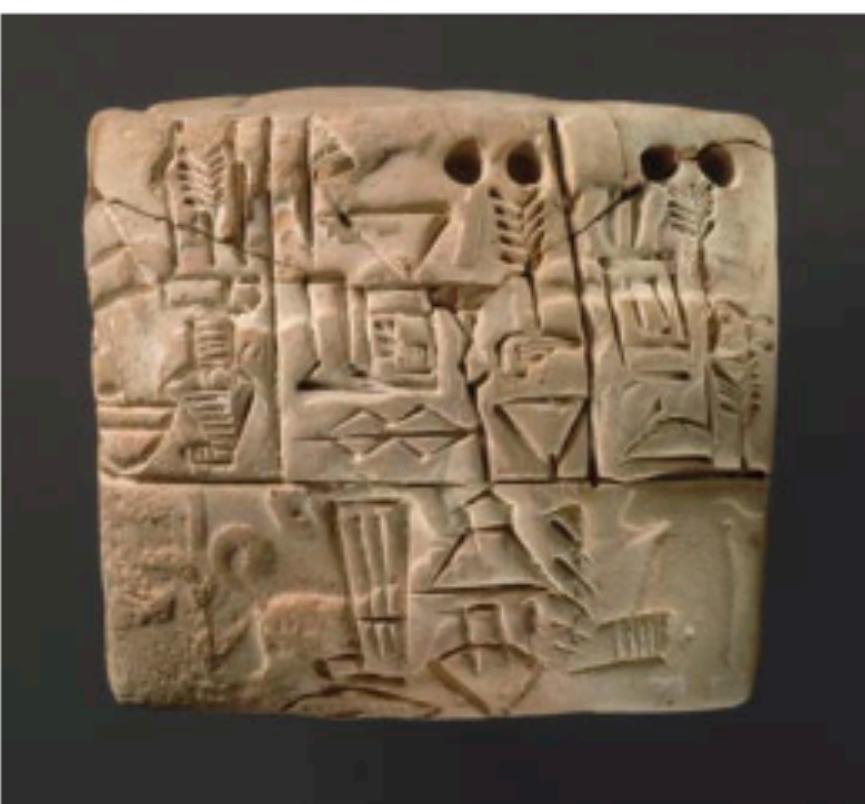
Reason for emergence of collectibles:

- Family heirlooms -> Transfer surpluses to future generations
- Starvation insurance
- “Marriage market”: Dowries, bride prices
- Mitigation of aggression: tribute between clans

LEDGERS

Definition in Merriam-Webster:

- a) “a book or other collection of financial accounts of a particular type.”
- b) “a digital record that is used similarly to an accounting ledger (as for maintaining a list of transactions)”



Proto Cuneiform
Uruk, ca 3000 B.C

1747	(1) Mr. Baily Washington Dr	1747	(2) Pers. Contra, Cr \$ 19
Sep 10	To two Books 2/6	1/8	1 1/8
	To me D ^r Scromberg 2/6	2/6	
July 25	To Cash P. & B. Luns for 500 Nails	1 8	
1/5/9	2 Pounds of Yer Letter 2 Pounds of Zed Letter 1 Pound of Thread & 50 Nails		2/6
Aug 1	2 Pounds of Yer Letter 2 Pounds of Zed Letter 1 Pound of Thread & 50 Nails		2/6
Sept 9	By 2 Pounds of Yer Letter 2 Pounds of Zed Letter 1 Pound of Thread & 50 Nails		2/6
Nov 3	By 2 Pounds of Yer Letter 2 Pounds of Zed Letter 1 Pound of Thread & 50 Nails		2/6

Personal Ledger
George Washington
1747

COMMODITY-BASED PUBLIC LEDGERS

- Used by inhabitants of Yap Island in Micronesia to represent wealth
- Huge limestones with holes
- Could only be quarried 250 miles away on island of Palau
- Ownership was transmitted through oral history/ oral agreements



Was exploited by Irishman David O'Keefe in late 1800's:

- > Quarry stones far away
- > Bring to island
- > Buy everything

Book “His Majesty O’Keefe”,
Klingman, Green, 1950

METAL MONEY



Bronze Aes Rude

Ancient Rome, 8th-4th century BC



Copper Plate
Sweden, 17th century
[\(History of Copper Currency in Sweden\)](#)



Bronze Spade

China
Zhou dynasty, 10th-3th century BC

MINTED MONEY



Bronze Yuan - China



Silver Dekadrachm - Greece



Gold Aureus - Rome

CURRENCY DEBASEMENT IN LATE ANCIENT ROME

Silver content in the denarius

Original weight (211 BC): 4.5g

190 BC: 3.9g

Nero (AD 64): 3.4g



Source: Lecture Series on History of Money, Jonathan Barth, Arizona State University
[Currency Debasement in the Late Roman Empire \(HOM 5-C\)](#)

CURRENCY DEBASEMENT IN LATE ANCIENT ROME

Silver content in the denarius

Original weight (211 BC): 4.5g (95% fine)

190 BC: 3.9g (95% fine)

Nero (AD 64): 3.4g (93.5% fine)

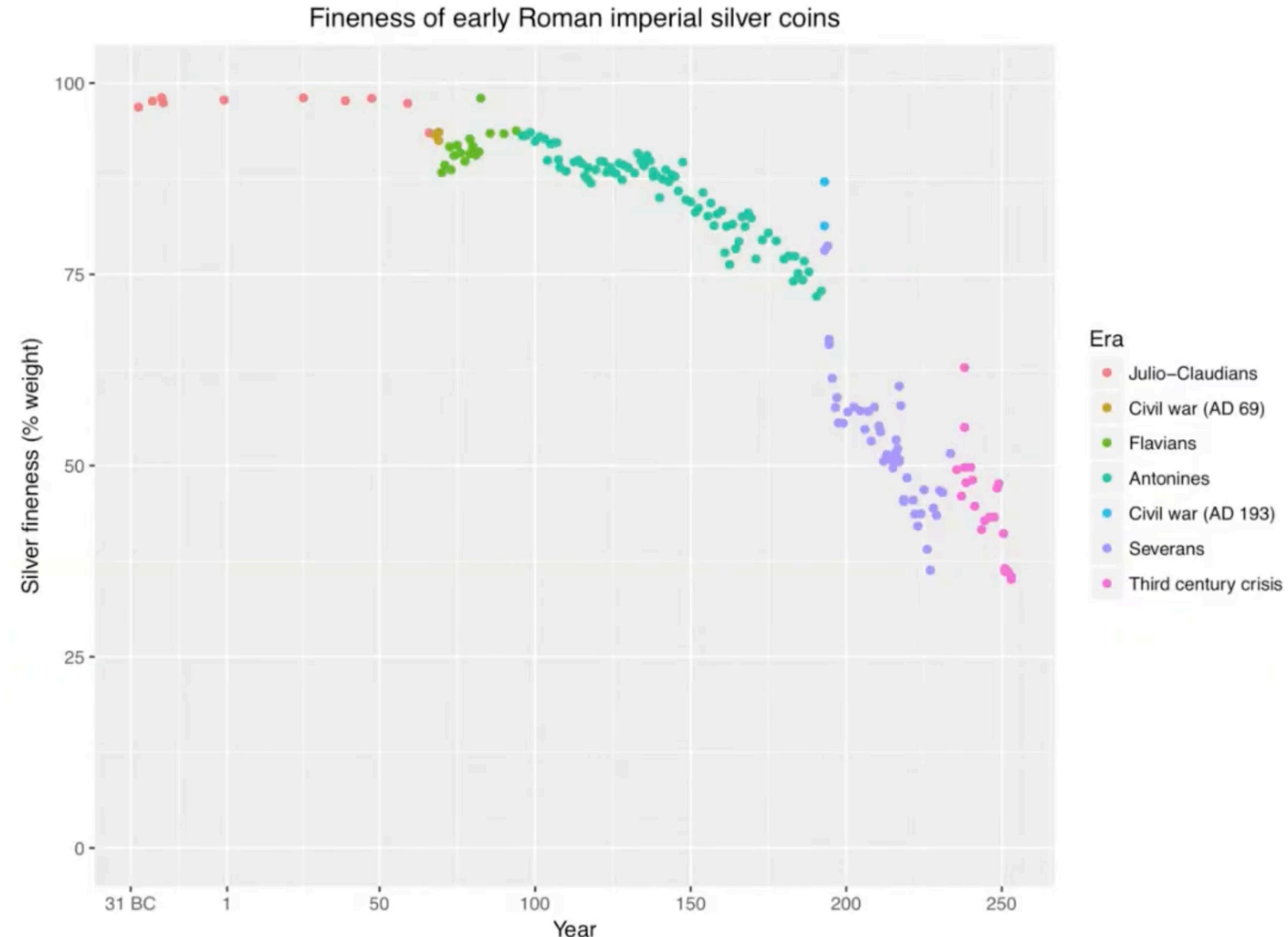
AD 150: 3.4g (83.5% fine)

AD 241: 3.4g (48% fine)

AD 260: 3.4g (20% fine)

AD 274: 3.4g (5% fine)

CURRENCY DEBASEMENT IN LATE ANCIENT ROME



Source: Lecture Series on History of Money, Jonathan Barth, Arizona State University
[Currency Debasement in the Late Roman Empire \(HOM 5-C\)](#)

PAPER MONEY



[Jiaozi Promissory Note - China](#)
(11th century)



5 Pound Note - England
(1793)



Continental Note – U.S.
(1779)

See also:
[The Continental Dollar and Revolutionary War \(HOM 17-A\)](#)

HYPERINFLATION OF THE CONTINENTAL DOLLAR

Ratio of Continental Dollar and Spanish Dollar

October 1777: 3:1

December 1778: 7:1

December 1779: 42:1

April 1781: 168:1

By 1781, one Continental dollar is worth only
0.005 Spanish dollars

INVASION MONEY

Issued by Imperial
Japan in WWII
In the Philippines
& Southeast Asia



- What might be the problem?

MONEY AS CREDIT

E.g. David Graeber: “Debt: The First 5000 Years”

- Money as credit relationship between debtor and creditor
 - > Creditor delivers a service, debtor issues an “I owe you” token / promise to make even for this
- Origin of modern money: Commodity-backed issuance of bank promises

Until 1934:

“Redeemable in Gold on Demand At the US Treasury, or in Gold or lawful money at any Federal Reserve bank”.



THE GOLD STANDARD

- 1717: Isaac Newton as “Master of Royal Mint” fixes ratio between British silver and gold (via respective coins) to 15.2:1
- Overvaluation of silver, [Gresham's law](#) leads to export of British silver coins abroad
- 19th century:
 - ▶ Dominance of Great Britain in global trade
 - ▶ Global trade network and several [gold rushes](#) convinces other powers to adapt national currency standards based on gold as well (US 1834/1873, Germany 1871, France 1874)
- Silver is phased out as metal to redeem banknotes in
- In Europe: National **central banks** centralize gold supplies in economies, issue bank notes redeemable in gold, make sure that redemption/convertibility in gold is guaranteed



(Source: Cooper, Richard N., Rüdiger Dornbusch, and Robert E. Hall. ["The gold standard: historical facts and future prospects."](#) Brookings Papers on Economic Activity 1982.1 (1982): 1-56.)