

# Ordinal Theory Overview

Ordinals are a numbering scheme for satoshis that allows tracking and transferring individual sats. These numbers are called [ordinal numbers](#). Satoshis are numbered in the order in which they're mined, and transferred from transaction inputs to transaction outputs first-in-first-out. Both the numbering scheme and the transfer scheme rely on *order*, the numbering scheme on the *order* in which satoshis are mined, and the transfer scheme on the *order* of transaction inputs and outputs. Thus the name, *ordinals*.

Technical details are available in [the BIP](#).

Ordinal theory does not require a separate token, another blockchain, or any changes to Bitcoin. It works right now.

Ordinal numbers have a few different representations:

- *Integer notation*: [2099994106992659](#) The ordinal number, assigned according to the order in which the satoshi was mined.
- *Decimal notation*: [3891094.16797](#) The first number is the block height in which the satoshi was mined, the second the offset of the satoshi within the block.
- *Degree notation*: [3°111094'214"16797"](#) . We'll get to that in a moment.
- *Percentile notation*: [99.99971949060254%](#) . The satoshi's position in Bitcoin's supply, expressed as a percentage.
- *Name*: [satoshi](#) . An encoding of the ordinal number using the characters `a` through `z` .

Arbitrary assets, such as NFTs, security tokens, accounts, or stablecoins can be attached to satoshis using ordinal numbers as stable identifiers.

Ordinals is an open-source project, developed [on GitHub](#). The project consists of a BIP describing the ordinal scheme, an index that communicates with a Bitcoin Core node to track the location of all satoshis, a wallet that allows making ordinal-aware transactions, a block explorer for interactive exploration of the blockchain, functionality for inscribing satoshis with digital artifacts, and this manual.

## Rarity

Humans are collectors, and since satoshis can now be tracked and transferred, people will naturally want to collect them. Ordinal theorists can decide for themselves which sats are rare and desirable, but there are some hints...

Bitcoin has periodic events, some frequent, some more uncommon, and these naturally lend themselves to a system of rarity. These periodic events are:

- *Blocks*: A new block is mined approximately every 10 minutes, from now until the end of time.
- *Difficulty adjustments*: Every 2016 blocks, or approximately every two weeks, the Bitcoin network responds to changes in hashrate by adjusting the difficulty target which blocks must meet in order to be accepted.
- *Halvings*: Every 210,000 blocks, or roughly every four years, the amount of new sats created in every block is cut in half.

- *Cycles*: Every six halvings, something magical happens: the halving and the difficulty adjustment coincide. This is called a conjunction, and the time period between conjunctions a cycle. A conjunction occurs roughly every 24 years. The first conjunction should happen sometime in 2032.

This gives us the following rarity levels:

- **common** : Any sat that is not the first sat of its block
- **uncommon** : The first sat of each block
- **rare** : The first sat of each difficulty adjustment period
- **epic** : The first sat of each halving epoch
- **legendary** : The first sat of each cycle
- **mythic** : The first sat of the genesis block

Which brings us to degree notation, which unambiguously represents an ordinal number in a way that makes the rarity of a satoshi easy to see at a glance:

```
A°B'C"D"
| | |  └─ Index of sat in the block
| | └─── Index of block in difficulty adjustment period
| └───── Index of block in halving epoch
└──────── Cycle, numbered starting from 0
```

Ordinal theorists often use the terms "hour", "minute", "second", and "third" for *A*, *B*, *C*, and *D*, respectively.

Now for some examples. This satoshi is common:

```
0°0'0"1"
| | |  └─ Not first sat in block
| | └─── Any block in difficulty adjustment period
| └───── Any block in halving epoch
└──────── Any cycle
```

This satoshi is uncommon:

```
0°1'1"0"
| | |  └─ First sat in block
| | └─── Not first block in difficulty adjustment period
| └───── Not first block in halving epoch
└──────── Any cycle
```

This satoshi is rare:

```
0°2016'0"0"
|   | |  └─ First sat in block
|   | └─── First block in difficulty adjustment period
|   └───── Not the first block in halving epoch
└──────── Any cycle
```

This satoshi is epic:

```
0°0'336"0"
| | |  └─ First sat in block
| | └─── Not first block in difficulty adjustment period
```

```
| ┌─── First block in halving epoch
└─── Any cycle
```

This satoshi is legendary:

```
1°0'0"0"
| | | ┌ First sat in block
| | └── First block in difficulty adjustment period
| └─── First block in halving epoch
└─── Any cycle but first
```

And this satoshi is mythic:

```
0°0'0"0"
| | | ┌ First sat in block
| | └── First block in difficulty adjustment period
| └─── First block in halving epoch
└─── First cycle
```

If the block offset is zero, it may be omitted. This is the uncommon satoshi from above:

```
1°1'1"
| | ┌ Not first block in difficulty adjustment period
| └── Not first block in halving epoch
└── Second cycle
```

## Rare Satoshi Supply

### Total Supply

- common : 2,099,999,990,760,000
- uncommon : 6,926,535
- rare : 3432
- epic : 27
- legendary : 5
- mythic : 1

### Current Supply

- common : ~1.98 quadrillion
- uncommon : ~880,000 (a new uncommon is mined roughly every ten minutes)
- rare : ~430 (a new rare is mined roughly every two weeks)
- epic : 3
- legendary : 0
- mythic : 1

At the moment, even uncommon satoshis are quite rare. As of this writing, 876,023 uncommon satoshis have been mined - one per 22.6 bitcoin in circulation.

## Names

Each satoshi has a name, consisting of the letters A through Z, that get shorter the further into the future the satoshi was mined. They could start short and get longer, but then all the good, short names would be

trapped in the unspendable genesis block.

As an example, 1905530482684727°'s name is "iaiuifjszmoba". The name of the last satoshi to be mined is "a". Every combination of 10 characters or less is out there, or will be out there, someday.

## Exotics

Satoshis may be prized for reasons other than their name or rarity. This might be due to a quality of the number itself, like having an integer square or cube root. Or it might be due to a connection to a historical event, such as satoshis from block 477,120, the block in which SegWit activated, or 2099999997689999°, the last satoshi that will ever be mined.

Such satoshis are termed "exotic". Which satoshis are exotic and what makes them so is subjective. Ordinal theorists are encouraged to seek out exotics based on criteria of their own devising.

## Inscriptions

Satoshis can be inscribed with arbitrary content, creating Bitcoin-native digital artifacts. Inscribing is done by sending the satoshi to be inscribed in a transaction that reveals the inscription content on-chain. This content is then inextricably linked to that satoshi, turning it into an immutable digital artifact that can be tracked, transferred, hoarded, bought, sold, lost, and rediscovered.

## Archaeology

A lively community of archaeologists devoted to cataloging and collecting early NFTs has sprung up. [Here's a great summary of historical NFTs by Chainleft.](#)

A commonly accepted cut-off for early NFTs is March 19th, 2018, the date the first ERC-721 contract, [SU SQUARES](#), was deployed on Ethereum.

Whether or not ordinals are of interest to NFT archaeologists is an open question! In one sense, ordinals were created in early 2022, when the Ordinals specification was finalized. In this sense, they are not of historical interest.

In another sense though, ordinals were in fact created by Satoshi Nakamoto in 2009 when he mined the Bitcoin genesis block. In this sense, ordinals, and especially early ordinals, are certainly of historical interest.

Many ordinal theorists favor the latter view. This is not least because the ordinals were independently discovered on at least two separate occasions, long before the era of modern NFTs began.

On August 21st, 2012, Charlie Lee [posted a proposal to add proof-of-stake to Bitcoin to the Bitcoin Talk forum](#). This wasn't an asset scheme, but did use the ordinal algorithm, and was implemented but never deployed.

On October 8th, 2012, jl2012 [posted a scheme to the same forum](#) which uses decimal notation and has all the important properties of ordinals. The scheme was discussed but never implemented.

These independent inventions of ordinals indicate in some way that ordinals were discovered, or rediscovered, and not invented. The ordinals are an inevitability of the mathematics of Bitcoin, stemming not from their modern documentation, but from their ancient genesis. They are the culmination of a sequence of events set in motion with the mining of the first block, so many years ago.