



3NF proof:

All entities have a primary key, and all non-key attributes are fully functionally dependent on the whole primary key, with no transitive dependencies.

Investor:

All attributes are atomic. Single-attribute PK → No partial dependencies.

Non-prime attributes (name, birthDate) depend only on PK (iid).

Ownership (the junction table to resolve M:N relationship between investor and portfolio):

All attributes are atomic. No transitive or partial dependencies.

Portfolio:

All attributes are atomic. No partial dependencies.

Non-prime attributes (name, volatility) depend only on PK (pfid).

Transaction:

All attributes are atomic. After i remove tradingPrice and tradingDate into TransactionDetails junction table, it satisfies the 2NF and 3NF, with only describing the high level transaciton properties. type and qty only rely on tid, with pfid connects with portfolio table (one to one or many relationship).

TransactionDetails (the junction table to resolve M:N relationship between Transaction and Security table):

All attributes are atomic. No partial dependencies.

highPrice, lowPrice, closePrice only depend on the date granularity.

Security:

All attributes are atomic. No partial dependencies.

Non-prime attributes (name, cusip) depend only on PK (sid).

A portfolio is a collection of securities acquired through purchases. Securities can also be sold. So, a portfolio is associated with numerous "transactions" that are purchases ("buy") or sales ("sell") of some security. For example, portfolio "Education" with a volatility of "high" and a target date of "2038" is owned by "Jeff Lupis". The portfolio had several transactions: a purchase of 500 shares of Microsoft ("MSFT") at \$134.58 on Sept 14 2022 and 1000 shares of Berkshire Hathaway ("BRYN") at 332.95 on Oct 11 2023, plus a sale of 100 shares of BRYN at 408.17 on Mar 18 2024.

A portfolio can be co-owned by two investors.

The current market price of a security on the most recent date traded is a triple of high/low/close, so, for example, for BRYN on Sep 3 2024 might have been 431.5/430.25/431.15.