Balancing respondent confidentiality and data user needs

Consumer Expenditure Survey

Arcenis Rojas

What is the crux?

- **Conflicting goals**
  - Maximize data access
  - Protect respondents identity

Why is confidentiality important?

- Ensure future cooperation by respondents
- It's the law

Title 13?

Federal law to protect identities of survey respondents

Who determines threats?

- Disclosure Review Board (DRB) by the U.S. Census

BLS

How could microdata reveal respondents' identity?

- High income
- High expenditures
- High age
- Small PSUs

How to protect respondents' confidentiality?

Conceal information that *could* reveal respondents

How to protect respondents' confidentiality?

Two stages:

- Census removes *obvious* identifiers
- BLS suppresses *data related* identifiers

How to protect respondents' confidentiality?

- **Top-code**: Provide average of expenditures above threshold
- **Re-code**: Change metadata but provide numerical data
- **Suppress**: Delete numerical data or entire record

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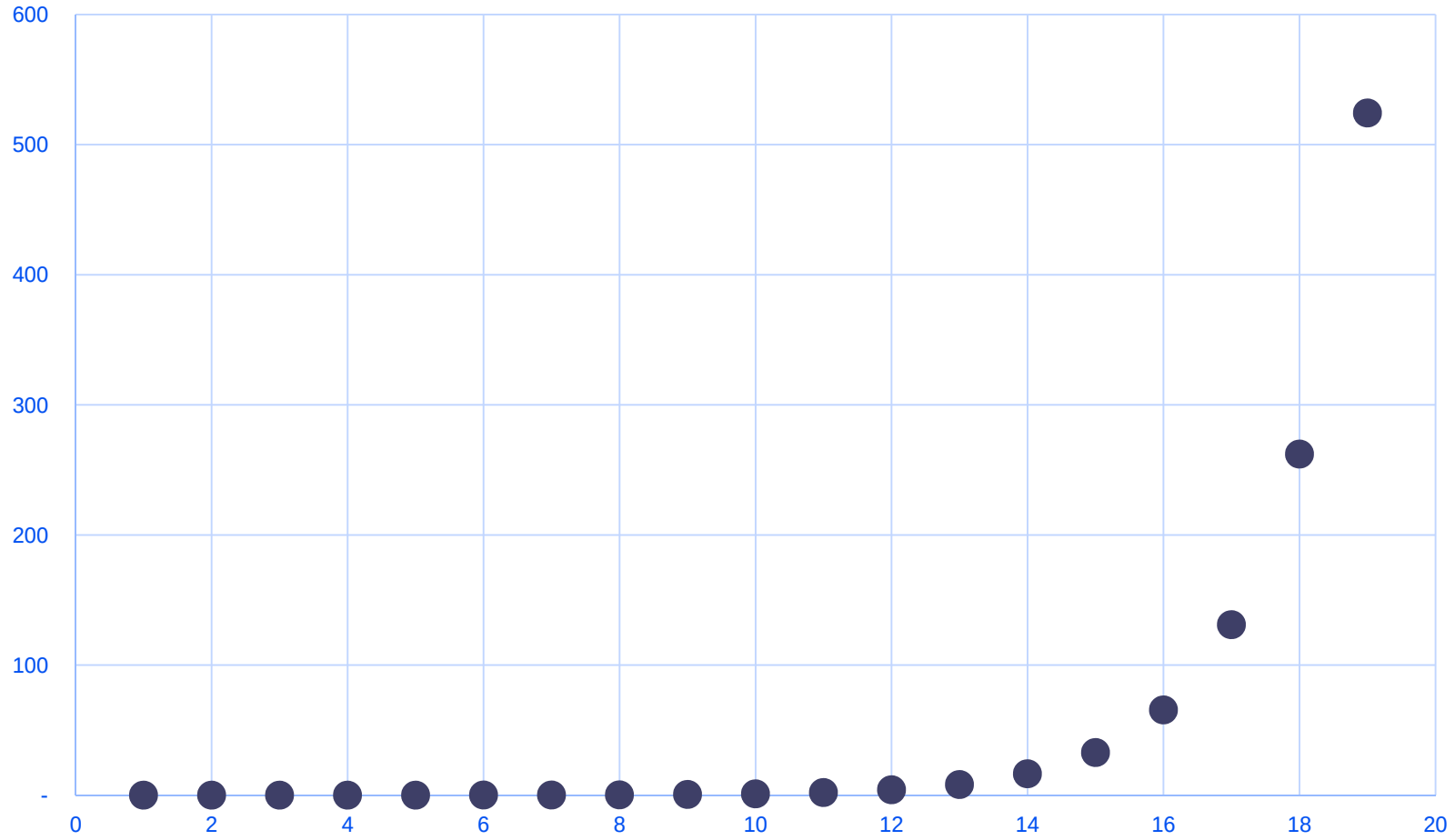
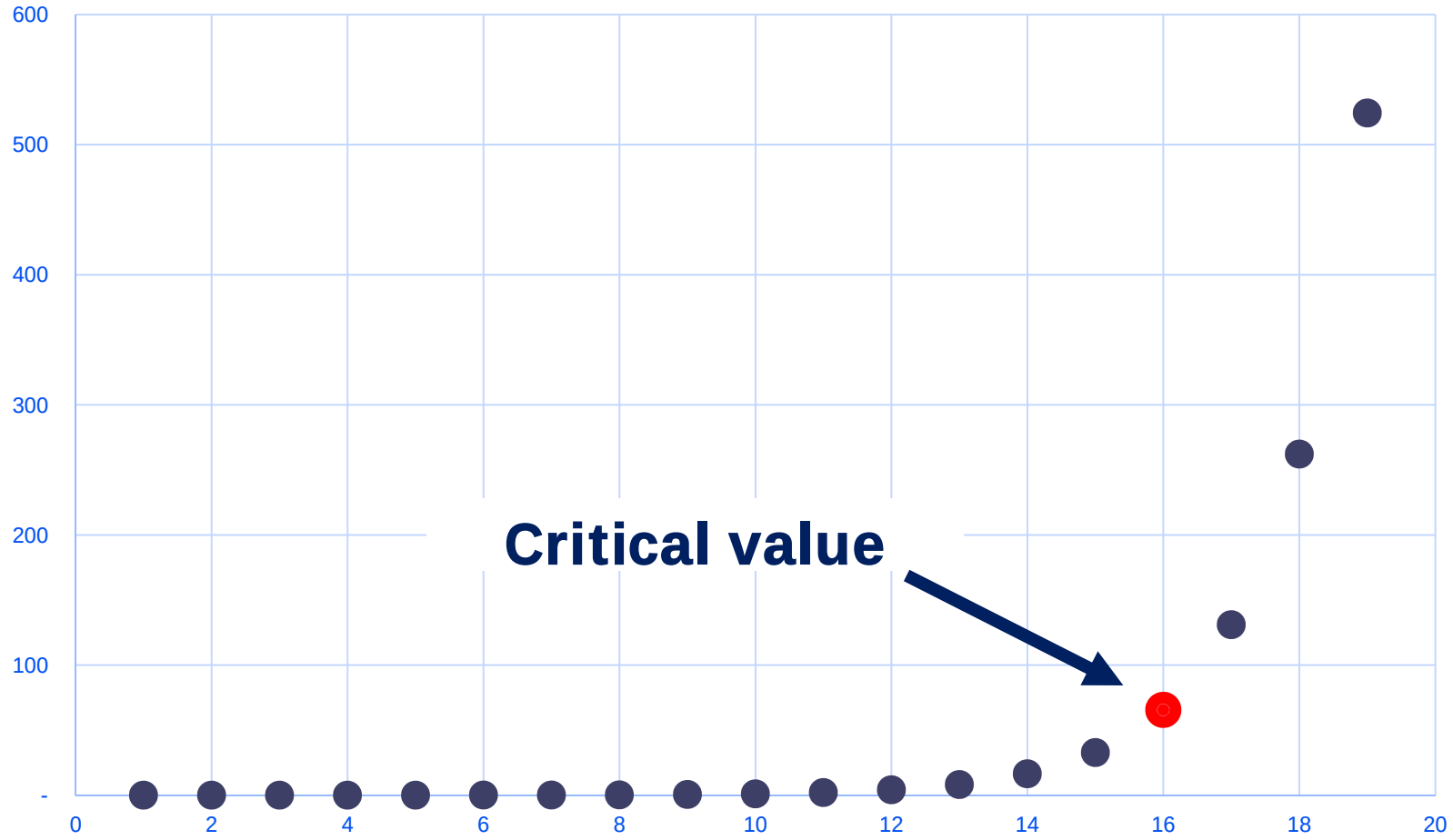
How do we topcode?

- Determine critical value
- Find values exceeding critical value
- Average values exceeding critical value
- Replace values with top-coded values

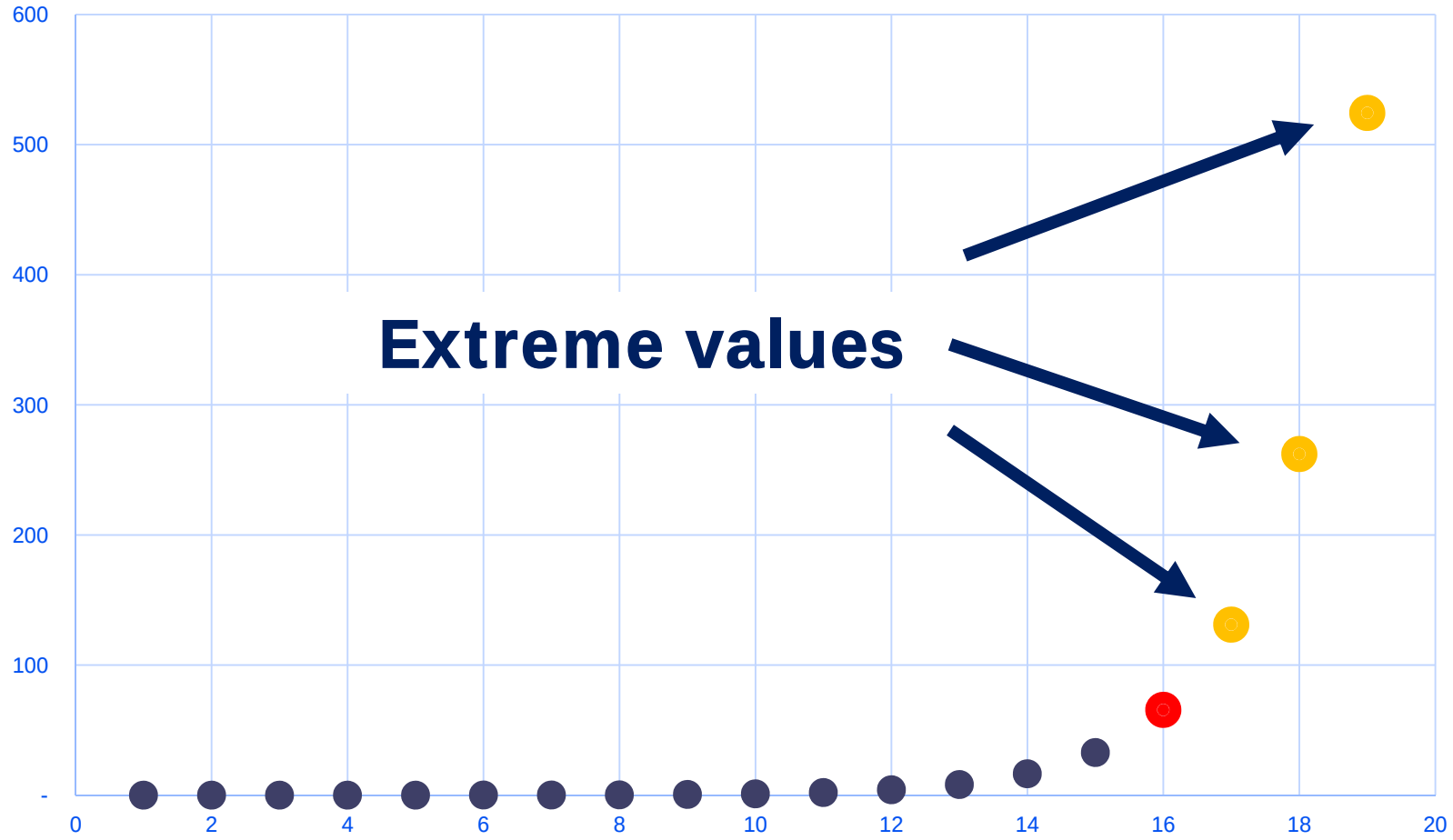
Topcoding example



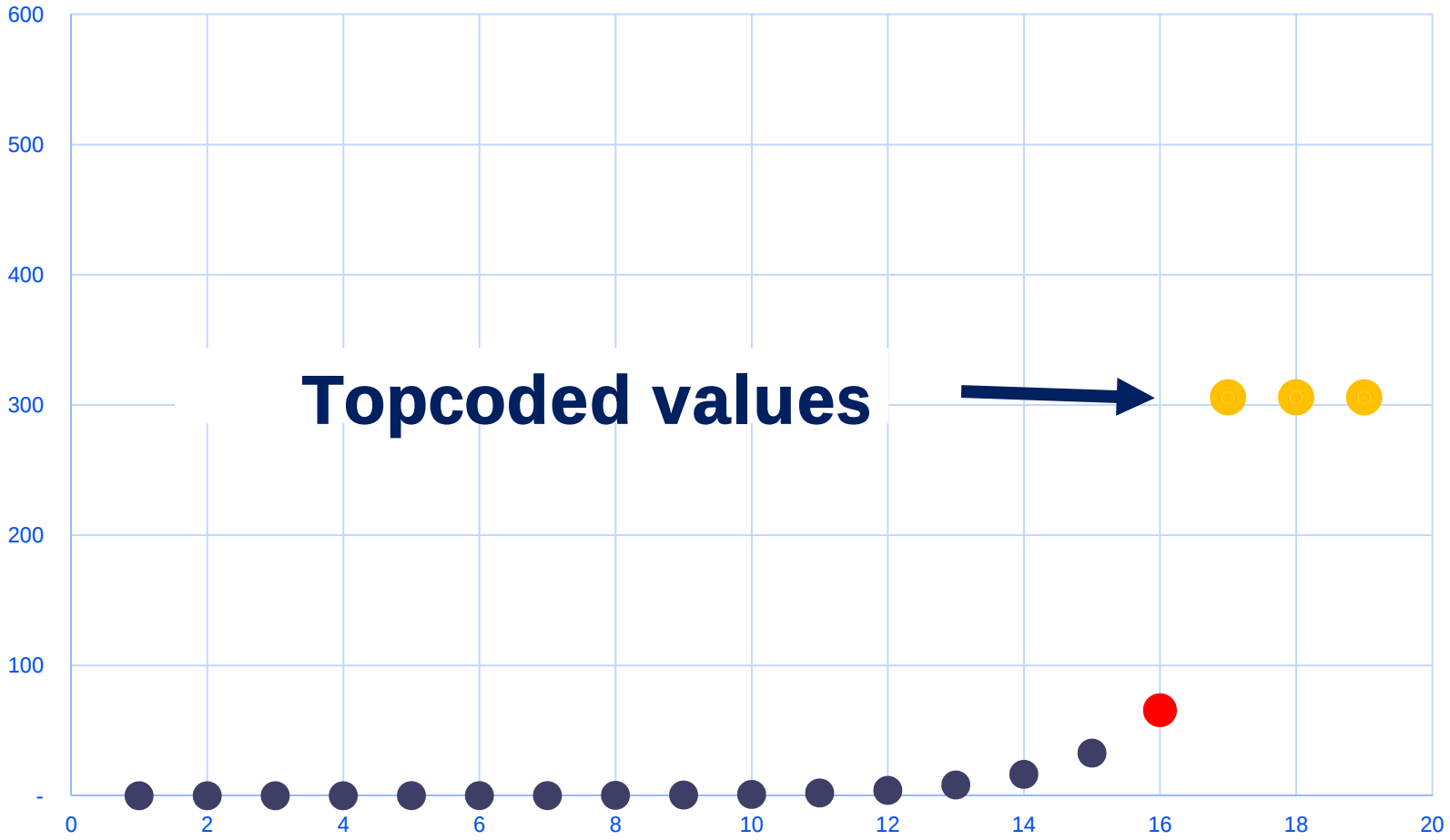
Topcoding example



Topcoding example



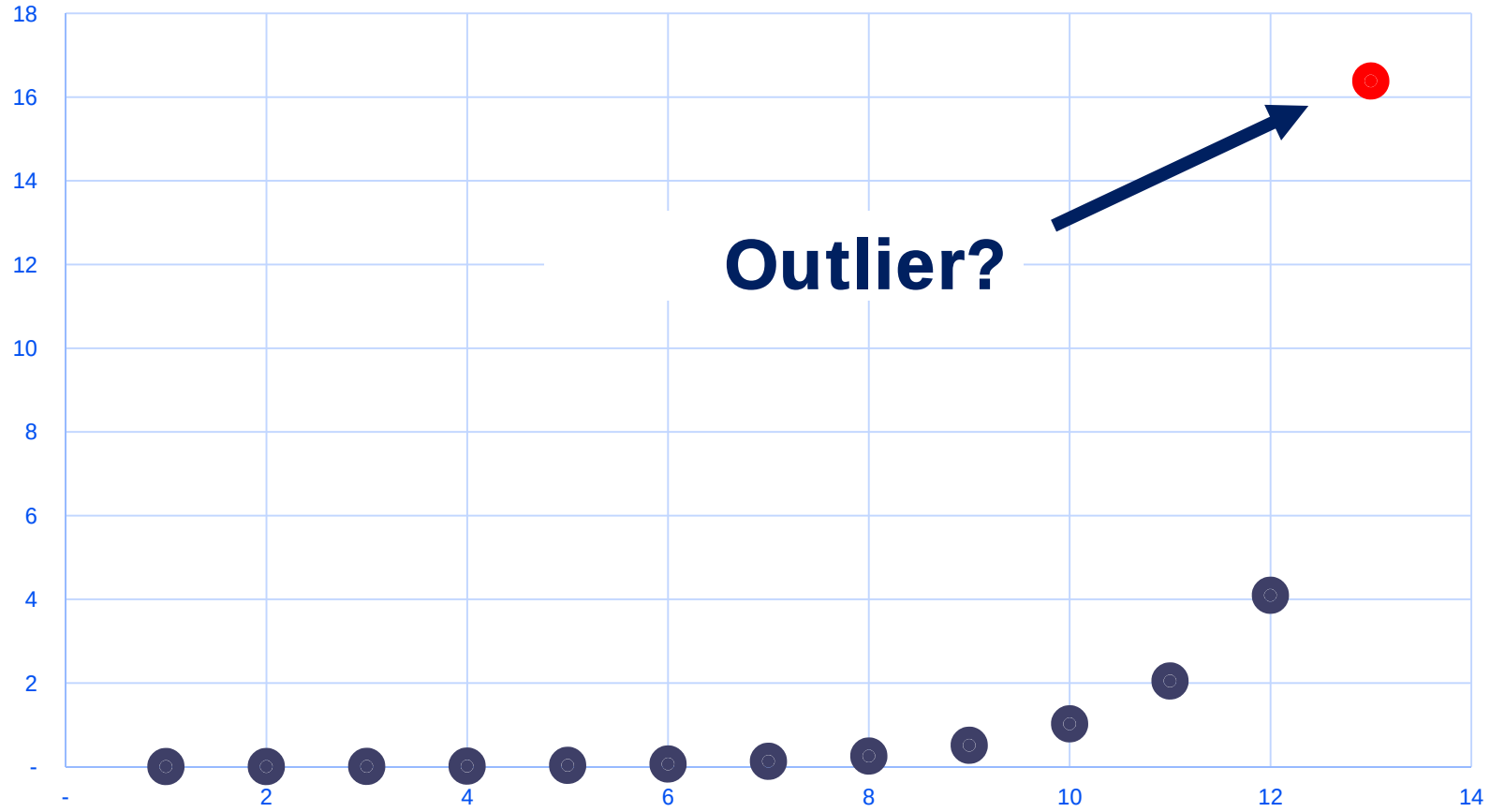
Topcoding example



How to determine critical values?

- **Percentiles**:
  - Population & expenditure: 99.5 %
  - Sample: 97 %
- **Outside sources:**
  If sample differs from population

Distribution in Sample



Distribution in Population

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How do we recode?

- Find values that meet criteria
- Determine method:
  - Generalize info
  - Change info
- Replace original metadata with recoded metadata

Re-code: Generalize information

- Broaden production year of cars
  - From Toyota Corolla 1999
  - To Toyota Corolla 1990s

BLS

Re-code: Change information

- Change data to comparable data
- Change respondents' age over 82 to 87

How to protect respondents' confidentiality?

- **Top-code**: Provide average of expenditures above a threshold
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Suppress

Delete the reported data or delete the entire record

How to suppress?

- Blank out numerical value but maintain metadata
- Erase entire record

Suppression

- **Blanking numerical data**
  - Blank values of normal but infrequent purchases
  - Example: Specialized mortgages

Suppression

- **Complete eradication**
  - Erase entire record
  - Example: Airplane purchase

Reverse engineering

$$5 = 3 + X$$

Reverse engineering

Prevent the use of available information to deduce protected information

How to prevent reverse engineering?

- Find protected values
- Protect them in all locations
- Protect related values

Reverse engineering

- **Scenarios**
  - Within file
  - Across files

Reverse Engineering: Within File

- Income = Wage + taxes
- 1000 = 800 + 200
- 1000 = 750 + 200
- 950 = 750 + 200

- Critical value: 700
- Topcode value: 750

Reverse Engineering: Within File

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Reverse Engineering: Across Files

- **Income**

  Topcoded income in FMLI
  => Topcode associated UCC in ITBI

- **Expenditure**

  Topcoded expenditures in EXPN/FMLI
  => topcode associated UCC in MTBI

How do we document?

- **Flag the values**
  - **T**: Topcoded value
  - **D**: Valid value

What percentage of data points changed?

- Un-weighted impact:
- Weighted impact:

Impact on trends?

- No: ??????
- Small: ??????
- Large: Area and income extremes

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Next presentation...