Modernizing the Disclosure Avoidance System for the 2020 Census

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United States Census Bureau | U.S. Department of Commerce
Economics and Statistics Administration
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Acknowledgments

This presentation incorporates work by:

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Outline

Motivation

The flow of census response data

Disclosure Avoidance for the 2010 census

Disclosure Avoidance for the 2018 census End-to-End test

Disclosure Avoidance for the 2020 census

Conclusion

Motivation


We the People
insure domestic Tranquility, provide for the common defence,
and our Posterity, do ordain and establish this Constitution
Article. I

Article 1, Section 2

The House of Representatives shall be composed of Members chosen every second Year by the People of the several States, and the Electors in each State shall have the Qualifications requisite for Electors of the most numerous Branch of the State Legislature.

No Person shall be a Representative who shall not have attained to the Age of twenty five Years, and been seven Years a Citizen of the United States, and who shall not, when elected, be an Inhabitant of that State in which he shall be chosen.

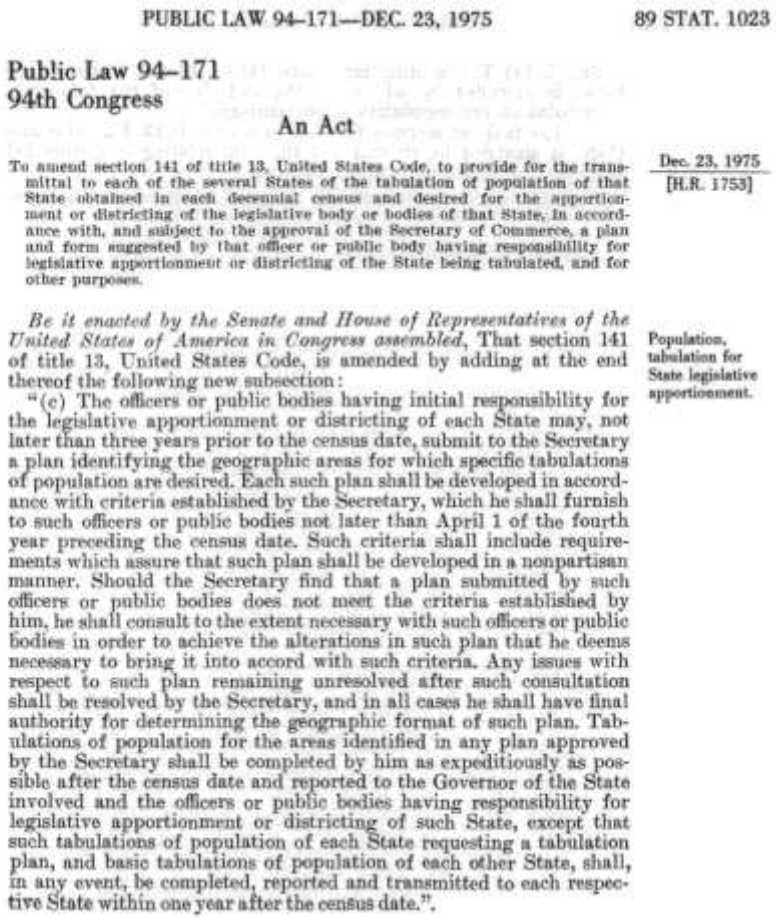
Representatives and direct Taxes shall be apportioned among the several States which may be included within this Union, according to their respective Numbers, which shall be determined by adding to the whole Number of free Persons, including those bound to Service for a Term of Years, and excluding Indians not taxed, three fifths of all other Persons. **The actual Enumeration shall be made within three Years after the first Meeting of the Congress of the United States, and within every subsequent Term of ten Years, in such Manner as they shall by Law direct.**

The Number of Representatives shall not exceed one for every thirty Thousand, but each State shall have at Least one Representative; and until such enumeration shall be made, the State of New Hampshire shall be entitled to chuse three, Massachusetts eight, Rhode-Island and Providence Plantations one, Connecticut five, New-York six, New Jersey four, Pennsylvania eight, Delaware one, Maryland six, Virginia ten, North Carolina five, South Carolina five, and Georgia three.

When vacancies happen in the Representation from any State, the Executive Authority thereof shall issue Writs of Election to fill such Vacancies.

The House of Representatives shall chuse their Speaker and other Officers; and shall have the sole Power of Impeachment.

"in such Manner as they shall by Law direct."
Public Law 94-171



PUBLIC LAW 94–171—DEC. 23, 1975 89 STAT. 1023

Public Law 94–171
94th Congress

An Act

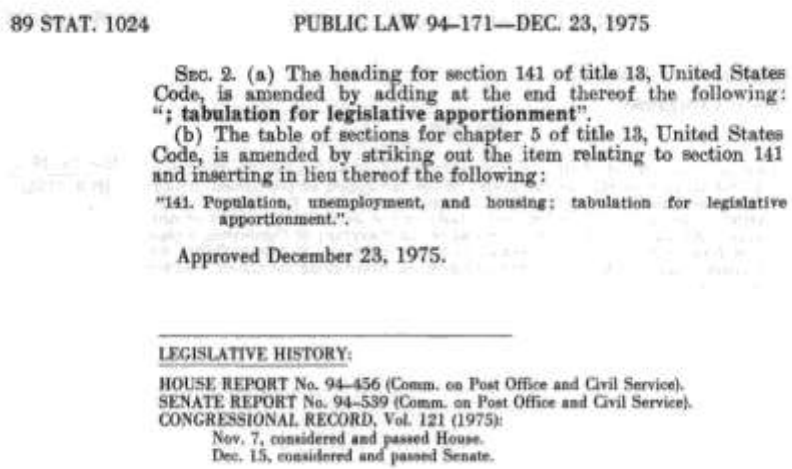
To amend section 141 of title 13, United States Code, to provide for the transmittal to each of the several States of the tabulation of population of that State obtained in each decennial census and desired for the apportionment or districting of the legislative body or bodies of that State, in accordance with, and subject to the approval of the Secretary of Commerce, a plan and form suggested by that officer or public body having responsibility for legislative apportionment or districting of the State being tabulated, and for other purposes.

Dec. 23, 1975
[H.R. 1753]

Be it enacted by the Senate and House of Representatives of the United States of America in Congress assembled, That section 141 of title 13, United States Code, is amended by adding at the end thereof the following new subsection:

Population, tabulation for State legislative apportionment.

"(c) The officers or public bodies having initial responsibility for the legislative apportionment or districting of each State may, not later than three years prior to the census date, submit to the Secretary a plan identifying the geographic areas for which specific tabulations of population are desired. Each such plan shall be developed in accordance with criteria established by the Secretary, which he shall furnish to such officers or public bodies not later than April 1 of the fourth year preceding the census date. Such criteria shall include requirements which assure that such plan shall be developed in a nonpartisan manner. Should the Secretary find that a plan submitted by such officers or public bodies does not meet the criteria established by him, he shall consult to the extent necessary with such officers or public bodies in order to achieve the alterations in such plan that he deems necessary to bring it into accord with such criteria. Any issues with respect to such plan remaining unresolved after such consultation shall be resolved by the Secretary, and in all cases he shall have final authority for determining the geographic format of such plan. Tabulations of population for the areas identified in any plan approved by the Secretary shall be completed by him as expeditiously as possible after the census date and reported to the Governor of the State involved and the officers or public bodies having responsibility for legislative apportionment or districting of such State, except that such tabulations of population of each State requesting a tabulation plan, and basic tabulations of population of each other State, shall, in any event, be completed, reported and transmitted to each respective State within one year after the census date.".



89 STAT. 1024 PUBLIC LAW 94–171—DEC. 23, 1975

SEC. 2. (a) The heading for section 141 of title 13, United States Code, is amended by adding at the end thereof the following: "; **tabulation for legislative apportionment**".

(b) The table of sections for chapter 5 of title 13, United States Code, is amended by striking out the item relating to section 141 and inserting in lieu thereof the following:

"141. Population, unemployment, and housing; tabulation for legislative apportionment.".

Approved December 23, 1975.

LEGISLATIVE HISTORY:

HOUSE REPORT No. 94–456 (Comm. on Post Office and Civil Service).
SENATE REPORT No. 94–539 (Comm. on Post Office and Civil Service).
CONGRESSIONAL RECORD, Vol. 121 (1975):
Nov. 7, considered and passed House.
Dec. 15, considered and passed Senate.

http://uscode.house.gov/statutes/pl/94/171.pdf

Federal Register / Vol. 82, No. 215 / Nov 8, 2017 / Notices

Dec. 31, 2018

We will report (per block):

- P1. RACE/ETHNICITY
  Universe: Total population
  Group by: BLOCK

- P2. RACE/ETHNICITY
  Universe: Total population age 18 and over

- H1. OCCUPANCY STATUS

- P42. GROUP QUARTERS POPULATION
  Universe: Population in Group Quarters

DEPARTMENT OF COMMERCE

Bureau of the Census

[Docket Number 170824806–7806–01]

Proposed Content for the Prototype 2020 Census Redistricting Data File

AGENCY: Bureau of the Census, Department of Commerce.

ACTION: Notice and request for comment.

SUMMARY: The 2020 Census Redistricting Data Program provides states the opportunity to specify the small geographic areas for which they wish to receive 2020 decennial population totals for the purpose of reapportionment and redistricting. This notice pertains to Phase 3, the Data Delivery phase of the program, as the U.S. Census Bureau is providing notification and requesting comment on the content of the prototype 2020 Census Redistricting Data File that will be produced from the 2018 End-to-End Census Test. The Census Bureau anticipates publishing the content for the prototype 2020 Census Redistricting Data File from the 2018 End-to-End Census Test in the second quarter of fiscal year 2018 in a final notice. In that final notice, the Census Bureau also will respond to the comments received on this notice.

But, we need to protect privacy!
13 U.S. Code § 9 - Information as confidential; exception

(a) Neither the Secretary, nor any other officer or employee of the Department of Commerce or bureau or agency thereof, or local government census liaison may, except as provided in section 8 or 16 or chapter 10 of this title or section 210 of the Departments of Commerce, Justice, and State, the Judiciary, and Related Agencies Appropriations Act, 1998.

(1) Use the information furnished under the provisions of this title for any purpose other than the statistical purposes for which it is supplied; or

(2) Make any publication whereby the data furnished by any particular establishment or individual under this title can be identified; or

(3) Permit anyone other than the sworn officers and employees of the Department or bureau or agency thereof to examine the individual reports. No department, bureau, agency, officer, or employee of the Government, except the Secretary in carrying out the purposes of this title, shall require, for any reason, copies of census reports which have been retained by any such establishment or individual. **Copies of census reports, which have been so retained, shall be immune from legal process, and shall not, without the consent of the individual or establishment concerned, be admitted as evidence or used for any purpose in any action, suit, or other judicial or administrative proceeding.**

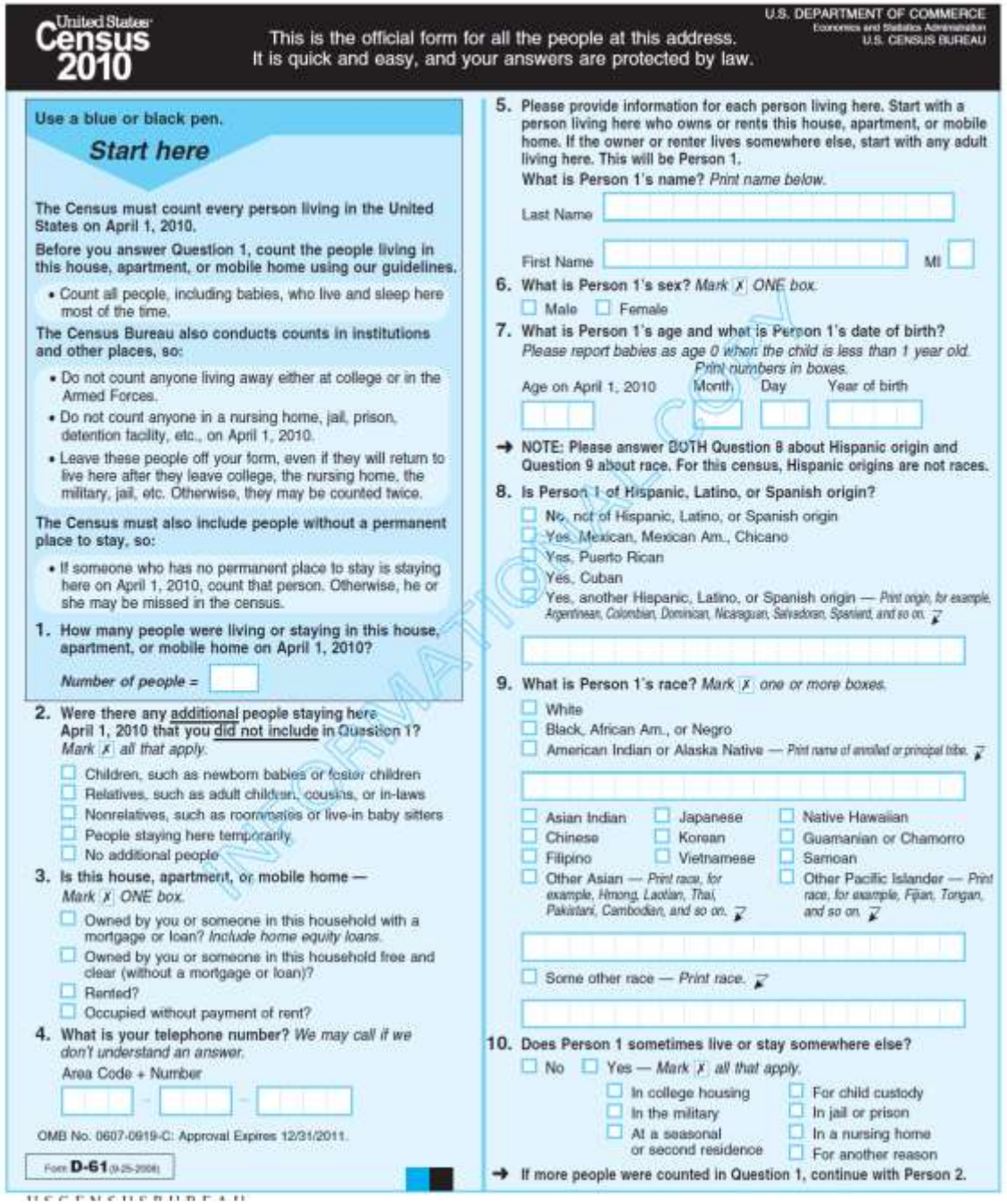
(b) The provisions of subsection (a) of this section relating to the confidential treatment of data for particular individuals and establishments, shall not apply to the censuses of governments provided for by subchapter III of chapter 5 of this title, nor to interim current data provided for by subchapter IV of chapter 5 of this title as to the subjects covered by censuses of governments, with respect to any information obtained therefore that is compiled from, or customarily provided in, public records.

Disclosure Avoidance for the 2010 Census

IT'S IN **OUR HANDS**

United States®
Census
2010

“This is the official form for all the people at this address.”



United States Census 2010

This is the official form for all the people at this address.
It is quick and easy, and your answers are protected by law.

U.S. DEPARTMENT OF COMMERCE
Economics and Statistics Administration
U.S. CENSUS BUREAU

Use a blue or black pen.

Start here

The Census must count every person living in the United States on April 1, 2010.

Before you answer Question 1, count the people living in this house, apartment, or mobile home using our guidelines.

- Count all people, including babies, who live and sleep here most of the time.

The Census Bureau also conducts counts in institutions and other places, so:

- Do not count anyone living away either at college or in the Armed Forces.
- Do not count anyone in a nursing home, jail, prison, detention facility, etc., on April 1, 2010.
- Leave these people off your form, even if they will return to live here after they leave college, the nursing home, the military, jail, etc. Otherwise, they may be counted twice.

The Census must also include people without a permanent place to stay, so:

- If someone who has no permanent place to stay is staying here on April 1, 2010, count that person. Otherwise, he or she may be missed in the census.

1. How many people were living or staying in this house, apartment, or mobile home on April 1, 2010?

   Number of people = ☐

2. Were there any additional people staying here April 1, 2010 that you did not include in Question 1? *Mark ✗ all that apply.*
   - ☐ Children, such as newborn babies or foster children
   - ☐ Relatives, such as adult children, cousins, or in-laws
   - ☐ Nonrelatives, such as roommates or live-in baby sitters
   - ☐ People staying here temporarily
   - ☐ No additional people

3. Is this house, apartment, or mobile home — *Mark ✗ ONE box.*
   - ☐ Owned by you or someone in this household with a mortgage or loan? *Include home equity loans.*
   - ☐ Owned by you or someone in this household free and clear (without a mortgage or loan)?
   - ☐ Rented?
   - ☐ Occupied without payment of rent?

4. What is your telephone number? *We may call if we don't understand an answer.*

   Area Code + Number

   ☐ – ☐ – ☐

OMB No. 0607-0919-C: Approval Expires 12/31/2011.

Form D-61 (3-25-2008)

5. Please provide information for each person living here. Start with a person living here who owns or rents this house, apartment, or mobile home. If the owner or renter lives somewhere else, start with any adult living here. This will be Person 1.

   What is Person 1's name? *Print name below.*

   Last Name ☐

   First Name ☐ MI ☐

6. What is Person 1's sex? *Mark ✗ ONE box.*
   - ☐ Male ☐ Female

7. What is Person 1's age and what is Person 1's date of birth?

   Please report babies as age 0 when the child is less than 1 year old.

   Print numbers in boxes.

Age on April 1, 2010	Month	Day	Year of birth
☐	☐	☐	☐

→ NOTE: Please answer BOTH Question 8 about Hispanic origin and Question 9 about race. For this census, Hispanic origins are not races.

8. Is Person 1 of Hispanic, Latino, or Spanish origin?
   - ☐ No, not of Hispanic, Latino, or Spanish origin
   - ☐ Yes, Mexican, Mexican Am., Chicano
   - ☐ Yes, Puerto Rican
   - ☐ Yes, Cuban
   - ☐ Yes, another Hispanic, Latino, or Spanish origin — *Print origin, for example, Argentinean, Colombian, Dominican, Nicaraguan, Salvadoran, Spaniard, and so on.*

9. What is Person 1's race? *Mark ✗ one or more boxes.*
   - ☐ White
   - ☐ Black, African Am., or Negro
   - ☐ American Indian or Alaska Native — *Print name of enrolled or principal tribe.*
   - ☐ Asian Indian
   - ☐ Chinese
   - ☐ Filipino
   - ☐ Japanese
   - ☐ Korean
   - ☐ Vietnamese
   - ☐ Other Asian — *Print race, for example, Hmong, Laotian, Thai, Pakistani, Cambodian, and so on.*
   - ☐ Native Hawaiian
   - ☐ Guamanian or Chamorro
   - ☐ Samoan
   - ☐ Other Pacific Islander — *Print race, for example, Fijian, Tongan, and so on.*
   - ☐ Some other race — *Print race.*

10. Does Person 1 sometimes live or stay somewhere else?
    - ☐ No ☐ Yes — *Mark ✗ all that apply.*
      - ☐ In college housing
      - ☐ In the military
      - ☐ At a seasonal or second residence
      - ☐ For child custody
      - ☐ In jail or prison
      - ☐ In a nursing home
      - ☐ For another reason

→ If more people were counted in Question 1, continue with Person 2.

“It is quick and easy, and your answers are protected by law.”

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Example: 2010 Census of Population

Basic results from the 2010 Census

Total population	308,745,538
Household population	300,758,215
Group quarters population	7,987,323
Households	116,716,292

Example: 2010 Census II

High-level database schema

Variables	Distinct values
Habitable blocks	10,620,683
Habitable tracts	73,768
Sex	2
Age	115
Race/Ethnicity (OMB Categories)	126
Race/Ethnicity (SF2 Categories)	600
Relationship to person 1	17
National histogram cells (OMB Categories)	492,660

Example: 2010 Census III

Summary of the publications (counts are approximate)

Publication	Released counts (including zeros)
PL94-171 Redistricting	2,771,998,263
Balance of Summary File 1	2,806,899,669
Summary File 2	2,093,683,376
Public-use micro sample	30,874,554
Lower bound on published statistics	7,703,455,862
Statistics/person	25

2003:
Database Reconstruction

ABSTRACT

We examine the tradeoff between privacy and usability of statistical databases. We model a statistical database by an n-bit string $d_1, .., d_n$, with a query being a subset $q \subseteq [n]$ to be answered by $\sum_{i \in q} d_i$. Our main result is a polynomial reconstruction algorithm of data from noisy (perturbed) subset sums. Applying this reconstruction algorithm to statistical databases we show that in order to achieve privacy one has to add perturbation of magnitude $\Omega(\sqrt{n})$. That is, smaller perturbation always results in a strong violation of privacy. We show that this result is tight by exemplifying access algorithms for statistical databases that preserve privacy while adding perturbation of magnitude $\tilde{O}(\sqrt{n})$.

For time-$\mathcal{T}$ bounded adversaries we demonstrate a privacy-preserving access algorithm whose perturbation magnitude is $\approx \sqrt{\mathcal{T}}$.

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Revealing Information while Preserving Privacy

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ABSTRACT

We examine the tradeoff between privacy and usability of

research which is based (among other things) on statistics of the information in the database. On the other hand, the hospital is obliged to keep the privacy of its patients, i.e. leak no medical information that could be related to a specific patient. The hospital needs an access mechanism to the database that allows certain 'statistical' queries to be answered, as long as they do not violate the privacy of any single patient.

*Work partly done when the author was at DIMACS, Rutgers University, and while visiting Microsoft Research Silicon Valley Lab.

PODS 2003, June 9-12, 2003, San Diego, CA.

One simple tempting solution is to remove from the database all 'identifying' attributes such as the patients' names and

n their comparative survey of privacy methods for statistical databases, Adam and Wortmann [2] classified the approaches taken into three main categories: (i) query restriction, (ii) data perturbation, and (iii) output perturbation. We give a brief review of these approaches below, and refer the reader to [2] for a detailed survey of the methods and their weaknesses.

Query Restriction. In the query restriction approach, queries are required to obey a special structure, supposedly to prevent the querying adversary from gaining too much information about specific database entries. The limit of this approach is that it allows for a relatively small number of queries.

A related idea is of query auditing [7], i.e. a log of the queries is kept, and every new query is checked for possible compromise, allowing/disallowing the query accordingly.

[1]A patient's gender, approximate age, approximate weight, ethnicity, and marital status – may already suffice for a complete identification of most patients in a database of a thousand patients. The situation is much worse if a relatively 'rare' attribute of some patient is known. For example, a patient having Cystic Fibrosis (frequency $\approx 1/3000$) may be uniquely identified within about a million patients.

2006:
Differential Privacy

The 2000 and 2010 Disclosure Avoidance System operated as a filter, on the Census Edited File:

Raw data from respondents: **Decennial Response File**

Selection & unduplication: **Census Unedited File**

Edits, imputations: **Census Edited File**

Confidentiality edits (household swapping), tabulation recodes: **Hundred-percent Detail File**

Pre-specified tabular summaries: **PL94-171, SF1, SF2** (SF3, SF4, … in 2000)

Special tabulations and post-census research

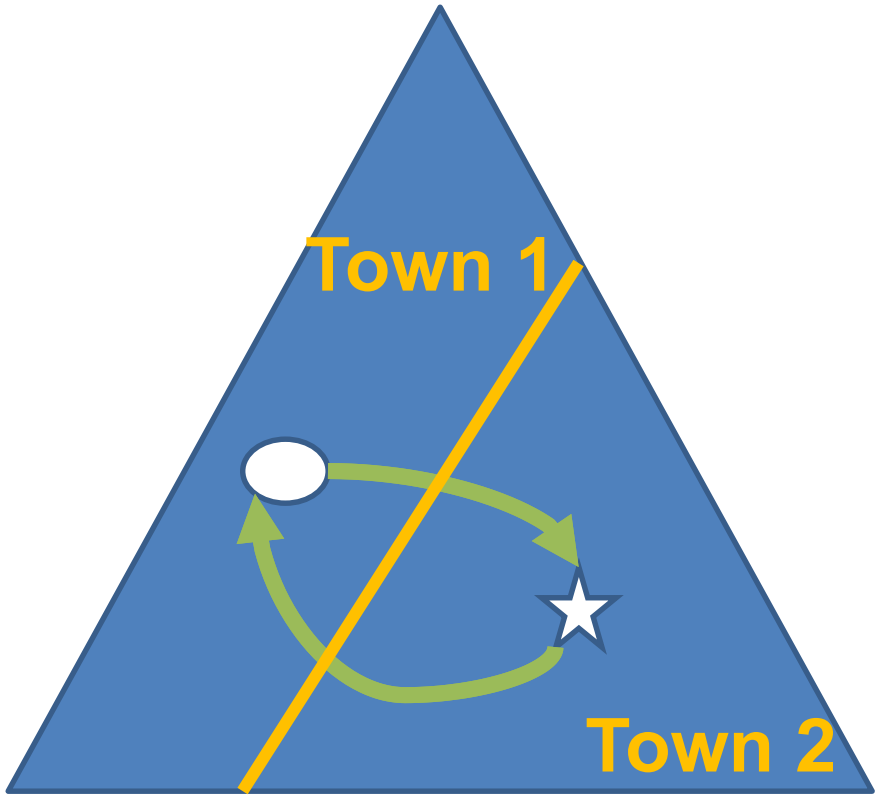
The protection system used in 2000 and 2010 relied on swapping households:

Advantages of swapping:

- Easy to understand
- Does not affect state counts if swaps are within a state
- Can be run state-by-state
- Operation is “invisible” to rest of Census processing

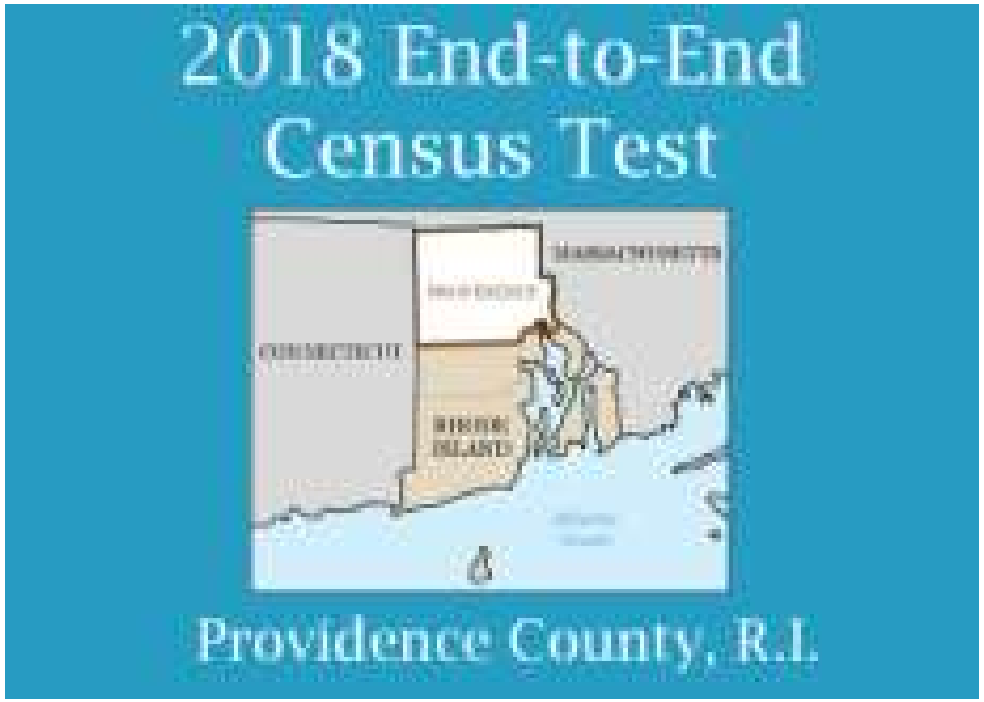
Disadvantages:

- Does not consider or protect against database reconstruction attacks
- Does not provide formal privacy guarantees
- Swap rate and details of swapping must remain secret.
- Privacy guarantee based on the lack of external data



State “X”

The US Census Bureau embraces formal privacy.



United States
Census
2020

Motivation:
To protect the privacy of individual survey responses

2010 Census:

- 7.7 billion independent tabular summaries published
- 25 records per person

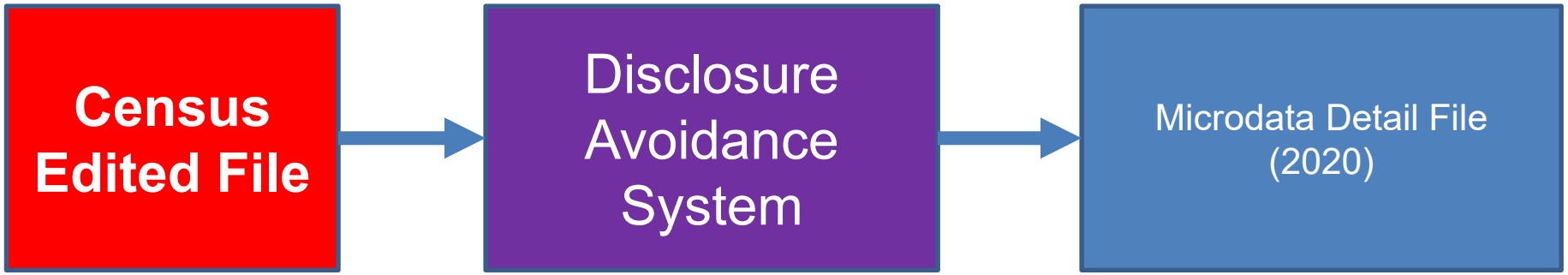
Database reconstruction (Dinur and Nissim 2003) is a serious disclosure threat that all statistical tabulation systems from confidential data must acknowledge.

The confidentiality edits applied to the 2010 Census were not designed to defend against this kind of attack.

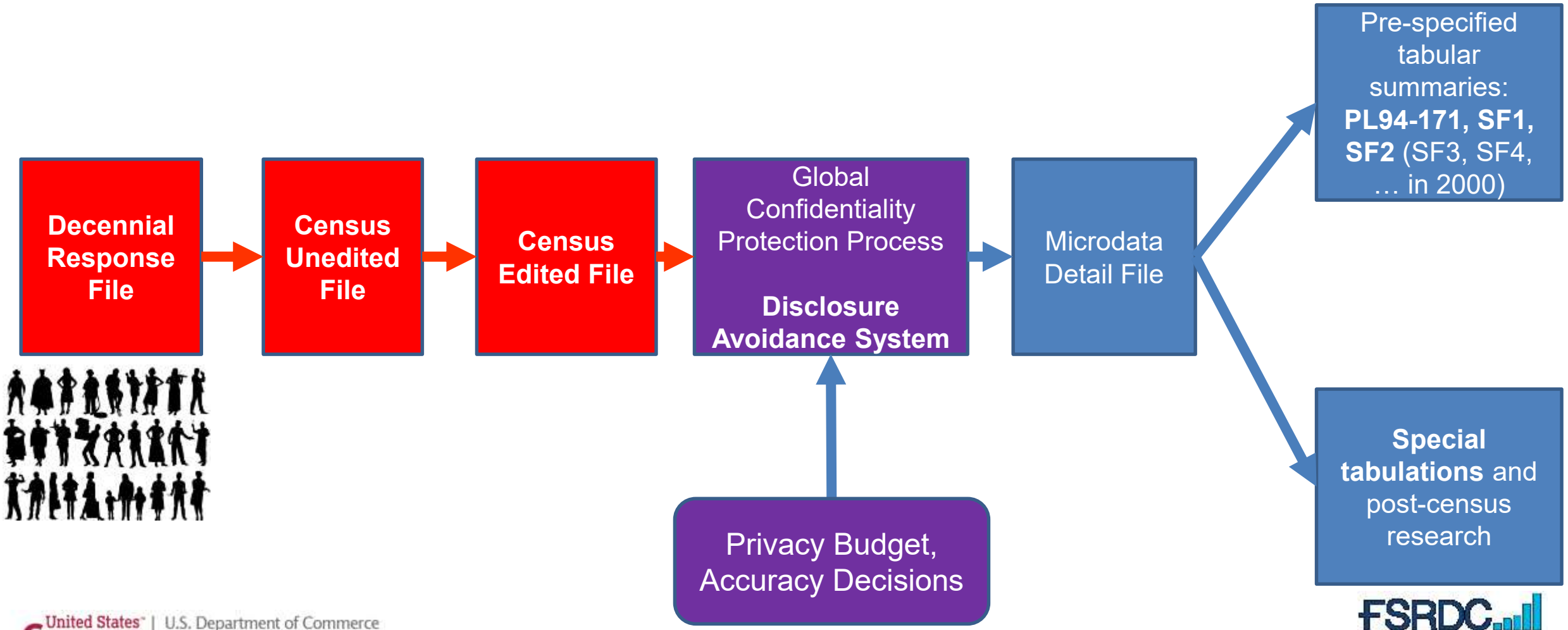
Our plan is to create a “Disclosure Avoidance System” that drops into the Census production system.

Features of the DAS:

- Operates on the edited Census records
- Designed to make records that are “safe to tabulate.”



The Disclosure Avoidance System allows the Census Bureau to enforce global confidentiality protections.

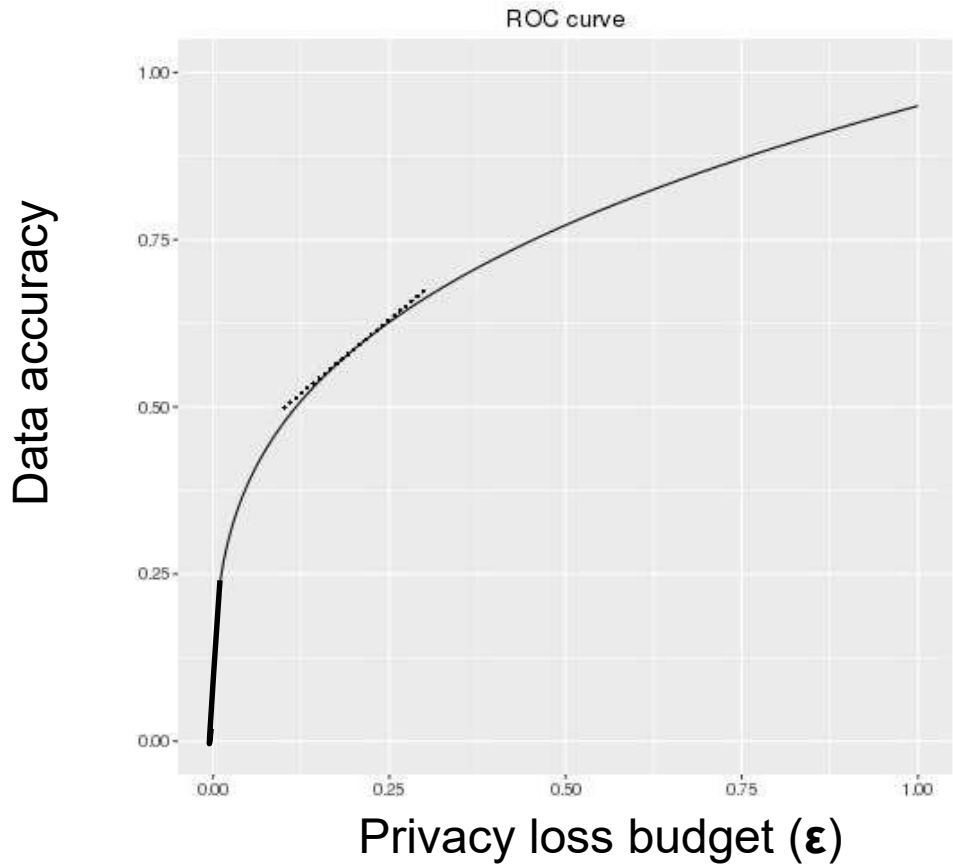


The Census disclosure avoidance system will use differential privacy to defend against a reconstruction attack,

Differential privacy provides:

- Provable bounds on the accuracy of the best possible database reconstruction given the released tabulations.

- Algorithms that allow policy makers to decide the trade-off between accuracy and privacy.

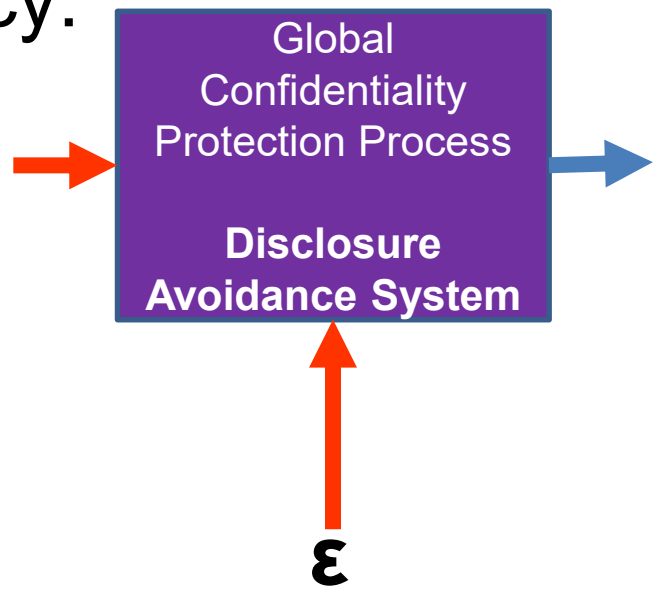


Final privacy-loss budget determined by Data Stewardship Executive Policy Committee (DSEP) with recommendation from Disclosure Review Board (DRB)

The Disclosure Avoidance System relies on infusing formally private noise.

Advantages of noise infusion with formal privacy:

- Easy to understand
- Provable and *tunable* privacy guarantees
- Privacy guarantees do not depend on external data
- Protects against database reconstruction attacks
- Privacy operations are *composable*



Disadvantages:

- Entire country must be processed at once for best accuracy
- Every use of private data must be tallied in the *privacy loss budget*

Differentially Private Disclosure Avoidance System: Requirements

DAS must be able to read the Census Edited File (CEF):

- CEF must be exactly specified and contain all information necessary for all tabulation recodes
- CEF must be kept confidential after DAS runs (as it was for historical censuses)

DAS must generate the Microdata Detail File (MDF):

- Must contain all information that appears in *any publicly released table* (e.g. PL94-171, SF1, SF2)
- Should not contain *any information* that does *not* appear in a publicly released table
- May be publicly released (in whole or in part)

Non-functional requirements:

- The disclosure avoidance system must provably move information from the CEF to PL94/SF1/SF2 with an adjustable total privacy-loss budget
- The source code and parameters for the DAS will be made publicly available

Why generate a differentially private MDF?

- Familiar to internal and external stakeholders
- Operates with legacy tabulation systems to produce PL-94 and SF-1 tabulations
- Guarantees population totals (voting age, non-voting age, householder) exact at all levels of geography
- Consistency among query answers

Challenges in creating a differentially private MDF

Changes required to Census business processes:

- All desired queries on MDF must be known in advance.
- All uses of confidential data need to be tracked and accounted.
- Data quality checks on tables cannot be done by looking at raw data.

Communications challenges:

- Differential privacy is not widely known or understood.
- Many data users want highly accurate data reports on small areas.
- Users in 2000 and 2010 didn't know the error introduced by swapping.

Differential privacy meets Article 2, Section 1 and PL-94

"Invariants"

Specific PL-94 queries must be exact:

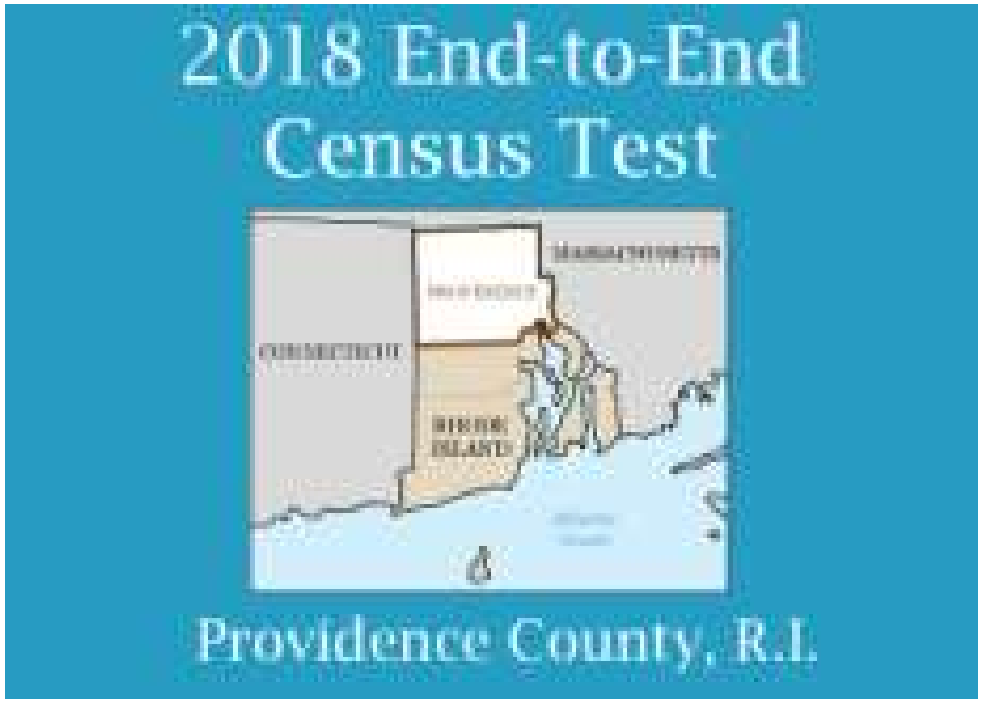
- Block population
- Block voting age population
- Block householders & vacancies

"Privacy protected"

Other PL-94 and SF-1 queries will not be exact:

- Age distribution under 18
- Age distribution 18 and over
- Race and ethnicity distribution
- Household relationship distribution
- Household ownership distribution

2018 End-to-End Test
Providence County, R.I.



2018 “Block-by-Block” System : High-level Overview:

Person-level histogram for each block

Differential privacy geometric mechanism

Optimizer applies invariants

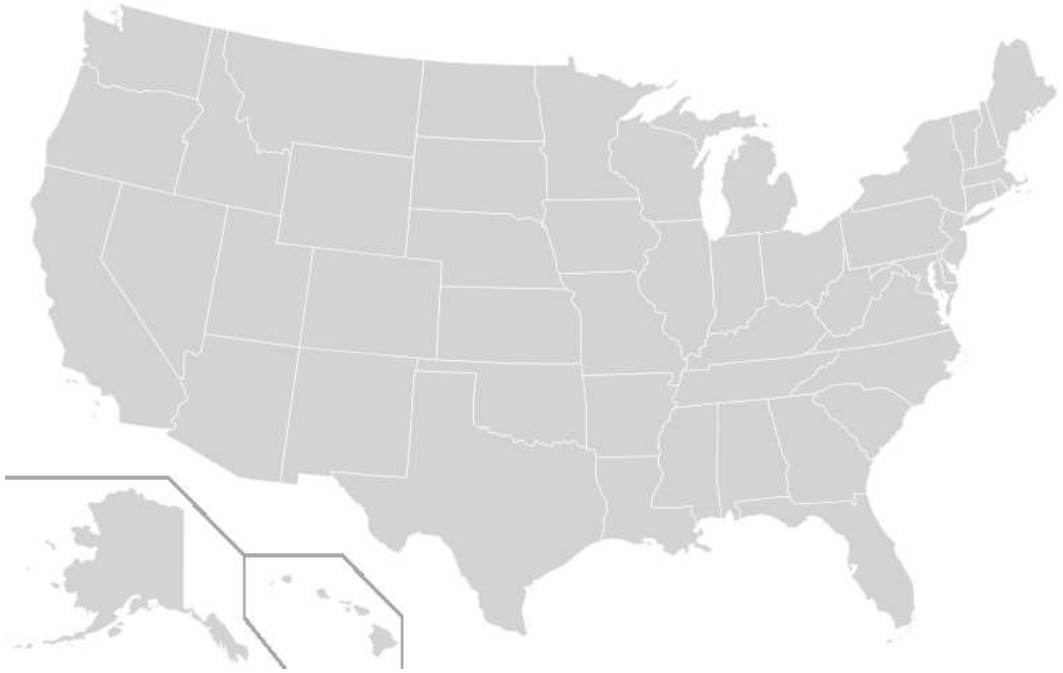
Census.gov

PL-94 Published Results

Invariants:
total population
age >= 18

Advantages:
Easy to implement
Provable privacy protection
Provable application of invariants

2020 Census of Population and Households



United States Census 2020

How the 2020 System Works: High-level Overview

- Every record in the population may be modified

  But modifications are bounded by the global privacy budget.

- Records in the tabulation data have no exact counterpart in the confidential data

  There is no one-to-one mapping between CEF and MDF records.

  But there are the same number of records for every block.

- Explicitly protected tabulations (PL-94 and SF-1) have provable, public accuracy levels

  2020 will publish the algorithms, the parameters and the accuracy of the tabulations.

Proposed "Top-Down" Algorithm

National table of US population

2 x 255 x 17 x 115

Spend ε_1 privacy-loss budget

National table with all 500,000 cells filled, structural zeros imposed with accuracy allowed by ε_1
2 x 255 x 17 x 115

Sex: Male / Female
Race + Hispanic: 255 possible values
Relationship to Householder: 17
Age: 0-114

Reconstruct individual micro-data without geography

325,000,000 records

State-level

State-level tables for only certain queries; structural zeros imposed; dimensions chosen to produce best accuracy for PL-94 and SF-1

Spend ε_2 privacy-loss budget

Target state-level tables required for best accuracy for PL-94 and SF-1
Exact state voting-age, non-voting age, and householder counts as enumerated.

Construct best-fitting individual micro-data with state geography

325,000,000 records now including state identifiers

identifiers

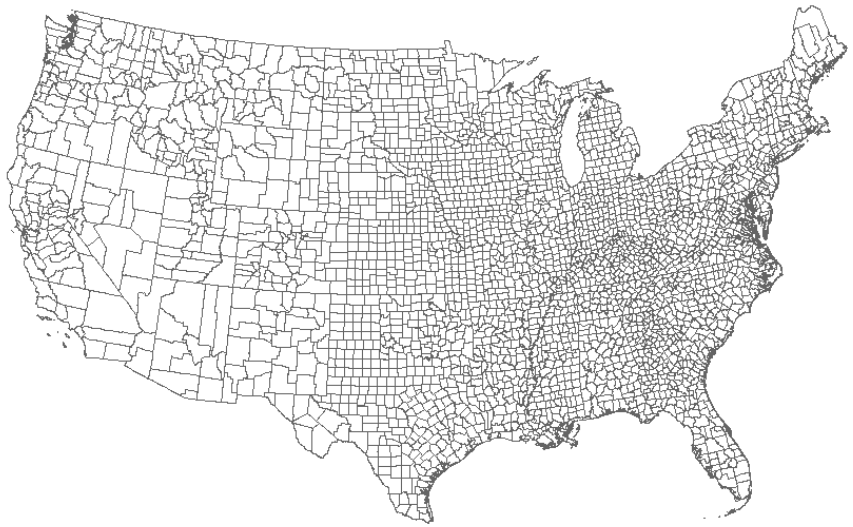
County-level

County-level tables for only certain queries; structural zeros imposed; dimensions chosen to produce best accuracy for PL-94 and SF-1

Spend ε_3 privacy-loss budget

Target county-level tables required for best accuracy for PL-94 and SF-1

Exact county voting-age, non-voting age, and householder counts as enumerated.



Construct best-fitting individual micro-data with state and county geography

325,000,000 records now including state and county identifiers

county identifiers

Census tract-level

Tract-level tables for only certain queries; structural zeros imposed; dimensions chosen to produce best accuracy for PL-94 and SF-1

Spend ε_4 privacy-loss budget

Target tract-level tables required for best accuracy for PL-94 and SF-1

Exact tract voting-age, non-voting age, and householder counts as enumerated.

Construct best-fitting individual micro-data with state, county, and tract geography

325,000,000 records now including state, county, and tract identifiers

and tract identifiers

Block-level

Block-level tables for only certain queries; structural zeros imposed; dimensions chosen to produce best accuracy for PL-94 and SF-1

Spend ε_5 privacy-loss budget

Block tract-level tables required for best accuracy for PL-94 and SF-1
Exact block voting-age, non-voting age, and householder counts as enumerated.

Construct best-fitting individual micro-data with state, county, tract and block geography

325,000,000 records now including state, county, tract identifiers

MDF for tabulating

Construct best-fitting individual micro-data with state, county, tract and block geography

325,000,000 records now including state, county, tract, and block identifiers

MDF used for tabulating PL-94, SF-1

MDF for tabulating

How accurate is the MDF?

Disclosure Avoidance Certificate

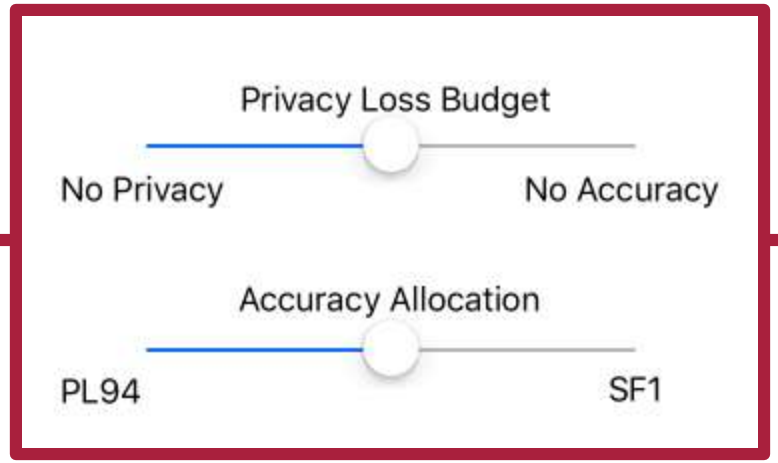
- Certifies that the DAS passed tests
- Reports the accuracy of the MDF
- Requires $\boldsymbol{\varepsilon}_A$

Construct best-fitting individual micro-data with state, county, tract and block geography

325,000,000 records now including state, county, tract, and block identifiers

MDF used for tabulating PL-94, SF-1

Operational Decisions



Set total privacy loss budget: $\boldsymbol{\varepsilon}$

- Ensure that $\boldsymbol{\varepsilon_1 + \varepsilon_2 + \varepsilon_3 + \varepsilon_4 + \varepsilon_5 + \varepsilon_A = \varepsilon}$

Within each stage, allocate privacy-loss budget between:

- PL-94
- Parts of SF-1 not in PL-94

These are policy levers provided by the system.

Levers are set by the Data Stewardship Executive Policy Committee

Inputs Used by the Development Team

Lists of matrices in technical documentation express core queries in the workload

- PL94: https://www.census.gov/prod/cen2010/doc/pl94-171.pdf
- SF1: https://www.census.gov/prod/cen2010/doc/sf1.pdf
- SF2: https://www.census.gov/prod/cen2010/doc/sf2.pdf

Over 1,000 pages of edit specifications for 2010 CEF

Uncurated tabulation recode programs

We are creating

A *framework* for Disclosure Avoidance Systems:

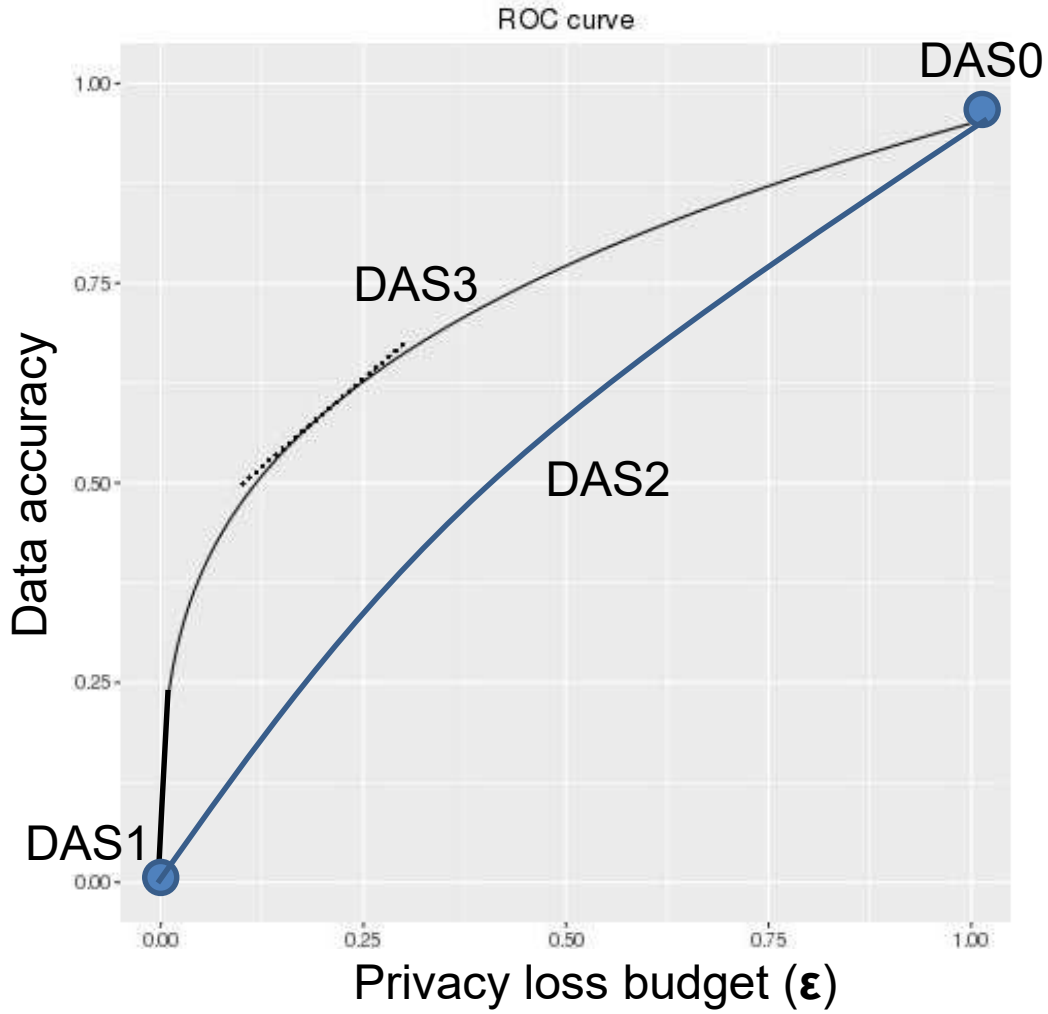
- Development & Test Mode
- Production Mode

Testing Systems:

- DAS0 — 100% accuracy, no privacy
  (No disclosure avoidance)
- DAS1 — 100% privacy, no accuracy
- DAS2 — “bottom-up” engine

Operational System:

- DAS3 — “top-down” engine



Plans for the 2018 End-to-End Test

The 2018 End-to-End test will incorporate differential privacy

- Likely DAS2 — Bottom-up algorithm

Only the prototype PL94-171 files will be produced

No decisions yet regarding the privacy-loss budget or accuracy level

Questions?