ECON 0150 | Economic Data Analysis

The economist's data analysis pipeline.

Part 2.1 | Data Cleaning

Data Cleaning

Q. Are students who live further away older?

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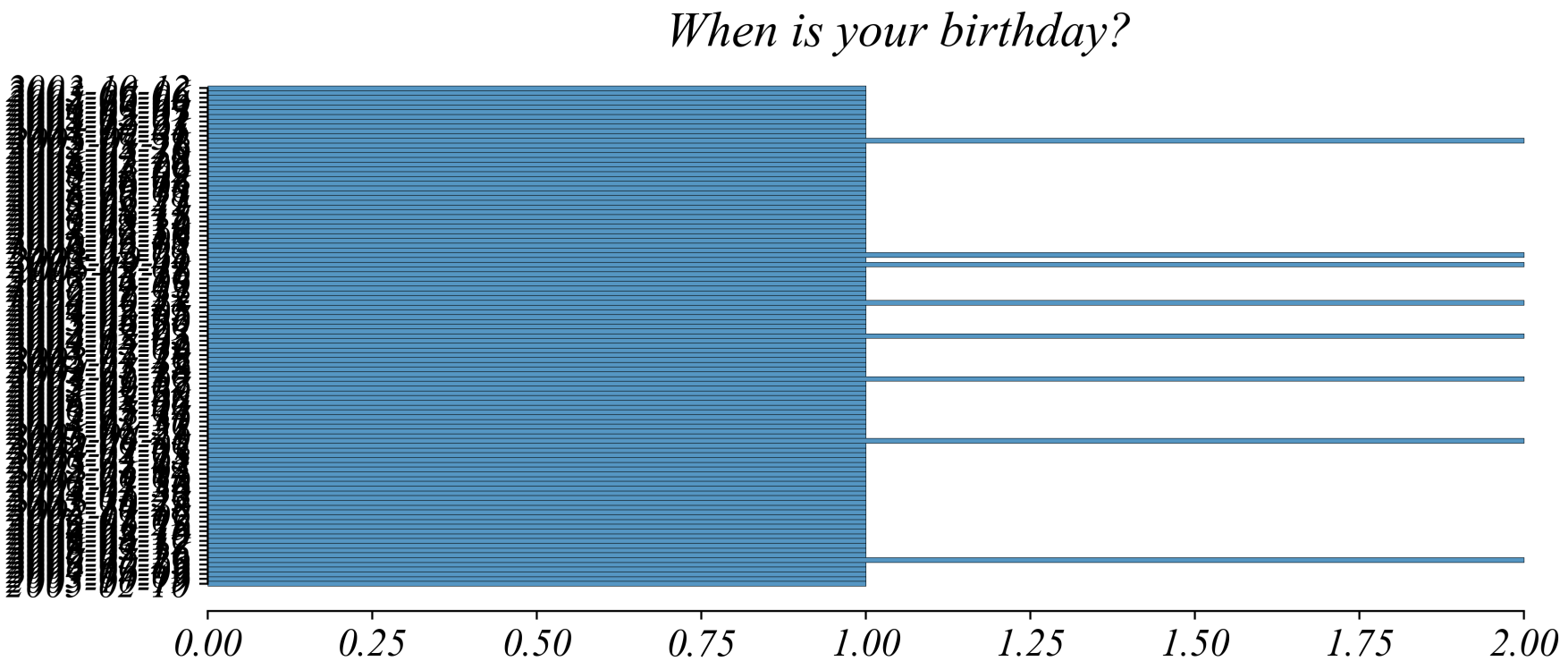
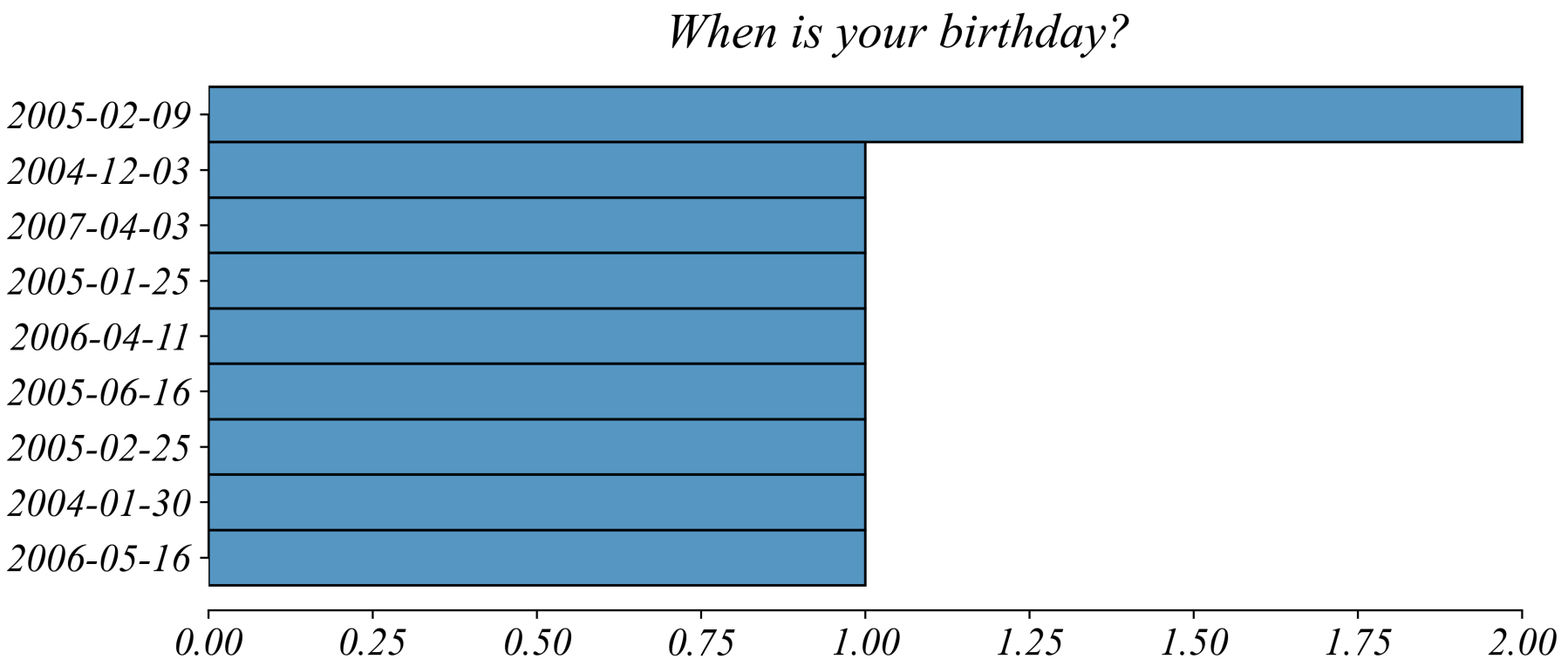
Let’s examine age and distance from Pittsburgh.



Data Cleaning

Q. Are students who live further away older?

Let's examine age and distance from Pittsburgh.



> the birthday data is stored as text: "08/15/2005"

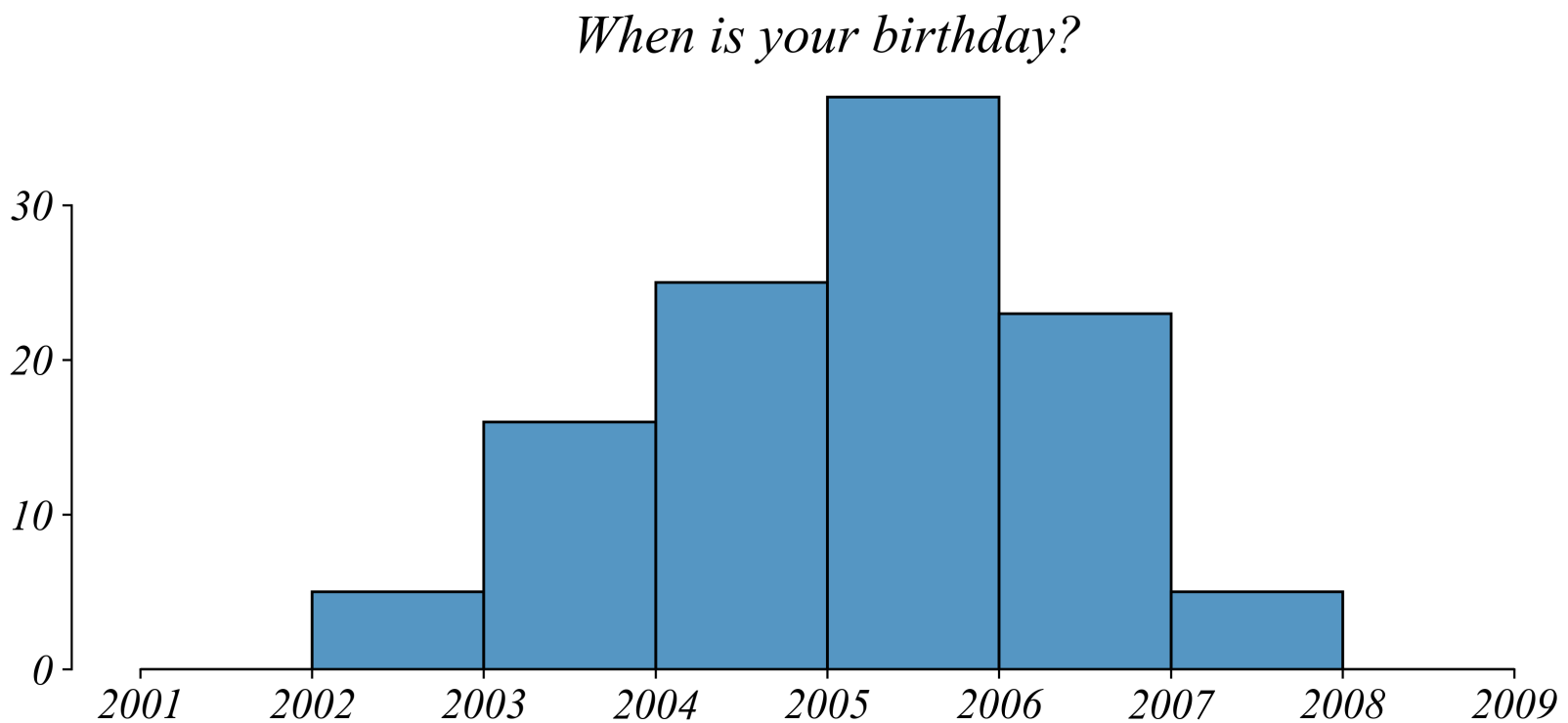
> we need to extract the year to calculate age

String Parsing

Extracting useful information from text

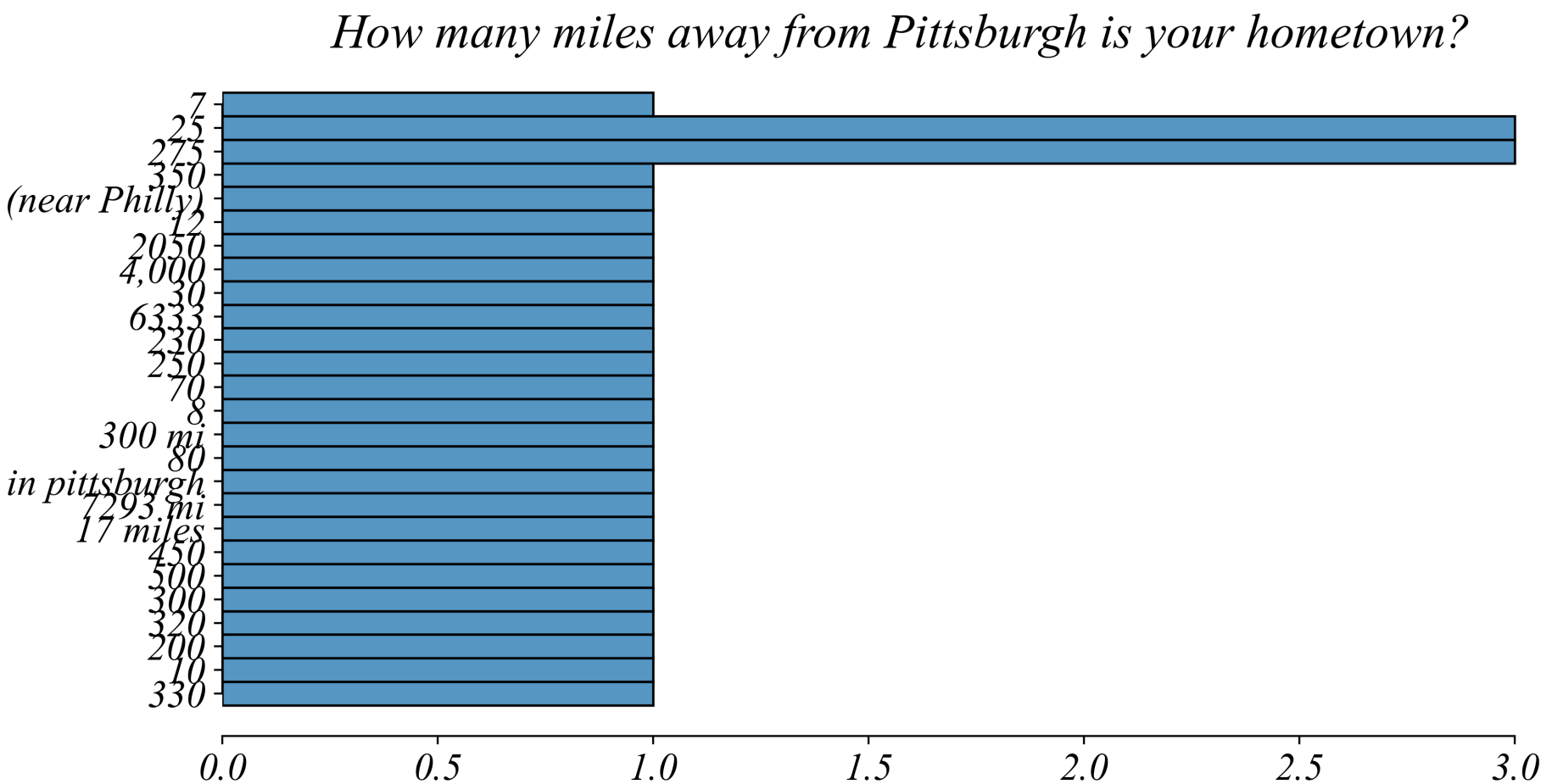
What we have: “08/15/2005”

What we need: 2005



Distance from Pittsburgh

Q. Are students who live further away older?



> *lots of different formats!*

Distance from Pittsburgh

Answers can be in many creative forms…

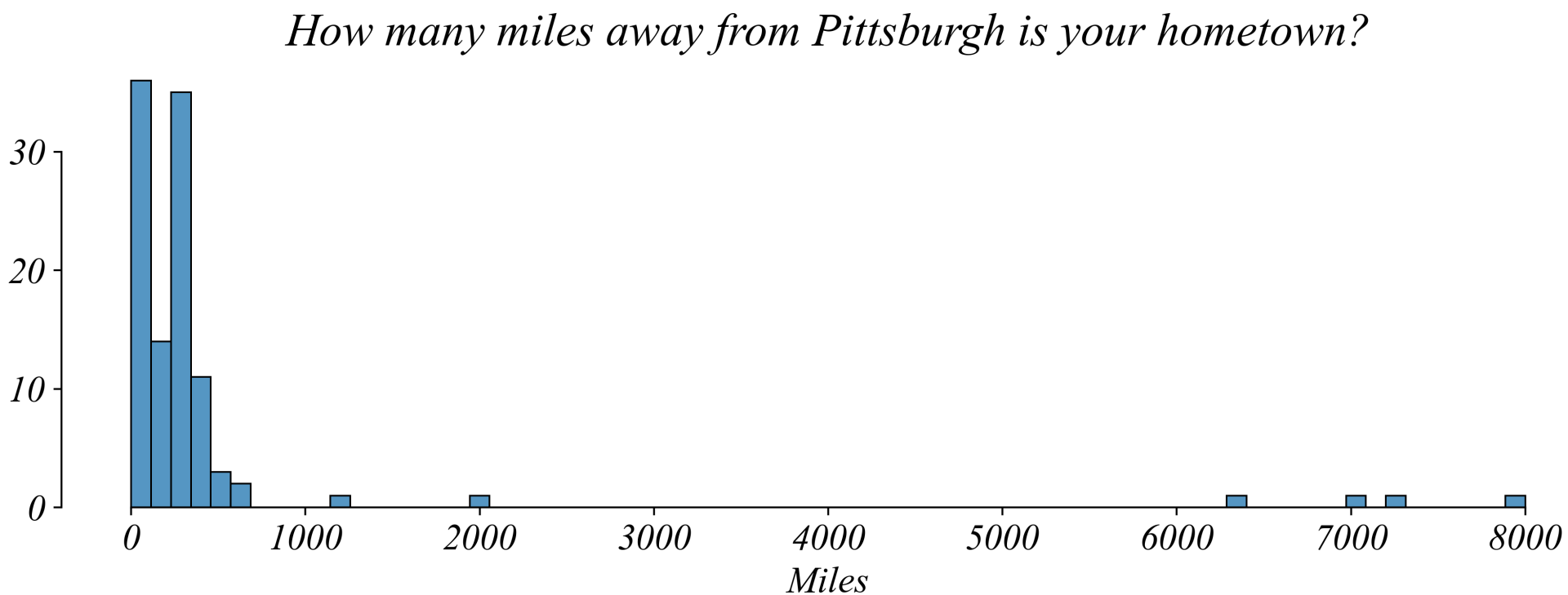
- *“0 miles”*
- *“~500”*
- *“about 1000”*
- *“2.5 hours”*
- *“very far”*

> computers can’t do math with text

Type Conversion

Converting text to numbers

We can convert text to numbers, forcing errors to become NA.



> entries like "very far" become NA

> entries like "500" become 500.0

Missing Values

What happened to the non-numeric entries?

	new	Approximately how many miles away from Pittsburgh is your hometown?
0	400.0	400
1	16.0	16
2	300.0	300
3	300.0	300
4	400.0	400

Missing Values

What happened to the non-numeric entries?

	new	Approximately how many miles away from Pittsburgh is your hometown?
6	NaN	176 miles away
17	NaN	0 (it’s Pittsburgh)
18	NaN	400-450ish miles
22	NaN	350 miles
23	NaN	240 miles

> *they all became NaN (Not Available)*

> *we need to decide what to do with them*

Handling Missing Values

Two main approaches

After replacing problematic values, there are generally two options.

Option 1: Drop the missing values

- *Removes entire rows with NA*
- *Reduces sample size*
- *Simple and clean*

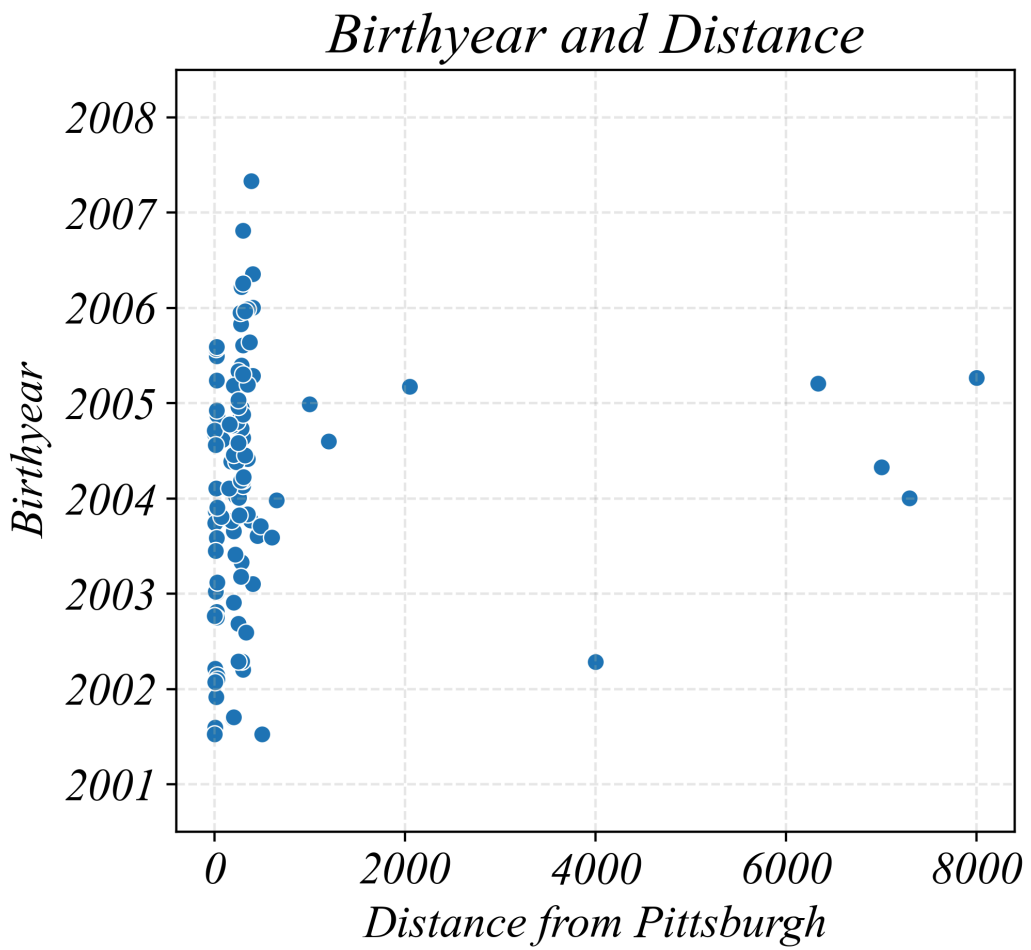
Option 2: Replace with a value

- *Fill with 0, mean, or median*
- *Keeps sample size*
- *May introduce bias*

> for distance, dropping makes sense - we can't guess locations

After Cleaning

Q. Are students who live further away older?



> as expected, there does not seem to be much of a relationship

Summary

Some common data cleaning operations

- ***String Parsing**: Extract information from text*
- ***Type Conversion**: Change text to numbers*
- ***Missing Values**: Drop or replace NAs*

Exercise 2.1 | Data Cleaning

Let’s find the median birthyear and the mean hometown distance from Pittsburgh.

- ***Data***: `Fall_2025_Survey_raw.csv`

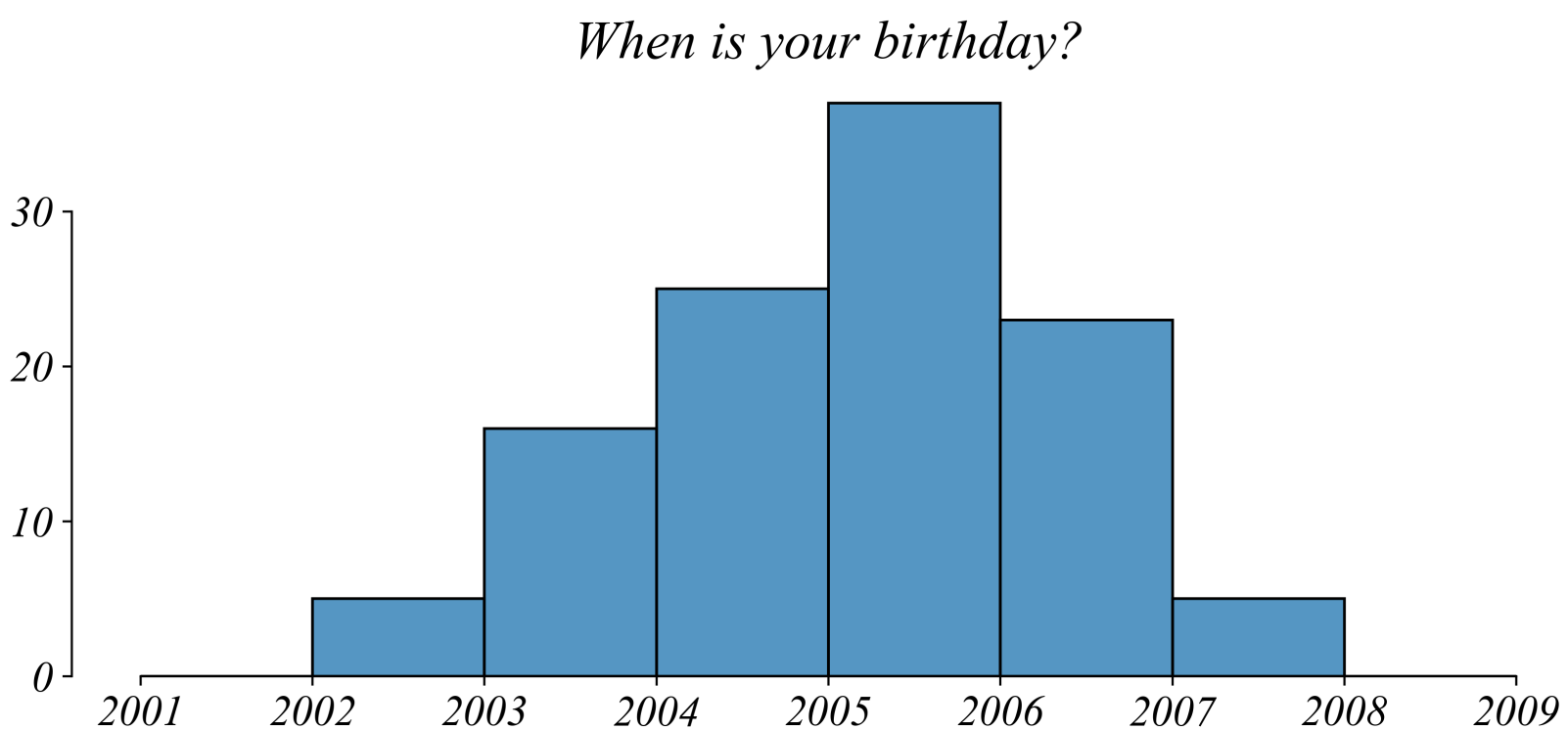
Exercise 2.1 | Birthday to Birthyear

Extract year from birthday text

```
# Convert birthday to datetime
survey['birthday'] = pd.to_datetime(survey['When is your birthday?'])
```

```
# Extract year from date
survey['birthyear'] = survey['birthday'].dt.year
```

```
sns.histplot(survey, x='birthyear')
```



Exercise 2.1 | Distance Conversion (Simple)

Convert distance text to numbers

```
# Convert to numeric, errors become NA
survey['distance'] = pd.to_numeric(survey['Approximately how many miles away from Pittsburgh i
```

```
# Check how many became NA
survey['distance'].isna().sum()
```

Exercise 2.1 | Handle Missing Values

Two approaches to NAs

Drop missing values:

```
# Remove rows where distance is NA
survey_dropped = survey.dropna(subset=['distance_clean'])
```

Replace with a value:

```
# Replace NA with median distance
median_dist = survey['distance_clean'].median()
survey['distance_filled'] = survey['distance_clean'].fillna(median_dist)
```

```
# Or replace with 0
survey['distance_zero'] = survey['distance_clean'].fillna(0)
```

Exercise 2.1 | Distance Conversion (Replace)

Convert distance text to numbers

```
# Replace non-numeric
replacements = {
    '400-450ish miles ': 400,
    'live in pittsburgh': 0,
    '176 miles away': 176,
    '0 (it’s Pittsburgh)': 0,
    '350 miles': 350,
    '240 miles': 240,
    '388 miles': 388,
    '17 miles': 17,
    '300 miles': 300,
    '7293 mi': 7293,
    '4 miles ': 4,
    '27 miles': 27,
    '255 (near Philly)': 255,
    '4,000': 4000,
    '650 miles': 650,
    '250 miles': 250,
    '318 mi': 318,
    '300 mi': 300,
    '1000+': 1000,
    '305 miles': 305
```

```
# Check how many became NA
survey['distance'].isna().sum()
```

Exercise 2.1 | Scatterplot

Check that it worked

```
1 # Create scatterplot
2 sns.scatterplot(data, x='distance', y='age')
```