SCIU4T4: Tidy data and data files

Attendance code

GI-TI-FG

- Addition
- Subtraction
- Multiplication
- Division
- Exponents
- Roots

Addition

- Natural numbers
- 1, 2, 3, 4, . . .

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Subtraction

- Integers
- . . . , -2, -1, 0, 1, 2, . . .

Greater than ($>$)

$$6 > 5$$

Greater than ($>$)

$$6 > 5$$

Less than ($<$)

$$-4 < 2$$

Greater than or equal to ($\geq$)

$$P \geq 0.1$$

Inequalities

Greater than or equal to ($\geq$)

$$P \geq 0.1$$

Less than or equal to ($\leq$)

$$P \leq 0.05$$

Multiplication

- Add a number multiple times
- $4 + 4 + 4 = 12$
- $4 \times 3 = 12$
- $4 * 3 = 12$ or $4(3) = 12$

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Division

- $12 \div 3 = 4$
- $12/3 = 4$
- *Rational* numbers

Exponent

- Multiply a number multiple times
- $4 \times 4 \times 4 = 64$
- $4^3 = 64$

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Roots

- $\sqrt[3]{64} = 4$
- $64^{\frac{1}{3}} = 4$
- *Real* numbers ($\sqrt{2} \approx 1.414$)

Negative exponents

$$4^{-1} = \frac{1}{4}$$

$$4^{-2} = \frac{1}{16}$$

Applies to units

$6\ g\ l^{-1} = 6\ g/l$

Logarithms

Exponent to which a number needs to be raised to get another number,

$$10^3 = 1000.$$

10 raised to the power of 3 equals 1000,

$$\log_{10}(1000) = 3.$$

Logarithms in figures

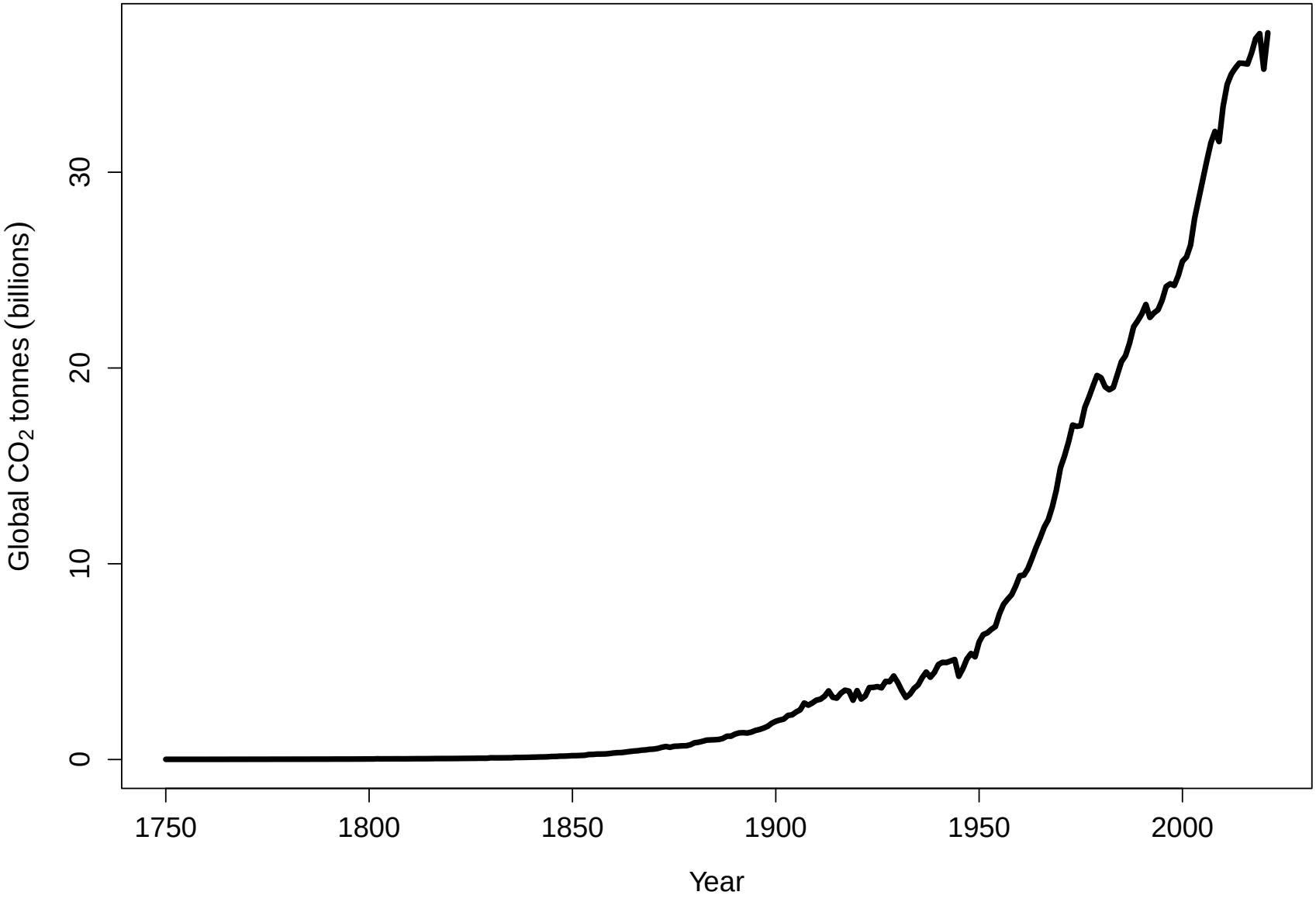


Figure 1: Global carbon dioxide emissions 1750-2021.

Logarithms in figures

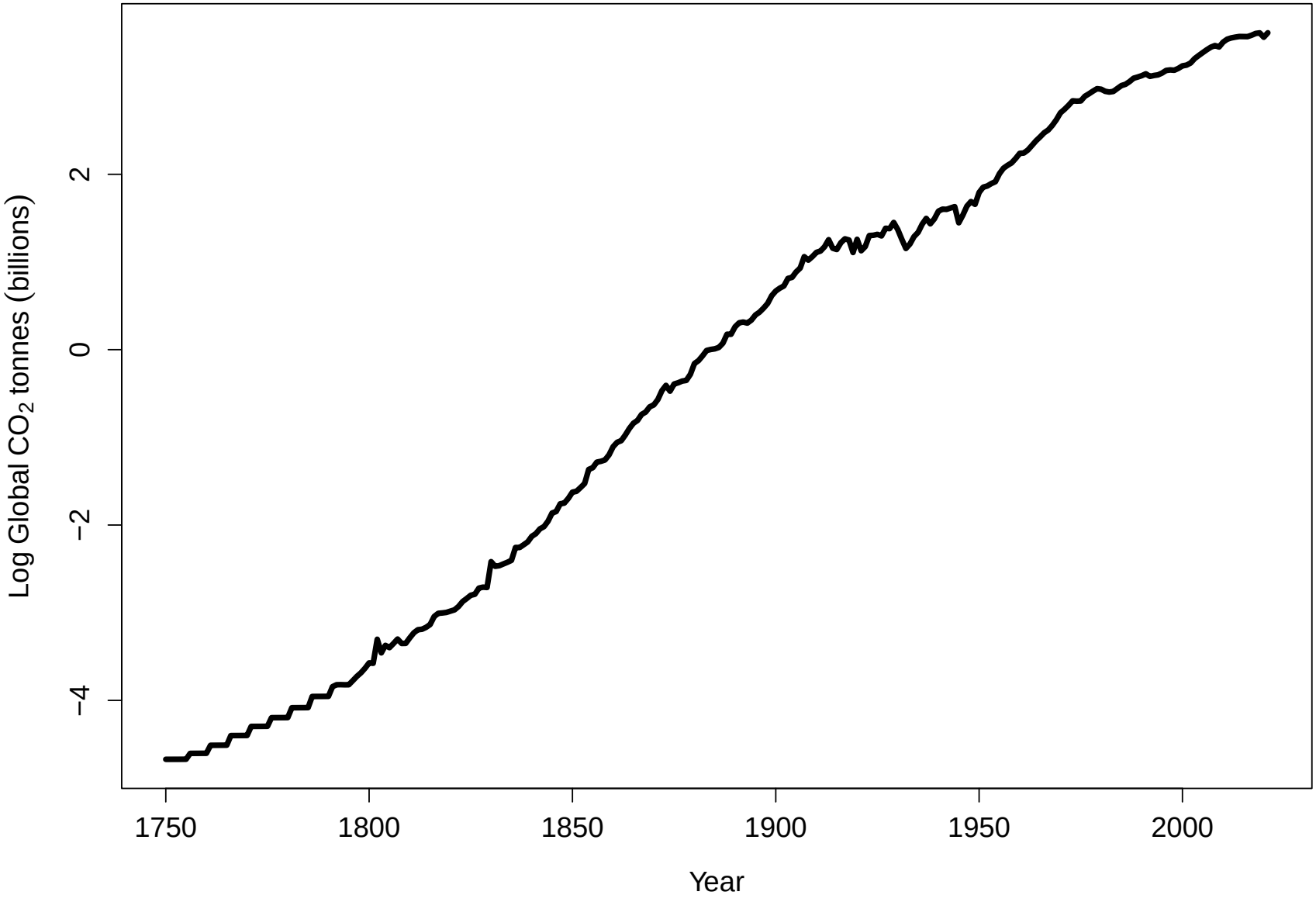


Figure 2: Natural logarithm of global carbon dioxide emissions 1750-2021.

Natural logarithms

Exponent to which a number needs to be raised to get another number,

$$e^1 \approx 2.718282.$$

Sometimes log denoted 'ln',

$$\ln(2.718282) = 1.$$

Order of operations

$$x = 3^2 + 2\,(1 + 3)^2 - 6 \times 0$$

Order of operations

1. Brackets (parentheses)
2. Exponents & radicals
3. Multiplication & division
4. Addition & subtraction

Order of operations

Division bars imply parentheses,

$$x = \frac{2^2 + 1}{3^2 + 2}.$$

Above is $(2^2 + 1)/(3^2 + 2)$,

$$x = \frac{(2^2 + 1)}{(3^2 + 2)} = \frac{(4 + 1)}{(9 + 2)} = \frac{5}{11}.$$

Order of operations

Radicals imply parentheses,

$$x = \sqrt{3 + 4^2} = \sqrt{\left(3 + 4^2\right)} \approx 3.59.$$

Tidy data: Getting data in the right format

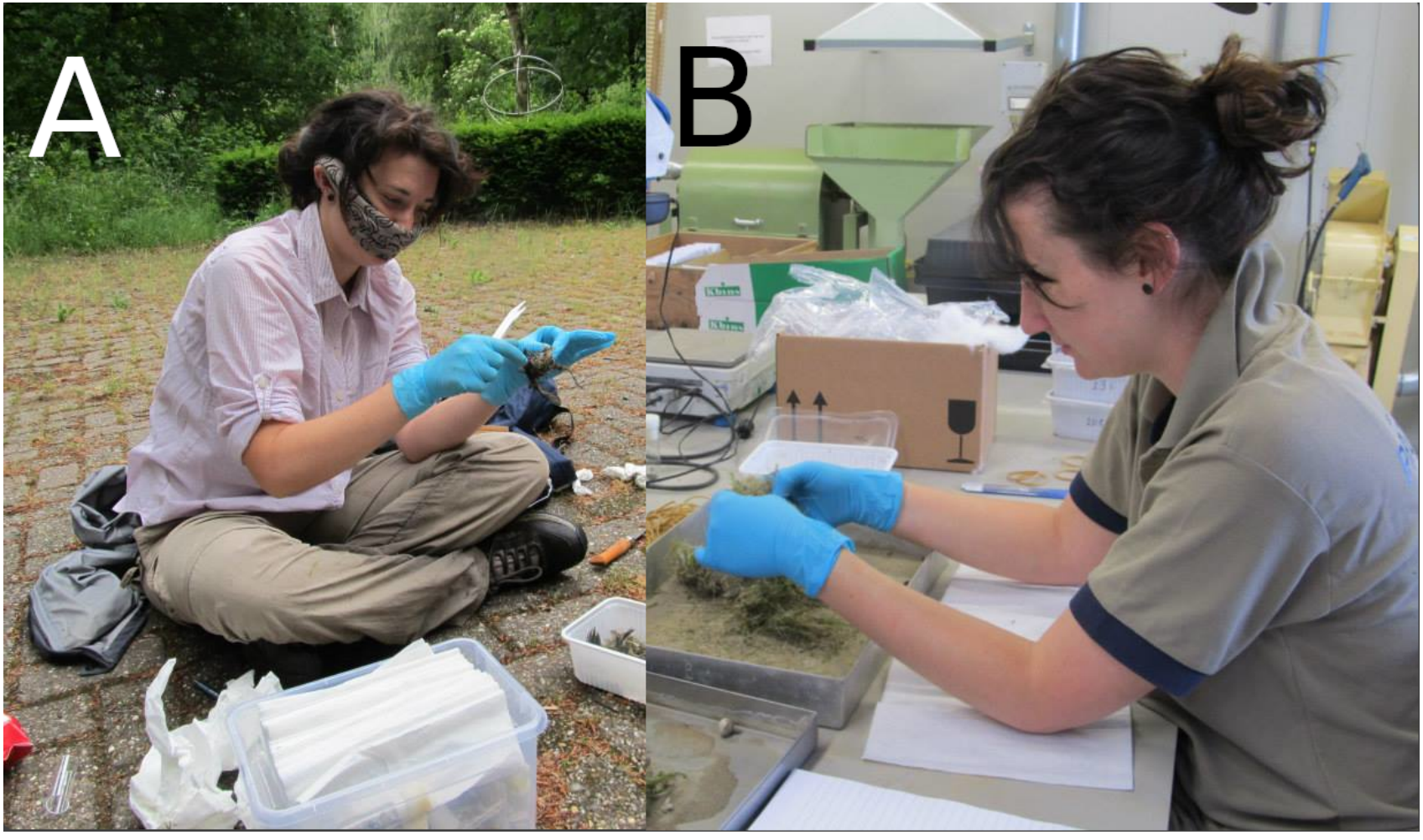
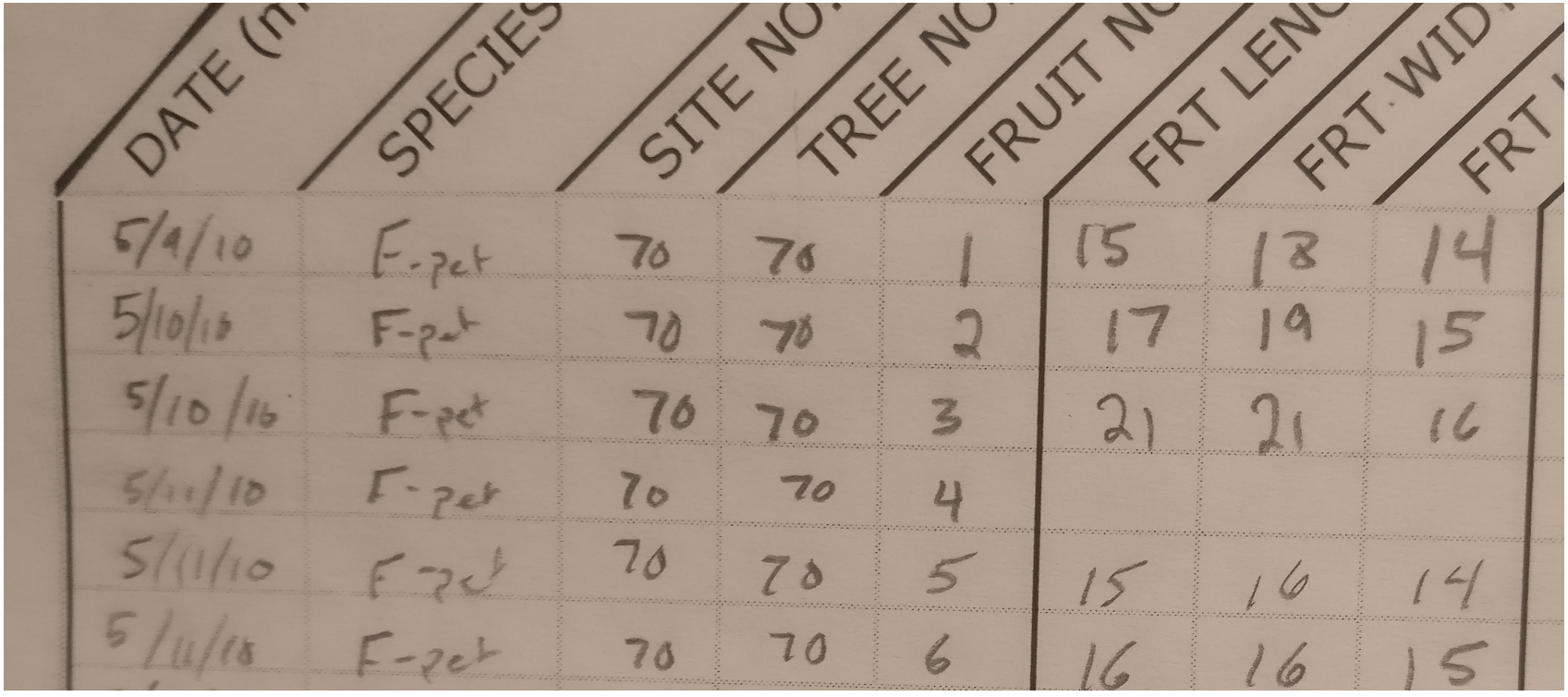


Figure 3: Dr Becky Boulton collects data from nest boxes in the field (A), then processes nest material in the lab (B).

Data collection is messy

Figure 4: Sonoran Desert Rock Fig in the desert of Baja, Mexico.

Data collection is messy



DATE (m	SPECIES	SITE NO.	TREE NO.	FRUIT NO.	FRT LENG	FRT WID	FRT
5/9/10	F-pet	70	70	1	15	18	14
5/10/10	F-pet	70	70	2	17	19	15
5/10/10	F-pet	70	70	3	21	21	16
5/10/10	F-pet	70	70	4			
5/11/10	F-pet	70	70	5	15	16	14
5/11/10	F-pet	70	70	6	16	16	15

Figure 5: A portion of a lab notebook used to record measurements of fig fruits from different trees in 2010.

Observations and variables

- **Observation:** Units of sample
- **Variable:** Unit measurement

Observations and variables

- **Observation:** Fig trees
- **Variable:** Tree height, location

Three characteristics of tidy data

Summarised by Wickham (2014)[1]:

1. Each **variable** gets its own column.
2. Each **observation** gets its own row.
3. Different units of observation require different data files.

[1] Wickham, H. 2014. *J. Stat. Softw.* 59:1-23.

Three characteristics of tidy data

Tree	Species	Height (m)	Leaf length (cm)
1	Oak	20.3	8.1
2	Oak	25.4	9.4
3	Maple	18.2	12.5
4	Maple	16.7	11.3

File extensions and types

- **File extensions** (e.g., PDF, JPG, DOCX)
- **Text files** (e.g., TXT, CSV, HTML)
- **Binary files** (e.g., PNG, MP3, PDF)

File extensions and types

- Text files can be opened by a plain text editor
- Binary files require a specific program
- Text files (e.g., CSV) are more secure long-term

Files stored in nested folders

- Important to organise files in a project
- One folder for a project, nested files
- Recommend a folder for SCIU4T4

Files stored in nested folders

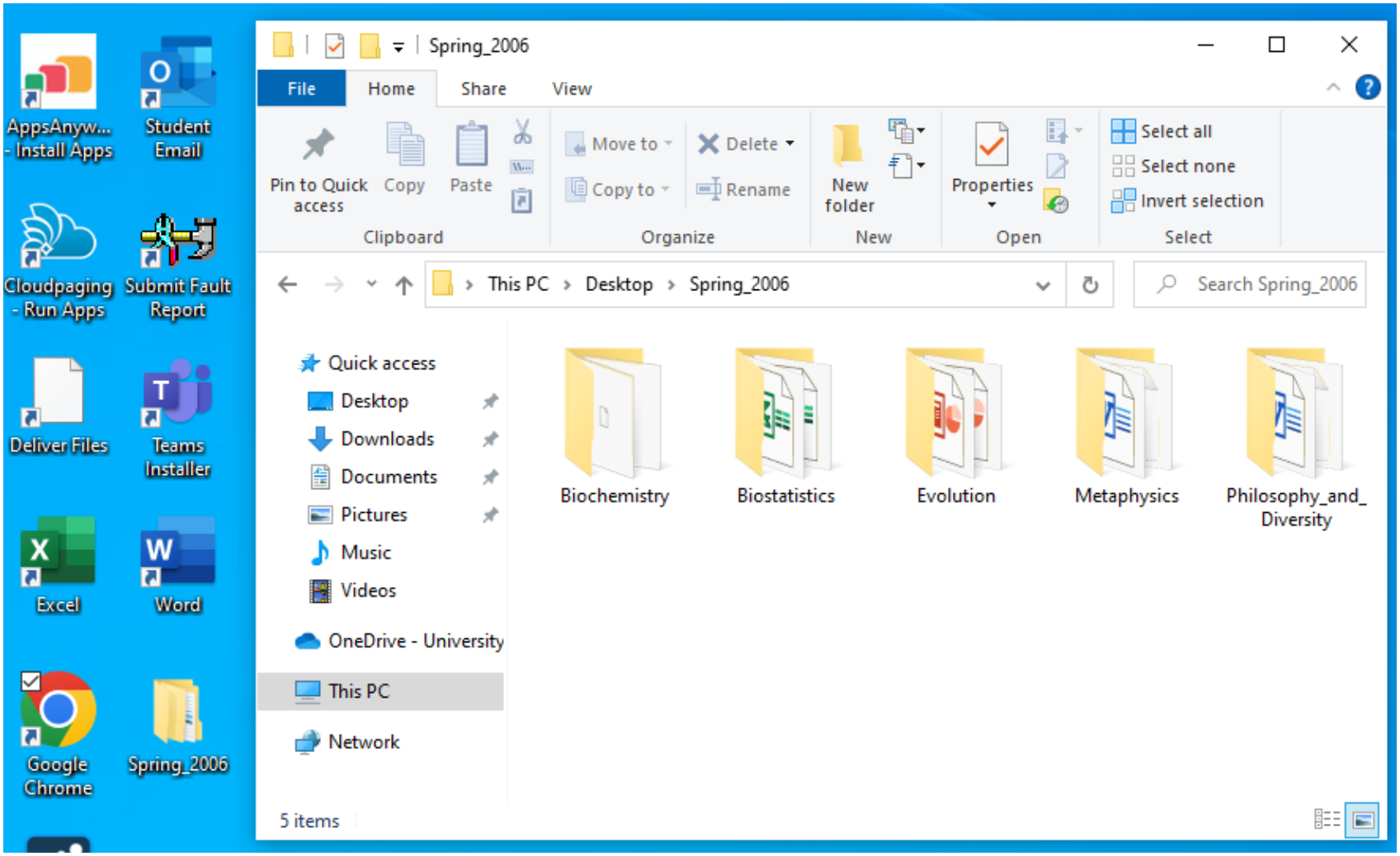


Figure 6: Windows file directory showing the file organisation of modules taken during spring 2006. In this case, the 'Spring_2006' folder is located on the desktop; the path to the folder is visible in the toolbar above the folders.

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