Coding Challenge 5

Maryam Saeed Noor Fatima

2025-03-20

#### Q.No.1 Adding the csv files

library(tidyverse)

## ── Attaching core tidyverse packages ──────────────────────── tidyverse 2.0.0 ──  
## ✔ dplyr 1.1.4 ✔ readr 2.1.5  
## ✔ forcats 1.0.0 ✔ stringr 1.5.1  
## ✔ ggplot2 3.5.1 ✔ tibble 3.2.1  
## ✔ lubridate 1.9.4 ✔ tidyr 1.3.1  
## ✔ purrr 1.0.2   
## ── Conflicts ────────────────────────────────────────── tidyverse\_conflicts() ──  
## ✖ dplyr::filter() masks stats::filter()  
## ✖ dplyr::lag() masks stats::lag()  
## ℹ Use the conflicted package (<http://conflicted.r-lib.org/>) to force all conflicts to become errors

library(readr)  
library(ggplot2)  
  
diversityData <- read.csv("DiversityData.csv")  
metadata <- read.csv("Metadata.csv")  
str(diversityData)

## 'data.frame': 70 obs. of 5 variables:  
## $ Code : chr "S01\_13" "S02\_16" "S03\_19" "S04\_22" ...  
## $ shannon : num 6.62 6.61 6.66 6.66 6.61 ...  
## $ invsimpson: num 211 207 213 205 200 ...  
## $ simpson : num 0.995 0.995 0.995 0.995 0.995 ...  
## $ richness : int 3319 3079 3935 3922 3196 3481 3250 3170 3657 3177 ...

str(metadata)

## 'data.frame': 70 obs. of 5 variables:  
## $ Code : chr "S01\_13" "S02\_16" "S03\_19" "S04\_22" ...  
## $ Crop : chr "Soil" "Soil" "Soil" "Soil" ...  
## $ Time\_Point : int 0 0 0 0 0 0 6 6 6 6 ...  
## $ Replicate : int 1 2 3 4 5 6 1 2 3 4 ...  
## $ Water\_Imbibed: chr "na" "na" "na" "na" ...

#### Q.No.2 Joining the data frame and giving them alpha name

left\_join(diversityData, metadata, by = "Code")

## Code shannon invsimpson simpson richness Crop Time\_Point Replicate  
## 1 S01\_13 6.624921 210.72795 0.9952545 3319 Soil 0 1  
## 2 S02\_16 6.612413 206.86664 0.9951660 3079 Soil 0 2  
## 3 S03\_19 6.660853 213.01843 0.9953056 3935 Soil 0 3  
## 4 S04\_22 6.660671 204.69080 0.9951146 3922 Soil 0 4  
## 5 S05\_25 6.610965 200.25523 0.9950064 3196 Soil 0 5  
## 6 S06\_28 6.650812 199.32110 0.9949830 3481 Soil 0 6  
## 7 S61\_32 6.570679 200.23177 0.9950058 3250 Soil 6 1  
## 8 S62\_35 6.492227 171.27965 0.9941616 3170 Soil 6 2  
## 9 S63\_38 6.610986 192.08535 0.9947940 3657 Soil 6 3  
## 10 S64\_41 6.472259 163.99814 0.9939024 3177 Soil 6 4  
## 11 S65\_44 6.508824 181.69248 0.9944962 2985 Soil 6 5  
## 12 S66\_47 6.482495 176.90684 0.9943473 2770 Soil 6 6  
## 13 S121\_51 6.276073 126.56259 0.9920988 3040 Soil 12 1  
## 14 S122\_54 6.461118 152.98152 0.9934633 3192 Soil 12 2  
## 15 S123\_57 6.334648 138.92556 0.9928019 2673 Soil 12 3  
## 16 S124\_60 6.461988 171.13732 0.9941567 3180 Soil 12 4  
## 17 S125\_63 6.501973 172.97532 0.9942188 3320 Soil 12 5  
## 18 S126\_66 6.354387 142.61016 0.9929879 2773 Soil 12 6  
## 19 S181\_70 6.299381 142.64506 0.9929896 2806 Soil 18 1  
## 20 S182\_74 6.340644 145.48656 0.9931265 3047 Soil 18 2  
## 21 S183\_78 6.282807 150.39829 0.9933510 2190 Soil 18 3  
## 22 S184\_82 6.268316 141.14138 0.9929149 2488 Soil 18 4  
## 23 S186\_90 6.289000 140.45260 0.9928802 2684 Soil 18 6  
## 24 C01\_11 6.618126 220.66218 0.9954682 3076 Cotton 0 1  
## 25 C02\_14 6.627206 211.03921 0.9952615 3180 Cotton 0 2  
## 26 C03\_17 6.616958 216.06631 0.9953718 2938 Cotton 0 3  
## 27 C04\_20 6.626465 215.93901 0.9953691 3371 Cotton 0 4  
## 28 C05\_23 6.642822 211.08960 0.9952627 3435 Cotton 0 5  
## 29 C06\_26 6.679131 216.31351 0.9953771 3629 Cotton 0 6  
## 30 C61\_30 6.454741 170.03639 0.9941189 2767 Cotton 6 1  
## 31 C62\_33 6.484032 172.35279 0.9941979 3377 Cotton 6 2  
## 32 C63\_36 6.517958 173.41489 0.9942335 3804 Cotton 6 3  
## 33 C64\_39 6.476069 167.13138 0.9940167 3204 Cotton 6 4  
## 34 C65\_42 6.569722 197.01186 0.9949242 3250 Cotton 6 5  
## 35 C66\_45 6.482145 172.96394 0.9942184 3009 Cotton 6 6  
## 36 C121\_49 5.944568 71.55607 0.9860249 2779 Cotton 12 1  
## 37 C122\_52 6.187755 96.43939 0.9896308 3193 Cotton 12 2  
## 38 C123\_55 6.129460 81.26646 0.9876948 2859 Cotton 12 3  
## 39 C124\_58 6.028523 75.49726 0.9867545 2950 Cotton 12 4  
## 40 C125\_61 6.148179 98.94468 0.9898933 3018 Cotton 12 5  
## 41 C126\_64 6.347332 150.05708 0.9933359 2946 Cotton 12 6  
## 42 C181\_68 6.301392 132.36230 0.9924450 3266 Cotton 18 1  
## 43 C182\_72 6.000205 83.90929 0.9880824 2969 Cotton 18 2  
## 44 C183\_76 5.981284 82.44127 0.9878702 2636 Cotton 18 3  
## 45 C184\_80 5.578566 50.73174 0.9802885 2043 Cotton 18 4  
## 46 C185\_84 6.064655 87.82732 0.9886140 3113 Cotton 18 5  
## 47 SB01\_12 6.644864 216.86110 0.9953888 3203 Soybean 0 1  
## 48 SB02\_15 6.615662 211.32573 0.9952680 3055 Soybean 0 2  
## 49 SB03\_18 6.693987 230.45439 0.9956607 3595 Soybean 0 3  
## 50 SB04\_21 6.647502 234.80343 0.9957411 3253 Soybean 0 4  
## 51 SB05\_24 6.605749 198.57265 0.9949641 3187 Soybean 0 5  
## 52 SB06\_27 6.640696 215.26494 0.9953546 3190 Soybean 0 6  
## 53 SB61\_31 6.044229 89.13912 0.9887816 2371 Soybean 6 1  
## 54 SB62\_34 6.437589 154.21624 0.9935156 3248 Soybean 6 2  
## 55 SB63\_37 6.194632 83.11681 0.9879687 2976 Soybean 6 3  
## 56 SB64\_40 6.117393 87.20257 0.9885324 3006 Soybean 6 4  
## 57 SB65\_43 5.439798 29.48338 0.9660826 2809 Soybean 6 5  
## 58 SB66\_46 6.195816 108.22394 0.9907599 2680 Soybean 6 6  
## 59 SB121\_50 4.393341 12.39587 0.9193280 2508 Soybean 12 1  
## 60 SB122\_53 5.630929 52.97931 0.9811247 2403 Soybean 12 2  
## 61 SB123\_56 5.579523 48.59842 0.9794232 2752 Soybean 12 3  
## 62 SB124\_59 5.406651 34.08685 0.9706632 2946 Soybean 12 4  
## 63 SB125\_62 5.863941 63.33020 0.9842097 3165 Soybean 12 5  
## 64 SB126\_65 5.738025 57.88780 0.9827252 2705 Soybean 12 6  
## 65 SB181\_69 5.671024 57.37726 0.9825715 2642 Soybean 18 1  
## 66 SB182\_73 5.489406 43.16854 0.9768350 2773 Soybean 18 2  
## 67 SB183\_77 5.713960 60.47882 0.9834653 2454 Soybean 18 3  
## 68 SB184\_81 5.467076 44.06798 0.9773078 2365 Soybean 18 4  
## 69 SB185\_85 5.729473 55.95864 0.9821297 2789 Soybean 18 5  
## 70 SB186\_89 5.556356 54.34527 0.9815991 2050 Soybean 18 6  
## Water\_Imbibed  
## 1 na  
## 2 na  
## 3 na  
## 4 na  
## 5 na  
## 6 na  
## 7 na  
## 8 na  
## 9 na  
## 10 na  
## 11 na  
## 12 na  
## 13 na  
## 14 na  
## 15 na  
## 16 na  
## 17 na  
## 18 na  
## 19 na  
## 20 na  
## 21 na  
## 22 na  
## 23 na  
## 24 0.0042  
## 25 0.0091  
## 26 0.0013  
## 27 0.0087  
## 28 0.0075  
## 29 0.0046  
## 30 0.058  
## 31 0.044  
## 32 0.0569  
## 33 0.0841  
## 34 0.0535  
## 35 0.0029  
## 36 0.0651  
## 37 0.0527  
## 38 0.0675  
## 39 0.0545  
## 40 0.0623  
## 41 0.0021  
## 42 0.0034  
## 43 0.0632  
## 44 0.0514  
## 45 0.0577  
## 46 0.0554  
## 47 0.1664  
## 48 0.0942  
## 49 0.1248  
## 50 0.115  
## 51 0.0993  
## 52 0.1005  
## 53 0.2308  
## 54 0.2603  
## 55 0.2111  
## 56 0.2808  
## 57 0.2712  
## 58 0.2887  
## 59 0.2822  
## 60 0.2557  
## 61 0.2982  
## 62 0.2489  
## 63 0.2573  
## 64 0.2285  
## 65 0.2528  
## 66 0.2706  
## 67 0.3196  
## 68 0.2437  
## 69 0.2461  
## 70 0.301

alpha<- left\_join(diversityData, metadata, by = "Code")  
head(alpha)

## Code shannon invsimpson simpson richness Crop Time\_Point Replicate  
## 1 S01\_13 6.624921 210.7279 0.9952545 3319 Soil 0 1  
## 2 S02\_16 6.612413 206.8666 0.9951660 3079 Soil 0 2  
## 3 S03\_19 6.660853 213.0184 0.9953056 3935 Soil 0 3  
## 4 S04\_22 6.660671 204.6908 0.9951146 3922 Soil 0 4  
## 5 S05\_25 6.610965 200.2552 0.9950064 3196 Soil 0 5  
## 6 S06\_28 6.650812 199.3211 0.9949830 3481 Soil 0 6  
## Water\_Imbibed  
## 1 na  
## 2 na  
## 3 na  
## 4 na  
## 5 na  
## 6 na

#### Q.No.3 Making pielou richness index column using mutate

alpha %>%  
 mutate(pielou\_eveness = shannon/log(richness))

## Code shannon invsimpson simpson richness Crop Time\_Point Replicate  
## 1 S01\_13 6.624921 210.72795 0.9952545 3319 Soil 0 1  
## 2 S02\_16 6.612413 206.86664 0.9951660 3079 Soil 0 2  
## 3 S03\_19 6.660853 213.01843 0.9953056 3935 Soil 0 3  
## 4 S04\_22 6.660671 204.69080 0.9951146 3922 Soil 0 4  
## 5 S05\_25 6.610965 200.25523 0.9950064 3196 Soil 0 5  
## 6 S06\_28 6.650812 199.32110 0.9949830 3481 Soil 0 6  
## 7 S61\_32 6.570679 200.23177 0.9950058 3250 Soil 6 1  
## 8 S62\_35 6.492227 171.27965 0.9941616 3170 Soil 6 2  
## 9 S63\_38 6.610986 192.08535 0.9947940 3657 Soil 6 3  
## 10 S64\_41 6.472259 163.99814 0.9939024 3177 Soil 6 4  
## 11 S65\_44 6.508824 181.69248 0.9944962 2985 Soil 6 5  
## 12 S66\_47 6.482495 176.90684 0.9943473 2770 Soil 6 6  
## 13 S121\_51 6.276073 126.56259 0.9920988 3040 Soil 12 1  
## 14 S122\_54 6.461118 152.98152 0.9934633 3192 Soil 12 2  
## 15 S123\_57 6.334648 138.92556 0.9928019 2673 Soil 12 3  
## 16 S124\_60 6.461988 171.13732 0.9941567 3180 Soil 12 4  
## 17 S125\_63 6.501973 172.97532 0.9942188 3320 Soil 12 5  
## 18 S126\_66 6.354387 142.61016 0.9929879 2773 Soil 12 6  
## 19 S181\_70 6.299381 142.64506 0.9929896 2806 Soil 18 1  
## 20 S182\_74 6.340644 145.48656 0.9931265 3047 Soil 18 2  
## 21 S183\_78 6.282807 150.39829 0.9933510 2190 Soil 18 3  
## 22 S184\_82 6.268316 141.14138 0.9929149 2488 Soil 18 4  
## 23 S186\_90 6.289000 140.45260 0.9928802 2684 Soil 18 6  
## 24 C01\_11 6.618126 220.66218 0.9954682 3076 Cotton 0 1  
## 25 C02\_14 6.627206 211.03921 0.9952615 3180 Cotton 0 2  
## 26 C03\_17 6.616958 216.06631 0.9953718 2938 Cotton 0 3  
## 27 C04\_20 6.626465 215.93901 0.9953691 3371 Cotton 0 4  
## 28 C05\_23 6.642822 211.08960 0.9952627 3435 Cotton 0 5  
## 29 C06\_26 6.679131 216.31351 0.9953771 3629 Cotton 0 6  
## 30 C61\_30 6.454741 170.03639 0.9941189 2767 Cotton 6 1  
## 31 C62\_33 6.484032 172.35279 0.9941979 3377 Cotton 6 2  
## 32 C63\_36 6.517958 173.41489 0.9942335 3804 Cotton 6 3  
## 33 C64\_39 6.476069 167.13138 0.9940167 3204 Cotton 6 4  
## 34 C65\_42 6.569722 197.01186 0.9949242 3250 Cotton 6 5  
## 35 C66\_45 6.482145 172.96394 0.9942184 3009 Cotton 6 6  
## 36 C121\_49 5.944568 71.55607 0.9860249 2779 Cotton 12 1  
## 37 C122\_52 6.187755 96.43939 0.9896308 3193 Cotton 12 2  
## 38 C123\_55 6.129460 81.26646 0.9876948 2859 Cotton 12 3  
## 39 C124\_58 6.028523 75.49726 0.9867545 2950 Cotton 12 4  
## 40 C125\_61 6.148179 98.94468 0.9898933 3018 Cotton 12 5  
## 41 C126\_64 6.347332 150.05708 0.9933359 2946 Cotton 12 6  
## 42 C181\_68 6.301392 132.36230 0.9924450 3266 Cotton 18 1  
## 43 C182\_72 6.000205 83.90929 0.9880824 2969 Cotton 18 2  
## 44 C183\_76 5.981284 82.44127 0.9878702 2636 Cotton 18 3  
## 45 C184\_80 5.578566 50.73174 0.9802885 2043 Cotton 18 4  
## 46 C185\_84 6.064655 87.82732 0.9886140 3113 Cotton 18 5  
## 47 SB01\_12 6.644864 216.86110 0.9953888 3203 Soybean 0 1  
## 48 SB02\_15 6.615662 211.32573 0.9952680 3055 Soybean 0 2  
## 49 SB03\_18 6.693987 230.45439 0.9956607 3595 Soybean 0 3  
## 50 SB04\_21 6.647502 234.80343 0.9957411 3253 Soybean 0 4  
## 51 SB05\_24 6.605749 198.57265 0.9949641 3187 Soybean 0 5  
## 52 SB06\_27 6.640696 215.26494 0.9953546 3190 Soybean 0 6  
## 53 SB61\_31 6.044229 89.13912 0.9887816 2371 Soybean 6 1  
## 54 SB62\_34 6.437589 154.21624 0.9935156 3248 Soybean 6 2  
## 55 SB63\_37 6.194632 83.11681 0.9879687 2976 Soybean 6 3  
## 56 SB64\_40 6.117393 87.20257 0.9885324 3006 Soybean 6 4  
## 57 SB65\_43 5.439798 29.48338 0.9660826 2809 Soybean 6 5  
## 58 SB66\_46 6.195816 108.22394 0.9907599 2680 Soybean 6 6  
## 59 SB121\_50 4.393341 12.39587 0.9193280 2508 Soybean 12 1  
## 60 SB122\_53 5.630929 52.97931 0.9811247 2403 Soybean 12 2  
## 61 SB123\_56 5.579523 48.59842 0.9794232 2752 Soybean 12 3  
## 62 SB124\_59 5.406651 34.08685 0.9706632 2946 Soybean 12 4  
## 63 SB125\_62 5.863941 63.33020 0.9842097 3165 Soybean 12 5  
## 64 SB126\_65 5.738025 57.88780 0.9827252 2705 Soybean 12 6  
## 65 SB181\_69 5.671024 57.37726 0.9825715 2642 Soybean 18 1  
## 66 SB182\_73 5.489406 43.16854 0.9768350 2773 Soybean 18 2  
## 67 SB183\_77 5.713960 60.47882 0.9834653 2454 Soybean 18 3  
## 68 SB184\_81 5.467076 44.06798 0.9773078 2365 Soybean 18 4  
## 69 SB185\_85 5.729473 55.95864 0.9821297 2789 Soybean 18 5  
## 70 SB186\_89 5.556356 54.34527 0.9815991 2050 Soybean 18 6  
## Water\_Imbibed pielou\_eveness  
## 1 na 0.8171431  
## 2 na 0.8232216  
## 3 na 0.8046776  
## 4 na 0.8049774  
## 5 na 0.8192376  
## 6 na 0.8155427  
## 7 na 0.8125582  
## 8 na 0.8053387  
## 9 na 0.8057856  
## 10 na 0.8026420  
## 11 na 0.8134652  
## 12 na 0.8178151  
## 13 na 0.7825905  
## 14 na 0.8007927  
## 15 na 0.8027732  
## 16 na 0.8012745  
## 17 na 0.8019483  
## 18 na 0.8015438  
## 19 na 0.7934213  
## 20 na 0.7904154  
## 21 na 0.8168340  
## 22 na 0.8016534  
## 23 na 0.7965737  
## 24 0.0042 0.8240330  
## 25 0.0091 0.8217613  
## 26 0.0013 0.8286233  
## 27 0.0087 0.8157692  
## 28 0.0075 0.8158938  
## 29 0.0046 0.8148549  
## 30 0.058 0.8144250  
## 31 0.044 0.7980600  
## 32 0.0569 0.7906489  
## 33 0.0841 0.8022726  
## 34 0.0535 0.8124399  
## 35 0.0029 0.8093209  
## 36 0.0651 0.7496447  
## 37 0.0527 0.7668822  
## 38 0.0675 0.7702042  
## 39 0.0545 0.7545500  
## 40 0.0623 0.7673379  
## 41 0.0021 0.7945881  
## 42 0.0034 0.7787840  
## 43 0.0632 0.7504026  
## 44 0.0514 0.7593336  
## 45 0.0577 0.7318864  
## 46 0.0554 0.7539969  
## 47 0.1664 0.8232153  
## 48 0.0942 0.8244294  
## 49 0.1248 0.8176063  
## 50 0.115 0.8219646  
## 51 0.0993 0.8188774  
## 52 0.1005 0.8231136  
## 53 0.2308 0.7777862  
## 54 0.2603 0.7961603  
## 55 0.2111 0.7744902  
## 56 0.2808 0.7638754  
## 57 0.2712 0.6850627  
## 58 0.2887 0.7849191  
## 59 0.2822 0.5612885  
## 60 0.2557 0.7233538  
## 61 0.2982 0.7044778  
## 62 0.2489 0.6768294  
## 63 0.2573 0.7275444  
## 64 0.2285 0.7260697  
## 65 0.2528 0.7197378  
## 66 0.2706 0.6924349  
## 67 0.3196 0.7320451  
## 68 0.2437 0.7037462  
## 69 0.2461 0.7221929  
## 70 0.301 0.7286456

alpha\_even<- alpha %>%  
 mutate(pielou\_eveness = shannon/log(richness))  
head(alpha\_even)

## Code shannon invsimpson simpson richness Crop Time\_Point Replicate  
## 1 S01\_13 6.624921 210.7279 0.9952545 3319 Soil 0 1  
## 2 S02\_16 6.612413 206.8666 0.9951660 3079 Soil 0 2  
## 3 S03\_19 6.660853 213.0184 0.9953056 3935 Soil 0 3  
## 4 S04\_22 6.660671 204.6908 0.9951146 3922 Soil 0 4  
## 5 S05\_25 6.610965 200.2552 0.9950064 3196 Soil 0 5  
## 6 S06\_28 6.650812 199.3211 0.9949830 3481 Soil 0 6  
## Water\_Imbibed pielou\_eveness  
## 1 na 0.8171431  
## 2 na 0.8232216  
## 3 na 0.8046776  
## 4 na 0.8049774  
## 5 na 0.8192376  
## 6 na 0.8155427

#### Q.No.4 calculating mean and Sd of pielou eveness group

alpha\_average<-alpha\_even %>%  
 group\_by(Crop, Time\_Point)%>%  
 summarise(mean\_even = mean(pielou\_eveness), # calculating mean  
 n = n(), # count of observation  
 sd\_eveness = sd(pielou\_eveness)) %>% # standard deviation  
 mutate(se\_eveness = sd\_eveness/sqrt(n)) #standard error

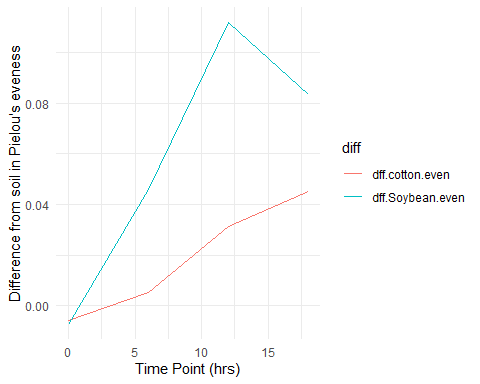
## `summarise()` has grouped output by 'Crop'. You can override using the  
## `.groups` argument.

#### Q.No.5 Calculating the difference

alpha\_average2<- alpha\_average%>%  
 select(Time\_Point, Crop, mean\_even) %>% # selecting the relevent columns  
 pivot\_wider(names\_from = Crop, values\_from = mean\_even)%>% # povot wider function   
 mutate(dff.cotton.even = Soil - Cotton, #creating a new column using mutate for calculating difference  
 dff.Soybean.even = Soil - Soybean)

#### Q.No.6 Connecting to plots

alpha\_average2 %>%  
 select(Time\_Point, dff.cotton.even, dff.Soybean.even)%>%  
 pivot\_longer(c(dff.cotton.even, dff.Soybean.even),  
 names\_to = "diff")%>%  
 ggplot(aes(x = Time\_Point, y = value, colour = diff))+  
 geom\_line()+  
 theme\_minimal()+  
 xlab("Time Point (hrs)")+  
 ylab("Difference from soil in Pielou's eveness" )

 #### Commit and push code to get clickable link of the pdf