Supplementary Table 1. The results from our unit tests. The specifications for the devices we used are as follows: **Web Server**: Intel Core i7-12700T (12-core) processor and 36 GB DDR4 memory on Ubuntu 20.04 with R version 4.2.0; **Local 1**: AMD Ryzen 7 5800U (8-core) processor and 8 GB DDR4 memory on Windows 11 Home (Version: 21H2, Build: 22000.1098) with R version 4.1.0; **Local 2**: Apple M1 Ultra (20-core) processor and 64 GB memory on macOS Monterey 12.4 with R version 4.2.0. The datasets we used are as follows: **Example Data 1** contains 348 features for 87 subjects for a two-group comparison (a baseline group at the time of antibiotic administration and 2 weeks afterwards) (Zhang et al., 2018); **Example Data 2** contains 348 features for 120 subjects for a three-group comparison (a baseline group at the time of antibiotic administration and 2 weeks and 4 weeks afterwards) based on a complete block design (Zhang et al., 2018); **Example Data 3** contains 348 features for 128 subjects for a three-group comparison (a baseline group at the time of antibiotic administration and 2 weeks and 4 weeks afterwards) based on an incomplete block design (Zhang et al., 2018); **Synthetic Data** contains 6,671 features for 3,000 subjects for a three-group comparison based on a complete block design (Goodrich et al., 2014).

|                     | Web Server        | Local 1            | Local 2            |
|---------------------|-------------------|--------------------|--------------------|
| **Installation**    | N/A (already installed) | OK (time: 23 sec) | OK (time: 22 sec)  |
| **Implementation Using Example Data 1** |                   |                    |                    |
| **Data Input**      |                   |                    |                    |
| Unified Data        | OK (time: 1 sec)  | OK (time: 1 sec)  | OK (time: 1 sec)  |
| Individual Data     | OK (time: 1 sec)  | OK (time: 1 sec)  | OK (time: 1 sec)  |
| **Quality Control** |                   |                    |                    |
| Filtering/Visualization | OK (time: 1 sec) | OK (time: 1 sec)  | OK (time: 1 sec)  |
| **Ecological Analysis** |                   |                    |                    |
| Diversity Calculation| OK (time: 2 sec)  | OK (time: 2 sec)  | OK (time: 2 sec)  |
| Paired t-test       | OK (time: 1 sec)  | OK (time: 1 sec)  | OK (time: 1 sec)  |
| Wilcoxon signed-rank test | OK (time: 1 sec) | OK (time: 1 sec)  | OK (time: 1 sec)  |
| Hotelling’s t-squared test | OK (time: 1 sec) | OK (time: 1 sec)  | OK (time: 1 sec)  |
| Taxonomic Analysis | PERMANOVA | OK (time: 3 sec) | OK (time: 4 sec) | OK (time: 3 sec) |
|-------------------|-----------|-----------------|-----------------|-----------------|
|                   | Data Transformation | OK (time: 2 sec) | OK (time: 3 sec) | OK (time: 2 sec) |
|                   | Paired t-test | OK (time: 2 sec) | OK (time: 3 sec) | OK (time: 2 sec) |
|                   | Wilcoxon signed-rank test | OK (time: 2 sec) | OK (time: 3 sec) | OK (time: 2 sec) |
|                   | LDM | OK (time: 12 sec) | OK (time: 15 sec) | OK (time: 13 sec) |

**Implementation Using Example Data 2**

| Data Input | Unified Data | OK (time: 2 sec) | OK (time: 2 sec) | OK (time: 2 sec) |
|------------|--------------|-----------------|-----------------|-----------------|
|            | Individual Data | OK (time: 2 sec) | OK (time: 2 sec) | OK (time: 2 sec) |

| Quality Control | Filtering/Visualization | OK (time: 2 sec) | OK (time: 2 sec) | OK (time: 2 sec) |
|-----------------|--------------------------|-----------------|-----------------|-----------------|

| Ecological Analysis | Diversity Calculation | OK (time: 2 sec) | OK (time: 2 sec) | OK (time: 2 sec) |
|---------------------|------------------------|-----------------|-----------------|-----------------|
|                     | ANOVA F-test/Tukey’s HSD | OK (time: 3 sec) | OK (time: 3 sec) | OK (time: 3 sec) |
|                     | Friedman’s test/Conover’s test | OK (time: 2 sec) | OK (time: 3 sec) | OK (time: 3 sec) |
|                     | LMM | OK (time: 2 sec) | OK (time: 3 sec) | OK (time: 2 sec) |
|                     | PERMANOVA | OK (time: 23 sec) | OK (time: 28 sec) | OK (time: 24 sec) |

| Taxonomic Analysis | Data Transformation | OK (time: 2 sec) | OK (time: 2 sec) | OK (time: 2 sec) |
|-------------------|---------------------|-----------------|-----------------|-----------------|
|                   | ANOVA F-test/Tukey’s HSD | OK (time: 3 sec) | OK (time: 5 sec) | OK (time: 3 sec) |
|                   | Friedman’s test/Conover’s test | OK (time: 2 sec) | OK (time: 3 sec) | OK (time: 2 sec) |
|                   | LDM | OK (time: 37 sec) | OK (time: 39 sec) | OK (time: 38 sec) |
## Implementation using Example Data 3

| Data Input          | Unified Data               | OK (time: 2 sec) | OK (time: 2 sec) | OK (time: 2 sec) |
|---------------------|-----------------------------|------------------|------------------|------------------|
|                     | Individual Data             | OK (time: 2 sec) | OK (time: 2 sec) | OK (time: 2 sec) |
| Quality Control     | Filtering/Visualization     | OK (time: 2 sec) | OK (time: 2 sec) | OK (time: 2 sec) |
| Ecological Analysis | Diversity Calculation       | OK (time: 2 sec) | OK (time: 2 sec) | OK (time: 2 sec) |
|                     | ANOVA F-test/Tukey’s HSD    | OK (time: 3 sec) | OK (time: 4 sec) | OK (time: 3 sec) |
|                     | Durbin’s test/Conover’s test| OK (time: 2 sec) | OK (time: 3 sec) | OK (time: 2 sec) |
|                     | LMM                         | OK (time: 2 sec) | OK (time: 2 sec) | OK (time: 2 sec) |
|                     | PERMANOVA                   | OK (time: 31 sec)| OK (time: 36 sec)| OK (time: 32 sec)|
| Taxonomic Analysis  | Data Transformation         | OK (time: 2 sec) | OK (time: 2 sec) | OK (time: 2 sec) |
|                     | ANOVA F-test/Tukey’s HSD    | OK (time: 5 sec) | OK (time: 6 sec) | OK (time: 5 sec) |
|                     | Durbin’s test/Conover’s test| OK (time: 2 sec) | OK (time: 2 sec) | OK (time: 2 sec) |
|                     | LDM                         | OK (time: 38 sec)| OK (time: 41 sec)| OK (time: 39 sec)|
|                     | LMM                         | OK (time: 5 sec) | OK (time: 8 sec) | OK (time: 6 sec) |

## Implementation Using Synthetic Data

| Data Input | Unified Data | OK (time: 7 sec) | OK (time: 8 sec) | OK (time: 7 sec) |
|                    | Individual Data          | Filtering/Visualization | Ecological Analysis | Taxonomic Analysis |
|--------------------|--------------------------|-------------------------|---------------------|--------------------|
| Quality Control    | OK (time: 7 sec)         | OK (time: 23 sec)       | Diversity Calculation | OK (time: 31 min)  |
|                    |                          | OK (time: 28 sec)       | ANOVA F-test/Tukey’s HSD | OK (time: 25 min)  |
|                    |                          | OK (time: 22 sec)       | Friedman’s test/Conover’s test | OK (time: 8 sec)  |
|                    |                          |                         | LMM                 | OK (time: 7 sec)  |
|                    |                          |                         | PERMANOVA           | OK (time: 25 min)  |
|                    |                          |                         | Data Transformation | OK (time: 6 min)  |
|                    |                          |                         | ANOVA F-test/Tukey’s HSD | OK (time: 32 min)  |
|                    |                          |                         | Friedman’s test/Conover’s test | OK (time: 22 min)  |
|                    |                          |                         | LDM                 | OK (time: 48 min)  |
|                    |                          |                         | LMM                 | OK (time: 8 min)  |