**Exam 3**

**Description:**

In order to confirm participants can use the R codes to analysis the data, participants are asked to complete the final exam. This final exam including the part of data analysis on quantification of PM exposure-health evaluation and data analysis on PM exposure factors with environmental and survey data. There is a total of **four questions** with different setting scenarios in this exam.

**Raw data:**

1. **AS-Lung data (PM data)**: The AS-Lung data has already finished the QA/QC procedures by Python and PyCharm.
2. **Rooti data (HRV data)**: The Rooti data is provided by Rooti company without any process.
3. **Questionnaire and time-activity diary data**
4. **Meteorological data**

**Section 1: Data analysis on quantification of PM exposure-health evaluation**

1. Please evaluate the effect of **personal** **PM2.5 exposure** on **HF/LF ratio** (ratio of high frequency to low frequency) under the following scenarios: (1) **no-raining periods**, (2) **awake periods**, and (3) **periods in the indoor environments including in transportation indoors** (hint: the “Loc\_In\_All” variable = “1” means subjects were in the indoor environments including in transportation indoors)
2. Please evaluate the effect of **personal** **PM1 exposure** on **LF** (low frequency power) under the following scenarios: (1) **no-raining periods**, (2) **awake periods**, and (3) **periods in the indoor environments which is not included the in transportation indoors** (hint: the “Loc\_In” variable = “1” means subjects were in the indoor environments which is not included the in transportation indoors)

Please provide the output of the models and interpret the results of models. The results should include (1) the **quantified effects of PM2.5 or PM1** on HRV indices (expressed as percent changes by interquartile range (IQR) changes) with 95% confidence intervals, (2) ***p* values** and (3) the **adjusted R2** of the models.

**Section 2: Data analysis on PM exposure factors with environmental and survey data**

Prior to analyzing the data, please modified the “S\_Other2” group in the R code of TAD data to **add the source of ETS (S\_ETS) to “S\_Other2” group**, which means that the “S\_Other2” group includes the sources of dust/clean, ETS, mosquito coils, aromatic products, open burning, odor of garbage, and other. **(from Line 121 to 127)**

1. Please evaluate the **personal PM2.5 exposure factors** including **outdoor PM2.5 concentration**, **indoor PM sources (vehicle exhaust, cooking, burning of incense/joss-paper and other sources)** and **ventilations** under the following scenarios: (1) **no-raining periods**, (2) **at-home periods**, and (3) **periods between 06:00 to 24:00**.
2. Please evaluate the **indoor PM1 exposure factors** including **outdoor PM1 concentration**, **indoor PM sources (vehicle exhaust, cooking, burning of incense/joss-paper and other sources)** and **ventilations** under the following scenarios: (1) **no-raining periods**, (2) **at-home periods**, and (3) **periods between 06:00 to 24:00**.

Please provide the output of the stepwise procedures, models and partial R2of each independent variables, and interpret the results of models. The results should include (1) the **incremental contribution** to PM2.5 or PM1 of these indoor sources, ventilations and outdoor PM concentration with 95% confidence intervals, (2) ***p* values**, (3) **partial R2 values** and (4) the **adjusted R2** of the models. Please also state which variable has **the greatest contribution** to PM2.5 or PM1.