In this project, an advanced data structure (mutually linked sections) is developed to model the mutual affection of sound levels between adjacent rooms. This data structure not only combines the features of the doubly linked list and the tree map, yet breaks the hierarchical format of a tree map to allow linking between any two objects, but also consists of specifical utility functions for relevant calculations and dictionaries to store additional information. The structure is maintained by storing key-value pairs in customized dictionaries within each section object, whereas keys are strings and values are pointers to section objects. Consider the situation shown in the figure below:
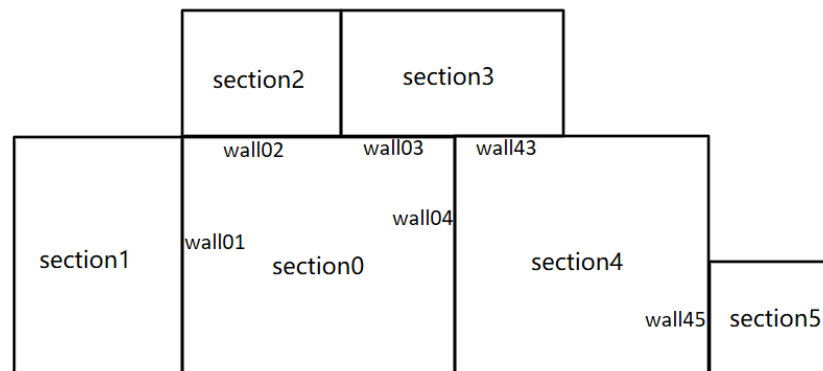
The mutually linked sections representation is shown below:
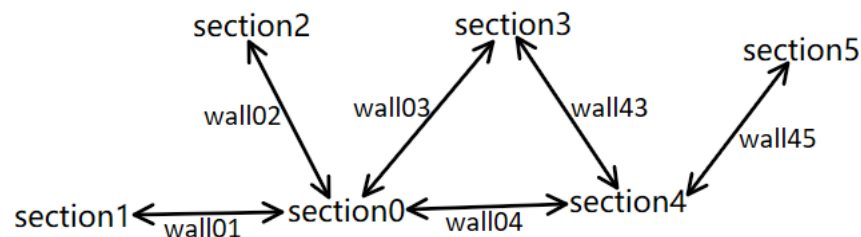
The major purpose of the model is to compute the sound pressure levels in 7 octaves from 63Hz to 4000Hz in each concerned section given the sound power levels emitted in each of its neighbor section, the transitional loss through wall to each neighbor, the wall areas and absorptivity of this section, and the volume of this section. This can be done by simply initializing the sections and linking them. Note that a link is automatically mutual by linking from one section to another. An additional purpose is to calculate the reverberation time of a section by inheriting a section class as a room class and access the overridden functions.

This project can easily be simplified for using this data structure for other purposes.

By running the C++ codes in this folder, the following output is generated:

```
ncdic:(classroom:25);(musicroom:25);(practice:25);(piano:25);(chapel:20);(office:
25);(corridor:30);
###s0 linked to s1###
###s2 linked to s0###
###s3 linked to s0###
###s0 linked to s4###
###s4 linked to s5###
```

```
###s3 linked to s4###
-----find s0 in s5's neighbor s3'neighbors and describe-----
name: room0
section type: classroom
NC: 25
noise emissions (dB): 78,91,100,108,92,94,91,
volume (m^3): 70
wall areas (m^2): 29.5,12.8,
absorptivities:
(0.11,0.12,0.13,0.24,0.25,0.17,0.16,);(0.543333,0.3,0.45,0.65,0.56,0.59,0.71,);
total noise from neighbors (dB):48.7,51.2,52.4,51,32.8,39.9,-5.3,
compare to NC (negative is good): -5.3,7.2,15.4,20,5.8,15.9,-27.3,
neighbors: room1,section2,section3,section4,
--------neighbors info--------
neighbor:room1
wall transition losses (dB): 36,46,62,78,89,91,90,
source SWL (dB): 72,85,93.5,102,85.5,87.5,85,
transmitted SWL (dB): 36,39,31.5,24,-3.5,-3.5,-5,
transmitted SPL (dB): 30.6,36,26.9,17,-9.8,-9.6,-12.3,
-----------------
neighbor:section2
wall transition losses (dB): 24,37,43,50,53,48,90,
source SWL (dB): 78,91,100,108,92,94,91,
transmitted SWL (dB): 54,54,57,58,39,46,1,
transmitted SPL (dB): 48.6,51,52.4,51,32.7,39.9,-6.3,
-----------------
neighbor:section3
wall transition losses (dB): 36,46,62,78,89,91,90,
source SWL (dB): 0,70,75,80,75,68,63,
transmitted SWL (dB): -36,24,13,2,-14,-23,-27,
transmitted SPL (dB): -41.4,21,8.4,-5,-20.3,-29.1,-34.3,
-----------------
neighbor:section4
wall transition losses (dB): 24,37,43,50,53,48,90,
source SWL (dB): 0,70,75,80,75,68,63,
transmitted SWL (dB): -24,33,32,30,22,20,-27,
transmitted SPL (dB): -29.4,30,27.4,23,15.7,13.9,-34.3,
-----------------
###s4 delinked with s0###
###s0 delinked with s2###
-----describe s0 after delinking with s1 and s2-----
name: room0
section type: classroom
NC: 25
noise emissions (dB): 78,91,100,108,92,94,91,
```

```
volume (m^3): 70
wall areas (m^2): 29.5,12.8,
absorptivities:
(0.11,0.12,0.13,0.24,0.25,0.17,0.16,);(0.543333,0.3,0.45,0.65,0.56,0.59,0.71,);
total noise from neighbors (dB):30.6,36.1,27,17,-9.5,-9.6,-12.2,
compare to NC (negative is good): -23.4,-7.9,-10,-14,-36.5,-33.6,-34.2,
neighbors: room1,section3,
--------neighbors info--------
neighbor:room1
wall transition losses (dB): 36,46,62,78,89,91,90,
source SWL (dB): 72,85,93.5,102,85.5,87.5,85,
transmitted SWL (dB): 36,39,31.5,24,-3.5,-3.5,-5,
transmitted SPL (dB): 30.6,36,26.9,17,-9.8,-9.6,-12.3,
------------------
neighbor:section3
wall transition losses (dB): 36,46,62,78,89,91,90,
source SWL (dB): 0,70,75,80,75,68,63,
transmitted SWL (dB): -36,24,13,2,-14,-23,-27,
transmitted SPL (dB): -41.4,21,8.4,-5,-20.3,-29.1,-34.3,
------------------
-----s0 reverberation time in seconds (7 octaves)-----
1.10494,1.5271,1.17457,0.731818,0.774943,0.896793,0.816194,
```