Scientific computing with Python - 2018
International Ph.D. in Science - Università Cattolica del Sacro Cuore, Brescia
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Hands-on exercises, day 1

Note: in all the following exercises, the program must read the input from `stdin` and print the output to `stdout`.

1. Sub-list sum problem (easy)

Given an ordered list of integer, compute the number of sub-lists that sum to zero. A sub-list is made by contiguous element of the original list. For example, in the list

```
[2, 3, -5, 5, 0, -3, 1]
```

there are five sub-lists that sum up to zero, namely:
`[2, 3, -5]`, `[3, -5, 5, 0, -3]`, `[-5, 5]`, `[-5, 5, 0]`, `[0]`

2. Subset sum problem (medium)

Given a set of integers, compute the number of subsets that sum to zero. Note that in this case the order does not count. Compare the solution with the previous problem, also in terms of computation time.

3. Letter frequency in the *Divina Commedia* (easy)

Compute the frequency of the letters in Dante's *Divina Commedia* (1320). Which is the most common letter? Compare the result with a text in another language, for example the classical John Milton's *Paradise Lost* (1667) in English.

4. Skyline problem (medium)

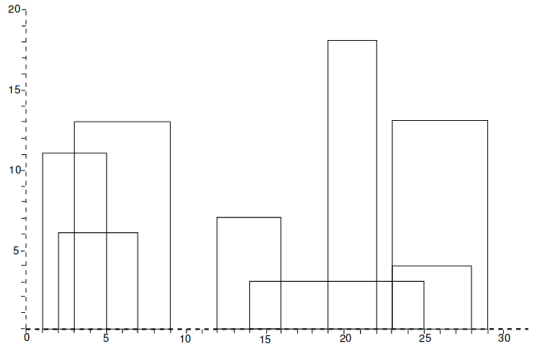
A city's skyline is the outer contour of the silhouette formed by all the buildings in that city when viewed from a distance. In this problem, a building is represented by a tuple of three integer (***L***, *H*, ***R***), where ***L*** and ***R*** are the x coordinate of the building and H represents the height of the building. The skyline of a set of n buildings is a stepwise function represented here with a list of coordinates x alternated with the heights.
For example, the skyline of the following eight buildings

[[**3**, 13, **9**], [**1**, 11, **5**], [**12**, 7, **16**], [**14**, 3, **25**], [**19**, 18, **22**], [**2** ,6, **7**], [**23**, 13, **29**], [**23**, 4, **28**]]

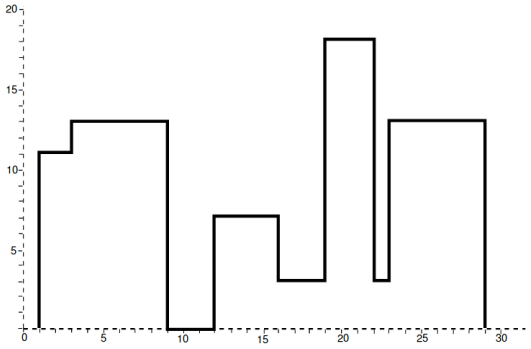
is

[**1**, 11, **3**, 13, **9**, 0, **12**, 7, **16**, 3, **19**, 18, **22**, 3, **23**, 13, **29**]

The following figure illustrates the case:



Buildings



Skyline