## Part B: Analysing Votes from Many Constituencies

In this part of the exercise we will analyse files containing voting results from many constituencies. The format of the files will be that for each constituency, the file will contain a set of lines that begin with text of the form.

\_Constituency:*name of constituency*

\_Seats:*number of seats to be allocated for the constituency*

Followed by lines containing parties (or individual contestants) and the number of votes that they got in the constituency in question, in the same form as the files that we looked at in the week 9 lecture. The file may contain blank lines. You may assume that constituency and party names do not contain colons or underscores. **You may use the code generated in the week 9 lecture in your solutions to these exercises.**

The Moodle site contains a file ‘ukeu2019.txt’ that contains the data from the 23 May 2019 UK EU parliament elections in this form (the results for Northern Ireland are omitted because that constituency uses a different voting method). In this part we will develop functions to analyse such files:

### Exercise 6 (1 mark):

Write a function whose parameter is the name of a file, whose contents are in the format shown above, and which returns a **set** containing all the constituencies that can be found in the file.

Example

>>> getConstituencies('ukeu2019.txt')

{'London', 'South East England', 'West Midlands', 'Scotland', 'East Midlands', 'North East England', 'North West England', 'Yorkshire and the Humber', 'Wales', 'East of England', 'South West England'}

### Exercise 7 (2 mark)

### Write a function getParties whose parameter is the name of a file in the format described above, and which returns the names of all the parties that have participated in the election (in any constituency).

Example:

>>> getParties('ukeu2019.txt')

{'Yorkshire Party', 'Daze Aghaji (Independent)', 'Ken Parke (Independent)', 'Henry Muss (Independent)', 'Brexit Party', "Women's Equality", 'Animal Welfare', 'Larch Maxey (Independent)', 'Mothiur Rahman (Independent)', 'Andrew Medhurst (Independent)', 'Tommy Robinson (Independent)', 'Scottish Green', 'Claudia Mcdowell (Independent)', 'Independent Network', 'Conservative', 'David Victor Round (Independent)', 'Attila Csordas (Independent)', 'Gordon Edgar (Independent)', 'English Democrat', 'Roger Hallam (Independent)', 'Green', 'Jason Guy Spencer McMahon (Independent)', 'Neville Seed (Independent)', 'Andrea Venzon (Independent)', 'Mike Shad (Independent)', 'Labour', 'Alan Kirkby (Independent)', 'UKIP', 'Mohammad Aslam (Independent)', 'Michael Jeffrey Turberville (Independent)', 'Liberal Democrats', 'Plaid Cymru', 'Change UK', 'Socialist (GB)', 'Simon Rood (Independent)', 'Zoe Lafferty (Independent)', 'Kofi Klu (Independent)', 'Ian Sowden (Independent)', 'UK EU', 'SNP'}

Note: There were some individuals who stood in the EU elections as independents, their votes are recorded in the same way as those for parties, and they should be treated in the same way as parties.

### Exercise 8 (3 marks):

Write a function getVotesForConstituency whose parameters are the name of a votes file, and the name of a constituency, and which returns a dictionary whose keys and values are respectively the parties that contested that constituency and the votes they received in the constituency

Example

>>> getVotesForConstituency('ukeu2019.txt', 'West Midlands')

{'Brexit Party': 507152, 'Labour': 228298, 'Liberal Democrats': 219982, 'Green': 143520, 'Conservative': 135279, 'UKIP': 66934, 'Change UK': 45673}

### Exercise 9 (1 mark): problem with list indexes – makes no sense. Seek help

Write a function getTotalVotes whose parameter is the name of a votes file, and which returns a dictionary whose keys are parties that contested the election and whose values are the total number of votes that they got across all constituencies. A party should appear as a key if it contested at least one constituency.

Hint: You may find that the addTo function developed in Exercise 5 is useful here.

Example:

>>> getTotalVotes('ukeu2019.txt')

{'Brexit Party': 5248533, 'Liberal Democrats': 3367284, 'Green': 1881306, 'Conservative': 1511485, 'Labour': 2347255, 'Change UK': 571846, 'UKIP': 549348, 'English Democrat': 39938, 'Attila Csordas (Independent)': 3230, 'Plaid Cymru': 163928, 'Independent Network': 7641, 'Simon Rood (Independent)': 4511, 'Yorkshire Party': 50842, 'Larch Maxey (Independent)': 1772, 'Mothiur Rahman (Independent)': 755, 'Neville Seed (Independent)': 3383, 'SNP': 594553, 'Scottish Green': 129603, 'Gordon Edgar (Independent)': 6128, 'Ken Parke (Independent)': 2049, 'Tommy Robinson (Independent)': 38908, 'UK EU': 33576, 'Mohammad Aslam (Independent)': 2002, 'Animal Welfare': 25232, "Women's Equality": 23766, 'Claudia Mcdowell (Independent)': 1036, 'Daze Aghaji (Independent)': 1018, 'Roger Hallam (Independent)': 924, 'Kofi Klu (Independent)': 869, 'Andrea Venzon (Independent)': 731, 'Mike Shad (Independent)': 707, 'Zoe Lafferty (Independent)': 436, 'Andrew Medhurst (Independent)': 430, 'Alan Kirkby (Independent)': 401, 'Ian Sowden (Independent)': 254, 'Henry Muss (Independent)': 226, 'Jason Guy Spencer McMahon (Independent)': 3650, 'Socialist (GB)': 3505, 'David Victor Round (Independent)': 2606, 'Michael Jeffrey Turberville (Independent)': 1587}

### Exercise 10 (2 marks):

Write a function getTotalSeats whose parameter is the name of a votes file and which returns a dictionary indicating how many seats each party gets if *each individual constituency* is allocated seats using the D’Hondt method.

**N.B.** You cannot simply take the *total* number of votes for each party (as returned by getTotalVotes) and then apply the D’Hondt method. You have to apply D’Hondt to each individual constituency and then add together the seats for each constituency.

You will probably find that the code from the week 9 lecture is particularly useful in answering this exercise, as well as the addTo function developed in Exercise 5.

Example:

>>> seats = getTotalSeats('ukeu2019.txt')

>>> printNonZero(seats)

Brexit Party : 29

Liberal Democrats : 16

Labour : 10

Conservative : 4

Green : 7

SNP : 3

Plaid Cymru : 1