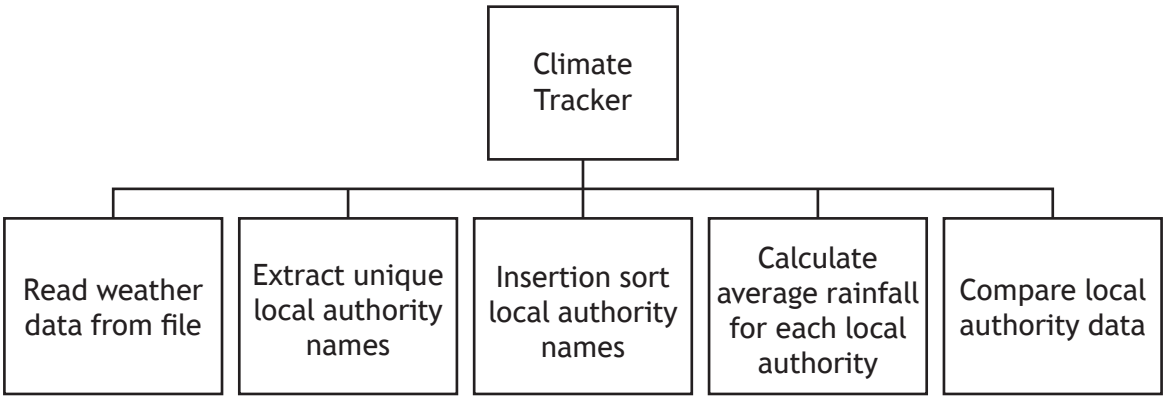
5. EnviroScot has set up 500 weather stations across Scotland to track the effect of climate change. Several weather stations have been placed in each of the 32 local authorities to ensure that the data gathered covers all areas of the country. **MARKS**

The rainfall (cm) for 28 February 2023 from all 500 weather stations has been stored in a CSV file.

A program is being developed to analyse the data. The structure diagram below shows the design of the program.



At the start of the program, the data is read from the CSV file into the program and stored in an array of 500 records called `readingsArray` with the following record structure:

```
RECORD reading IS { STRING place, STRING authority, INTEGER
rainfall }
```

A sample of the data held in `readingsArray` is shown below.

place	**authority**	**rainfall**
Inverurie	Aberdeenshire	5
Plockton	Highland	16
Inverary	Argyll and Bute	14
Braemar	Aberdeenshire	6
Cumbernauld	North Lanarkshire	11
Dunstaffnage	Argyll and Bute	15
Nairn	Highland	6
Paisley	Renfrewshire	11
Wick	Highland	7
…	…	…

(a) Using the data in the `readingsArray`, the program must calculate the average rainfall for each local authority and store the results in an array of 32 records called `rainfallArray`. The structure of each record in the `rainfallArray` array is shown below.

```
RECORD rainfall IS { STRING local, INTEGER averageRainfall }
```

(i) Using pseudocode, design an algorithm that will extract a unique list of local authority names from the `readingsArray` and store them in the `rainfallArray`. **3**

5. (a) (continued) **MARKS**

(ii) The local authority names stored in the `rainfallArray` array must be arranged in alphabetical order using the insertion sort algorithm. An incomplete algorithm for an insertion sort is shown below.

```
1.  set temp = ""
2.  set position = 0
3.  for loop = 1 to 31 do
4.      set temp to rainfallArray[loop].local
5.      set position = loop
6.      while _____________________________________
7.          _____________________________________________
8.          set position = position − 1
9.      end while
10.     _____________________________________________
11. end loop
```

Using pseudocode, write the instructions needed to complete the insertion sort design at lines 6, 7 and 10. **3**

(iii) In the calculation of the average rainfall for each local authority, any calculated averages with a decimal value must be rounded to the nearest integer.

Using pseudocode, design an algorithm to calculate the average rainfall for each local authority and store the results in the `rainfallArray`. **4**

(b) The program is required to compare the average rainfall for four local authorities. Users should be able to enter the names of four local authorities. The program will then use the binary search algorithm to find each local authority and its associated average rainfall.

The output from the program will be a diagram showing the average rainfall for each of the four local authorities entered by the user. Sample output from the program is shown below.

```
Average rainfall (cm) for the requested local authorities

Borders **************
Inverclyde ***********
Stirling *****
Highlands ****************
```

Using pseudocode, design an algorithm to:

- enter the names of the local authorities requested by the user
- apply the binary search algorithm to find the rainfall data for each local authority requested by the user
- display the diagram as shown in the sample output with one asterisk (*) representing 1 cm of average rainfall. **6**