

Program: CPA2-4
Course: INFO-3138
Professor: Osam Ali
Project: #2 – Green House Gases in Canada
Due Date: Friday, July 30th, 2021 by 11:59 pm
Last Update: June 8th, 2021

To be completed individually by each student!

Description

Code a C# console (.NET Core) application that uses an XML file (*ghg-canada.xml*) for data storage and generates parameterized reports based on user inputs. The XML file contains data about annual greenhouse gas (GHG) emissions from 1990 to 2019 for all provinces, territories and major sources. The data are from <https://open.canada.ca/data/en/dataset/779c7bcf-4982-47eb-af1b-a33618a05e5b>. Your users should be able to view two types of tabular reports: based on a selected region (province or territory) or based on a selected source of GHGs. After completing this project you should be able to apply the DOM and XPath to navigate and retrieve information from an XML document tree.

Requirements

Create a Windows C# console (.NET Core) program that does the following:

1. Displays an appropriate title
2. Displays a main menu of the following options for the user to choose from:
 - a. Select a range of years to include in the reports of either type below
 - b. Generate a GHGs report for a selected region within Canada
 - c. Generate a GHGs report for a selected sector of the economy (a source)
 - d. Exit the program
3. Obtains the user's main menu selection
4. If the user elects to set the years for the reports, prompts them for a *starting-year* (≥ 1990 and ≤ 2019) and an *ending-year* (≥ 1990 and ≤ 2019 and $< \text{starting-year} + 5$). Note that due to space limitation, the report should show a maximum of 5 consecutive years of GHG data. User inputs should be validated to ensure they are within range! You should set *starting-year* and *ending-year* to default values (such as 2015 and 2019 respectively) when the program launches so that a report can be generated even if the user doesn't adjust these values.
5. If the user elects to generate a report:
 - a. obtains input values from the user for the parameters of the selected report as follows:

Report Type	Prompt Should Include...	User Inputs
For a region	A numbered menu of all regions listed in the XML file (see sample output)	A valid region number
For a source of GHGs	A numbered menu of all sources of GHGs listed in the XML file (see sample output)	A valid source number

Again, user inputs should be validated to ensure they are within range!

- b. Generates a report in the console window for the selected report type and input parameters. The report should include:
 - i. An appropriate title that includes any additional information required to interpret the report such as the report type and the selected region or source of GHGs
- b. Appropriate column labels
- c. Values organized into neat columns as follows:

Report Type	Columns Required
For a region	A source of GHGs The number of Megatonnes of GHGs generated by each source. Note that there should be one row for each source and one column for each included year.
For a source of GHGs	The name of a region The number of Megatonnes of GHGs generated in each region by the selected source. Note that there should be one row for each region and one column for each included year.

IMPORTANT: The XML data set is incomplete such that some regions are missing data for some years. If a region is missing the requested data for a column in a report just print a '-' (hyphen) character!

Note that your report columns should be formatted neatly such that:

- No line exceeds 100 characters in length (if necessary you can truncate the descriptive data in the first column)
- Numbers are rounded to three decimal places
- Columns are consistently aligned/justified

Note also that you are not expected to sort the table rows.

6. After the user's selection from the main menu is processed the program should display the menu again and allow the user to select another option. This should continue until the user elects to exit the program.

Additional Non-Functional Requirements

1. Your program must use the DOM to load the XML document tree from the XML file, and it should use XPath for each of the following:
 - a. To obtain the names of all the regions included in the XML file and display a numbered menu of regions (for the first report type)
 - b. To obtain from sources of GHGs from the XML file and display a numbered menu of sources (for the second report type)
 - c. To obtain any specific data from the XML file that is needed to generate a report
2. Your program must use the XML data file in the form provided without modifications.
3. Your program should handle any *XmlException* or *XPathException* that could be generated.

Sample Output

```
Greenhouse Gas Emissions in Canada
=====

'Y' to adjust the range of years
'R' to select a region
'S' to select a specific GHG source
'X' to exit the program
Your selection: Y

Starting year (1990 to 2019): 2005

Ending year (1990 to 2019): 2015
ERROR: Ending year must be an integer between 2005 and 2009.

Ending year (1990 to 2019): 2009

Press any key to continue.
```

Figure 1 – Adjusting the range of years to use in the reports

```
Greenhouse Gas Emissions in Canada
=====

'Y' to adjust the range of years
'R' to select a region
'S' to select a specific GHG source
'X' to exit the program
Your selection: R

Select a region by number as shown below...
 1. Alberta
 2. British Columbia
 3. Manitoba
 4. New Brunswick
 5. Newfoundland and Labrador
 6. Northwest Territories
 7. Northwest Territories and Nunavut
 8. Nova Scotia
 9. Nunavut
10. Ontario
11. Prince Edward Island
12. Quebec
13. Saskatchewan
14. Yukon
15. Canada

Enter a region #: 15

Emissions in Canada (Megatonnes)
-----
```

Source	2005	2006	2007	2008	2009
Agriculture	72.153	70.184	70.735	70.587	67.949
Buildings	84.269	79.181	85.000	84.707	83.098
Heavy Industry	87.387	87.322	86.311	84.758	71.650
Light Manufacturing, Construction and Forest Resources	24.063	22.658	23.813	22.720	20.228
Oil and Gas	159.881	165.309	170.997	167.279	164.806
Transport	160.015	161.026	164.655	164.663	161.344
Waste	30.972	30.410	29.840	29.540	28.278
Total	738.717	730.099	751.661	735.693	693.598

```
Press any key to continue.
```

Figure 2 - Report for a selected region

Greenhouse Gas Emissions in Canada
=====

'Y' to adjust the range of years
'R' to select a region
'S' to select a specific GHG source
'X' to exit the program
Your selection: S

Select a source by number as shown below...

1. Agriculture
2. Buildings
3. Heavy Industry
4. Light Manufacturing, Construction and Forest Resources
5. Oil and Gas
6. Transport
7. Waste
8. Total

Enter a source #: 5

Emissions from Oil and Gas (Megatonnes)

Region	2005	2006	2007	2008	2009
Alberta	99.753	103.467	108.967	107.326	106.884
British Columbia	11.907	13.959	14.055	14.628	14.634
Manitoba	0.819	0.801	0.681	0.534	0.419
New Brunswick	2.730	2.981	2.977	3.039	3.373
Newfoundland and Labrador	2.636	2.944	3.113	2.648	2.718
Northwest Territories	0.242	0.196	0.197	0.102	0.038
Northwest Territories and Nunavut	-	-	-	-	-
Nova Scotia	1.539	1.385	1.276	1.384	1.444
Nunavut	0.000	0.000	0.000	0.000	0.000
Ontario	11.743	11.474	11.223	10.395	9.402
Prince Edward Island	0.000	0.000	0.000	0.000	0.000
Quebec	4.376	4.395	4.466	4.257	4.146
Saskatchewan	24.058	23.617	23.945	22.908	21.728
Yukon	0.077	0.091	0.099	0.057	0.022
Canada	159.881	165.309	170.997	167.279	164.806.

Press any key to continue.

Figure 3 - Report for a selected source

Greenhouse Gas Emissions in Canada
=====

'Y' to adjust the range of years
'R' to select a region
'S' to select a specific GHG source
'X' to exit the program
Your selection: X

Press any key to continue.

All done!

Figure 4 – Exiting the program

Grading Scheme

Item	Marks
Handles all exceptions of the following types: <i>XmlException</i> , <i>XPathException</i>	2
Program title and menu option selection by user, allows repeated selections	1
Setting the range of years based on user input, with input validation	2
Report for selected region: <ul style="list-style-type: none">Region selection by user, including a menu of numbered regions generated using XPath and including input validation	5
<ul style="list-style-type: none">Report title, columns labels, required formatting (e.g. maximum width = 100 characters)	5
<ul style="list-style-type: none">Report data obtained using XPath, complete and correct	10
Report for selected source of GHGs: <ul style="list-style-type: none">Source selection by user, including a menu of numbered sources generated using XPath and including input validation	5
<ul style="list-style-type: none">Report title, columns labels, required formatting (e.g. maximum width = 100 characters)	5
<ul style="list-style-type: none">Report data obtained using XPath, complete and correct	10
Deduction if the path information for the XML file needs to be corrected in the code!	-5
TOTAL	45

Submit

Via the link on the *Project 2* dropbox in FanshaweOnline an archive (ZIP) file of your cleaned Visual Studio solution including the XML data file

Submit your project on time!

The late submission policy for this project is that you will lose 10% if your project is less than 1 day (< 24 hours) late. You will lose an additional 10% for each additional day up to a maximum of 5 days or 50%. Projects received later than five days after the submission deadline won't receive any marks.

Submit your own work and keep it to yourself!

You must not submit code written by another student or obtained from another source. You must not share your code with another student. These activities are academic offenses. If you cheat, you may get a mark of zero. Repeat offenses carry even more severe penalties such as receiving an F grade or being expelled. However, students *are* encouraged to share ideas and to work together on practice exercises since this enhances the learning process. Just make sure to submit your own code and benefit from having made the effort on your own!

Project Corrections

If any corrections or changes are necessary they will be posted to the course web site and you will be notified of any changes in class. It is your responsibility to check the site periodically for changes to the project. Additional resources relating to the project may also be posted.