Nanyang Technological University
Nanyang Business School

BC2402 – Designing and Developing Databases
Semester 1, 2022

Individual Assignment

Advancing Sustainability with Adaptive Visualization Presentation (ASAP)

Are we decreasing our CO_2 emissions enough?

1. INTRODUCTION

The Overall Context - Global Warming

Global warming has become one of the most pressing problems for the world population. According to the Intergovernmental Panel on Climate Change, global warming has caused a wide array of extreme weather events that have displaced more than 13 million people (Pörtner et al. 2022). While some might assume that options exist for mankind to adapt to climate impacts, some environmental damages (e.g., glacier retreat, melting polar ice caps, and rising sea levels) are approaching irreversibility, if not already become a catastrophe (McGrath 2022). Unequivocally, global warming is threatening both the lives and livelihoods of many. For instance, Bangladesh has recurrently come under exacerbating cyclones and flooding due to global warming. Increasingly frequent and intense torrential rainfall has displaced close to 700,000 individuals yearly over the last decade (McDonnell 2022). The economic cost of global warming is mounting rapidly. In 2018, high temperatures and unusually dry conditions have contributed to large-scale wildfires that lead to about US$ 24 billion worth of damages in California alone.

The increase in global temperature can be attributed to a variety of activities, which include not only natural climate cycles and fluctuations but also human activities that generate carbon dioxide emissions through the burning of fossil fuels. In particular, scientists have long identified road transportation as the greatest contributor to global warming (Voiland 2010). Despite the increasing prevalence of electric vehicles, power generation and battery production may inevitably create carbon pollution (MIT Energy Initiative 2019). Around the world, the widespread adoption of electric vehicles remains hampered by significant barriers, such as the high upfront purchase costs, limited driving range, and lack of charging infrastructure. While these barriers are not entirely insurmountable, a significant amount of time, money, and effort are likely required.

2. Data Descriptions

The individual assignment involves datasets from five sources:

1. International Greenhouse Gas Emissions
   https://www.kaggle.com/datasets/unitednations/international-greenhouse-gas-emissions?ref=hackernoon.com&select=greenhouse_gas_inventory_data_data.csv

2. Temperature change statistics 1961–2021. Global, regional and country trends
   https://www.fao.org/food-agriculture-statistics/data-release/data-release-detail/en/c/1492093/

3. Climate Change: Earth Surface Temperature Data
   https://www.kaggle.com/datasets/berkeleyearth/climate-change-earth-surface-temperature-data?ref=hackernoon.com

4. Daily Sea Ice Extent Data
   https://www.kaggle.com/datasets/nsidcorg/daily-sea-ice-extent-data?ref=hackernoon.com

5. Glaciers elevation and mass change data from 1850 to present from the Fluctuations of Glaciers Database
   https://cds.climate.copernicus.eu/cdsapp#!/dataset/insitu-glaciers-elevation-mass?tab=overview

To manage your workload, you are encouraged to use the SQL database implementations provided together with this document.

Do note that you must submit your database implementation, if you choose to use the datasets to implement your own databases. Otherwise (if you shall be using the provided databases), you are not required to submit the database implementations.

2. PROJECT DELIVERABLES

The due date for the assignment is 30 September 2022 (23:59 hrs NTULearn server time)

You are not expected to modify the provided mySQL database implementation. You are only expected to submit one file, as follows:

A. 1 x SQL script file

A. SQL script file

You are tasked to develop some SQL scripts to query the data, as follows:

You are to create SQL scripts (e.g., SELECT statements) that generate answers for the following queries.

1) Table considered: <greenhouse_gas_inventory_data_data>
What are the unique [categories]?

2) Tables considered: <greenhouse_gas_inventory_data_data>
What is the sum of emission [value] in the [year] 2010 to 2014 for European Union?

3) Table considered: <greenhouse_gas_inventory_data_data>
What are the [year], [category], and [value] for Australia where emission [value] is greater than 530,000?

4) Tables considered: <seaice> + <greenhouse_gas_inventory_data_data>
For each year (2010 to 2014), display the average [extent] of sea ice, maximum [extent] of sea ice, minimum [extent] of sea ice, and the total amount of emission [value].
Expected output format:

Year	avg_extent	max_extent	min_extent	total_emission
2010	11.409091780821907	9.981	10.002	14331206.801084073
2011	10.992034246575338	9.972	10.029	13864181.86509148
2012	11.205267759562853	9.962	10.001	13666022.309107218
2013	11.710360273972597	9.957	10.015	13393527.874335092
2014	11.78331095890411	9.994	10.043	12838261.285020653

5) Tables considered: <seaice> + <globaltemperatures>

For each year (2010 to 2014), display the average [extent] of sea ice, maximum [extent] of sea ice, minimum [extent] of sea ice, average [landaveragetemperature], minimum [landaveragetemperature], and maximum [landaveragetemperature].

Expected output format:

Year	avg_extent	max_extent	min_extent	avgLandTemperature	minLandTemperature	maxLandTemperature
2010	11.409091780821907	9.981	10.002	9.703083333333332	10.442	9.671
2011	10.992034246575338	9.972	10.029	9.516	10.352	9.483
2012	11.205267759562853	9.962	10.001	9.507333333333333	10.428	9.675999999999998
2013	11.710360273972597	9.957	10.015	9.6065	10.255999999999998	9.044
2014	11.78331095890411	9.994	10.043	9.570666666666666	10.33	9.589

6) Tables considered: <greenhouse_gas_inventory_data_data> + <temperaturechangebycountry>

For each year (2010 to 2014), display the sum of emission [value], average temperature change [temperaturechangebycountry.value], minimum temperature change, and maximum temperature change in Australia.

Expected output format:

year	total_emission	avgTemperatureChange	minTemperatureChange	maxTemperatureChange
2010	67297427.81650822	0.5404117647058824	-0.015	1.494
2011	66504699.902610905	0.16452941176470587	-0.204	1.219
2012	65745037.33324525	0.3499411764705882	-0.049	1.526
2013	65554642.98907402	1.433470588235294	0.829	2.833
2014	64513834.68306794	1.177176470588235	0.382	2.079

7) Table considered: <mass_balance_data>

Display a list of glaciers [name], [investigator], and amount of surveyed on the glacier done by the investigator, when the investigator has conducted more than 11 surveys on the glacier. Sort the output in alphabetic order of [name].

Expected output format:

name	investigator	surveyedAmt
AALFOTBREEN	Glacier group/Bjarne Kjøllmoen (NVE)	22
AALFOTBREEN	Kjøllmoen B. (NVE)	12
ABRAMOV	scientists of the SANGIMI institute	20
ALLALIN		59
ARGENTIERE	Christian Vincent	16
ARGENTIERE	Louis Reynaud	12
AUSTRE BROEGGERBREEN		21
AUSTRE BROEGGERBREEN	Kohler J. (NPI)	19
BABY		18
BABY	Graham Cogley	14
BEZENGI		15

8) Table considered: <temperaturechangebycountry>

For each year (2010 to 2014), display a list of [area], [year], average [value] of temperature change of the ASEAN countries (see https://asean.org/about-

asean/member-states/for the list of member states). Include the overall average of temperature change of all the ASEAN countries of each year.

Expected output format:

area	year	avgValueChange
Cambodia	2010	1.1934117647058824
Indonesia	2010	0.7202352941176471
Malaysia	2010	0.9467058823529411
Myanmar	2010	1.2108823529411763
Philippines	2010	0.9438823529411764
Singapore	2010	0
Thailand	2010	1.3101176470588232
ASEAN	2010	0.9036050420168069
Cambodia	2011	0.3735294117647059
Indonesia	2011	0.35217647058823537

9) [revised] Table considered: <greenhouse_gas_inventory_data_data>

Display a list of [country_or_area], [category], and overall average emission [value] per category, when the country's emission [value] for the category of the [year] is less than the country's overall average emission [value] for the category.

Expected output format:

country_or_area	category	cat_overallAvgValue	year	cat_yearValue
Australia	carbon_dioxide_co2_emissions_without_land_u...	354207.95097606187	2000	349885.433108928
Australia	carbon_dioxide_co2_emissions_without_land_u...	354207.95097606187	1999	343713.906947774
Australia	carbon_dioxide_co2_emissions_without_land_u...	354207.95097606187	1998	334328.142646602
Australia	carbon_dioxide_co2_emissions_without_land_u...	354207.95097606187	1997	320439.116819391
Australia	carbon_dioxide_co2_emissions_without_land_u...	354207.95097606187	1996	311914.819824229
Australia	carbon_dioxide_co2_emissions_without_land_u...	354207.95097606187	1995	305162.543548735
Australia	carbon_dioxide_co2_emissions_without_land_u...	354207.95097606187	1994	293830.709141192
Australia	carbon_dioxide_co2_emissions_without_land_u...	354207.95097606187	1993	289142.267681326
Australia	carbon_dioxide_co2_emissions_without_land_u...	354207.95097606187	1992	284766.092717838
Australia	carbon_dioxide_co2_emissions_without_land_u...	354207.95097606187	1991	279741.639011863
Australia	carbon_dioxide_co2_emissions_without_land_u...	354207.95097606187	1990	278265.898940768
Austria	carbon_dioxide_co2_emissions_without_land_u...	68923.08506256565	2014	64262.5639931315
Austria	carbon_dioxide_co2_emissions_without_land_u...	68923.08506256565	2013	67957.1211123863
Austria	carbon_dioxide_co2_emissions_without_land_u...	68923.08506256565	2012	67698.6586349119
Austria	carbon_dioxide_co2_emissions_without_land_u...	68923.08506256565	2009	67682.7251493548
Austria	carbon_dioxide_co2_emissions_without_land_u...	68923.08506256565	2000	66274.7432545115

10) Tables considered: <temperaturechangebycountry> +<seaice> + <elevation_change_data>

For each year (2008 to 2017), display the average [value] of temperature change in "United States of America", the year's average [extent] of [seaice.extent] sea ice, and the corresponding average [value] of [temperaturechangebycountry.elevation_change_unc] glacier elevation change surveyed by "Martina Barandun Robert McNabb" in the same year.

Expected output format:

Year	avgValue	avgExtent	avgElevationChange
2008	0.16670588235294118	11.608627049180335	9210.23076923077
2009	0.36564705882352944	11.490280821917816	13482.666666666666
2010	0.6884117647058823	11.409091780821907	8237.548192771084
2011	0.6764705882352942	10.992034246575338	10154.137254901962
2012	1.4029999999999998	11.205267759562853	9139.490267639903
2013	0.5327647058823529	11.710360273972597	8500.638143176733
2014	0.683235294117647	11.78331095890411	11040.009478672986
2015	1.5461176470588234	11.489958904109592	8378.963294538944
2016	2.0618235294117646	10.682796448087432	12666.801801801801
2017	1.5284117647058824	10.570813698630129	8626.15473568282

3. SUBMISSION

A submission folder will be made available on NTULearn. You can make as many submissions as you deem necessary, but only the latest submission will be evaluated.

The submission must be made by 30 September 2022, 23:59.