CISC 204 Modelling Project Report

Group 1: Tung Pham, Ngoc Nguyen, Rebecca De Venezia, Lucas March

**Project Summary**

* The project aims to assess whether a trip from one city to another can be made in a reasonable amount of time, based on variables that affect the length of trip.
* Our project scope would only be countries in Canada and the United States only
* A model will correspond to possible trips that can be made given all the constraints are satisfied.

**Propositions:**

* Weather:
  + Sunny
  + Rainy
  + Snowstorm
* Means of transportation:
  + Drive
  + Transit
  + Plane
* External factors:
  + Virus
  + Documents
  + International
  + Roadwork
  + Holidays
  + Accidents
  + Money
  + Toll

**Constraints: (we use implication here but, in the code, we only use NNFs and CNFs)**

* Weather constraints:
  + If it is sunny, it cannot be rainy or a snowstorm:
    - (sunny ↔ ¬rainy)
    - (sunny ↔ ¬snowstorm)
  + If it is rainy or if there is a snowstorm, it cannot be sunny
    - (rain ↔ ¬sunny)
    - (snowstorm ↔¬sunny)
  + Good weather and holiday imply that tickets will be sold out and you must drive
    - (sunny ∧ holiday) → drive
  + Rainy or snowstorm increases the likelihood of accidents
    - (rainy ∨ snowstorm) → accident
  + Snowstorm implies that transit and planes will be shut down
    - (snowstorm → ¬transit ∧ ¬plane)
* Driving constraints:
  + Bad weather and roadwork imply unfeasible trip
    - (rainy ∨ snowstorm) ∧ roadwork →¬drive
  + Bad weather and holiday imply unfeasible trip
    - (rainy ∨ snowstorm) ∧ holiday → ¬drive
  + Roadwork and holiday imply unfeasible trip
    - (roadwork ∧ holiday) → ¬drive
  + Roadwork and accident imply unfeasible trip
    - (roadwork ∧ accident) → ¬drive
  + Holiday and accident imply unfeasible trip
    - (holiday ∧ accident) → ¬drive
* Transit constraints:
  + (to be added more in the future)
* Plane constraints:
  + (to be added more in the future)
* You must have at least one form of travel
  + (drive ∨ transit ∨ plane)
* Only one form of travel can be true at once
  + (drive ↔ ¬ (transit ∨ plane))
  + (transit ↔ ¬ (drive ∨ plane))
  + (plane ↔ ¬ (transit ∨ drive))
* When travelling internationally:
  + You have tested positive for the virus/been in contact, you cannot cross the border
    - (international → (¬virus ∧ documents))
  + No documents mean you cannot cross the border
    - (international ∧ documents) ∨ ¬international)

**Model Exploration**

* Solutions for our project are possible sets of True/False of propositions that correspond to a feasible trip from one place to another
* For the example solution analysis, you can run our draft codes and see what our solutions look like
* We had a bunch of testing codes for constraints and assignments and at the end because they all worked, we just removed them off the original coding file we have on GitHub, but the changes history should be accessible from GitHub for progress checking if necessary!
* As an interesting touch on the project, we added a user-input prompt so that they can enter where they want to begin their trip and where they would like to end their trip at. They can also add how many stops they want along the way and the program would return possible stops, then they can choose where to stop. Ultimately, the solutions would be return with the total time it would take to complete the user-specified trip!

**First-Order Extension**

* We will finish up constraints for transit and plane!
* We may implement a time system so that when the user enters a time limit for their trip, it will limit the number of solutions down for the trip even further
* We may implement some additional information such as informing them which cities have airports and which do not, which therefore narrow down the plane option for some models
* We will also make use of propositions such as accidents, holidays and weathers so that it would take extra time to travel if those propositions happen to be True during the trip, and in the end the final solution would just be the best/fastest/most feasible trip possible.