Homework Assignment #1
ECGR 5100

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Fall 2023

Overview

Complete the following assigned work. For the first two parts, create a PDF with your answers to the questions. (You may use this LaTeX document as template.) Be sure to include your name, student (80x) id number, NinerNet (email) id, as well the semester, year, course, and assignment number. For the third part, create a single Python source file with required functionality. Use the condition ___name___=='___main___' to run a sample script that tests your data structure.

When ready to submit, combine the the PDF, your original LaTeX source, and Python script into a single submission file using `tar` that is compressed with XZ compression. Upload this file to Canvas by the due date.

1   Problems

1. Translate the following English passages into propositions and logical connectors.

   (a) "You can see the movie only if you are over 18 years old or you have permission of a parent." Use m, e, and p as the symbols.

   (b) "You can use Linux or you can upgrade your Windows operating system. However, to upgrade Windows you need to have a 64-bit processor running at 1 GHz or faster, and 16 GB of free hard disk space."

   (c) Experience with C++ or Java is required.

   (d) If you had a candy bar or an apple, you had a light snack; if you had both it was more than a snack.

2. Are these system specifications consistent?

"If the filesystem is not locked, then new messages will be queued. If the filesystem is not locked, then the system is functioning normally, and conversely. If new messages are not queued, then they will be sent to the message buffer. If the filesystem is not locked, then new messages will be sent to the message buffer. New messages will nto be sent to the message buffer."

In other words, does this lead to a contradiction?

3. Show that $p \leftrightarrow q$ and $(p \wedge q) \vee (\neg p \wedge \neg q)$ are logically equivalent using algebra. (Use the Theorems/Postulates in Rosen's textbook or the ones listed in the notes from Harris & Harris.)

4. Show that $(p \vee q) \wedge (\neg p \vee r) \rightarrow (q \vee r)$ is a tautology using algebra.

5. For the first four problems, enumerate the truth tables that describe the relationships between the propositions.

6. From proposition One: $(p \wedge q) \rightarrow p$, can you infer proposition Two: $p \vee q$? Can you prove this with a truth table? (Do not simply write a truth table, explain how the truth table demonstrates the inference.)

7. Use propositional calculus to determine which person did which exercise and what beverage they drank after their workout.

   After an invigorating workout, five fitness-conscious friends know that nothing is more refreshing than a tall cool glass of mineral water! Each person (including Annie) has a different, favorite form of daily exercise (one likes to Rollerblade), and each drinks a different form brand of mineral water (one is Crystal). From the information provided, determine the type of exercise and brand of water each person prefers.

   - The friends are Annie, Ben, Meg, Page, and Tim.
   - The exercises are: **A**erobics, **B**icycling, **J**ogging, **R**ollerblading, and **W**alking.
   - The brands of water are Ocean, Crystal, Mountain, Purity, and Creek.
   - The one who bicycles in pursuit of fitness drinkes Ocean.
   - Tim enjoys Aerobics every morning before work. Ben is neither the one who drinks Creek nor the one who imbibes Ocean.
   - Page (who is neither the one who jogs nor the one who walks to keep in shape) drinks Purity.
   - Meg drinks Mountain but not after jogging.

2 Research Reading and LATEX Document

1. Read the journal *Science* news article:

   https://www.science.org/doi/10.1126/science.ade6577

```
      The commands (or the process you
      used) to create a PDF
      in this listing goes in
      here.
```

Figure 1: commands

Write a paragraph summarizing the *implications* of the policy change.

Write a second paragraph taking a stand for or against the change and justify why it is good for science.

In addition to evaluating the content of your answer, the following format issues will also be considered. (a) Create a title/author/date using the internal LaTeX commands. (b) Use the LaTeX `listings` package to create floating figure with a code listing that shows the commands you used to create a PDF document from the LaTeX source. Then add the lines shown in Figure 1 to reference your figure with the instructions.

3 Coding

Create a Python program creates a Binary Tree data structure.

- For this assignment, you need to create your own class and you are not allowed to use an existing Python library (like the `binarytree` library, for example) for the functionality.

- The information to be stored is just an integer.

- Only two operations are required: `insert()` and `display()`

  - `insert()` takes one argument (an integer) to store the value
  - `display()` takes no arguments and uses the built-in `print()` function to display the stored integer values in increasing order

- You are to implement this as collection of objects and not simply as a sorted list.