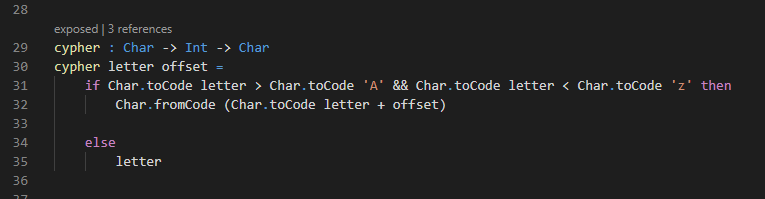
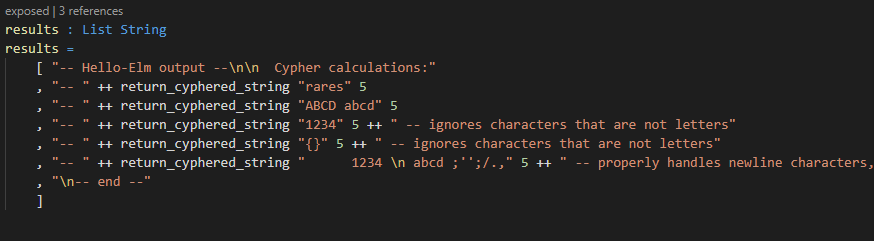
AP-Functional Programming

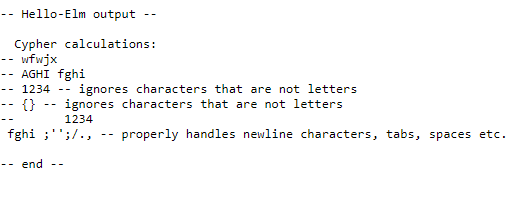
# Week1- Caesar

Assignment: Code Caesar’s Cypher for a string of characters.

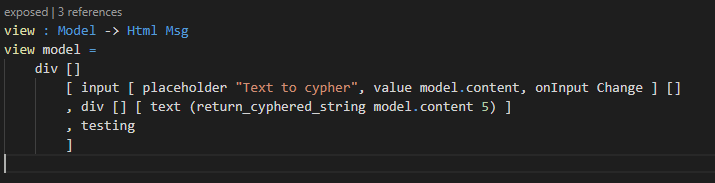


Main code that does the cypher. Takes the character as input and an offset amount and outputs the corresponding letter.

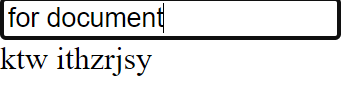




Test cases with output: Testing that only letters are getting cyphered. Also testing against newline and other special characters.

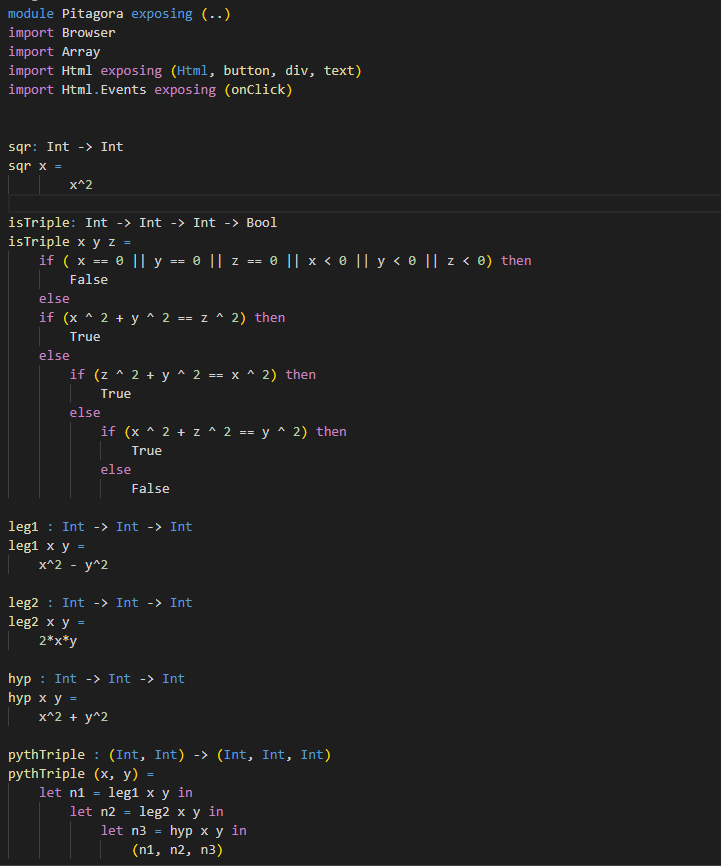


Also implemented a module that runs the cypher in real time on text using an html input in the browser.

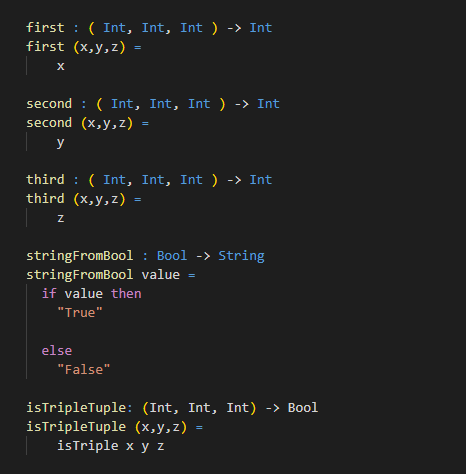


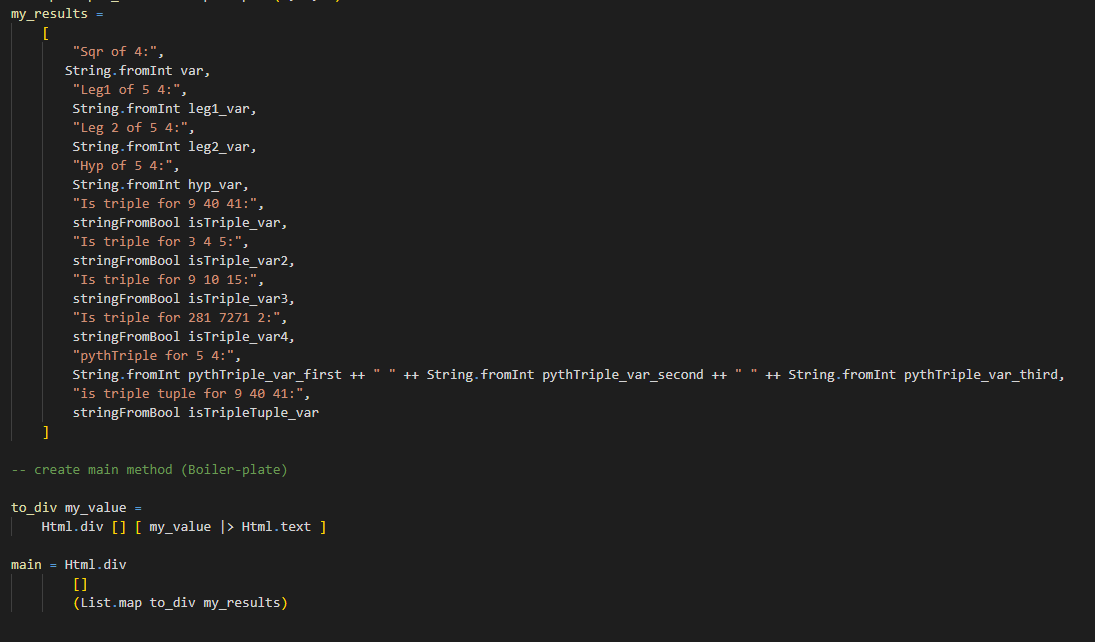
# Week1- Pythagoras Problem

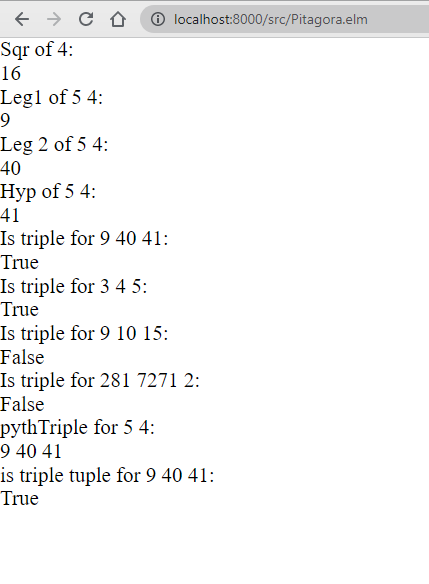
For this assignment my logic was pretty simple. Initially for checking the Pythagoras formula I thought about ordering the list and just checking if the sum of the squares of the first two numbers is equal to the square of the third, it would mean the numbers are in fact Pythagorean. As I found some issues with the elm syntax I ended up having three if statements.



Also for showing the output of the Boolean functions I had to write another function that would return a string based on the Boolean sent. That way I could have shown that my algorithm was working correctly. Also, I created functions for returning the first/second or third element of a tuple. Overall everything is working as intended and tested.



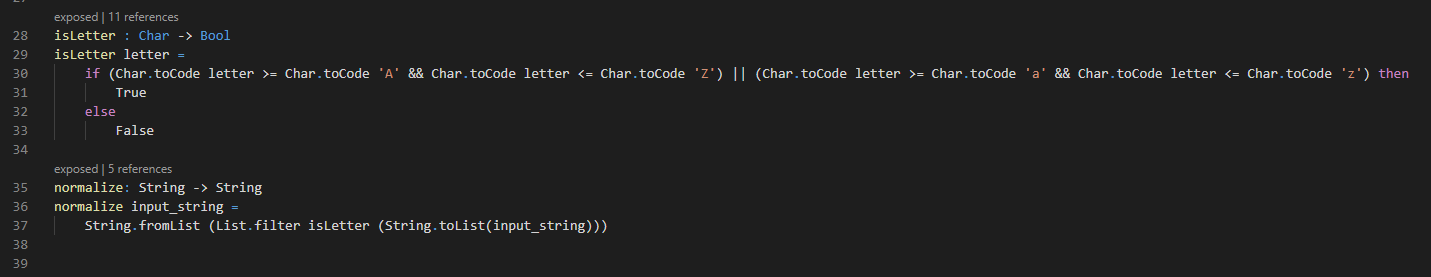




# Week 2: Caesar

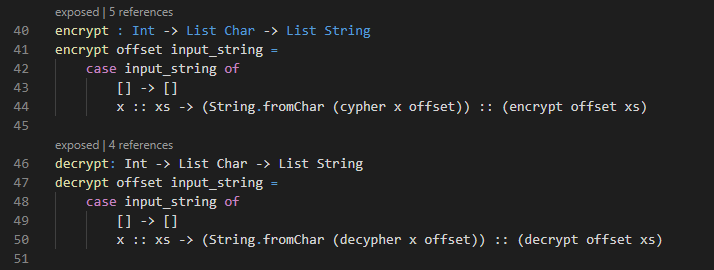
For this week, the goals were to implement a normalize() function that removes all unwanted characters from the input string, recreate the cypher without using the .map function, and make sure that the letters cannot over/underflow (when applying the offset on the ASCII code, it could be the case that “Char.toCode letter + offset” would go above/below the character set.

1. Normalize function



Pretty self explanatory implementation, I am just looking if characters in the input string are withing the character set defined (a-Z). For this function, I have used the list functions in order to go through the input string character by character, WITHOUT using map, as can be seen in the code snippet above.

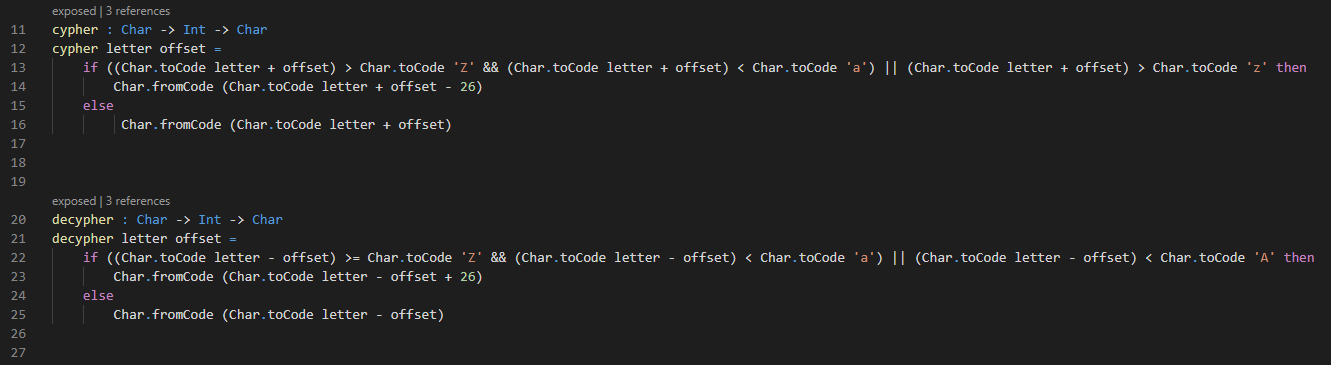
1. Encrypt/Decrypt without map



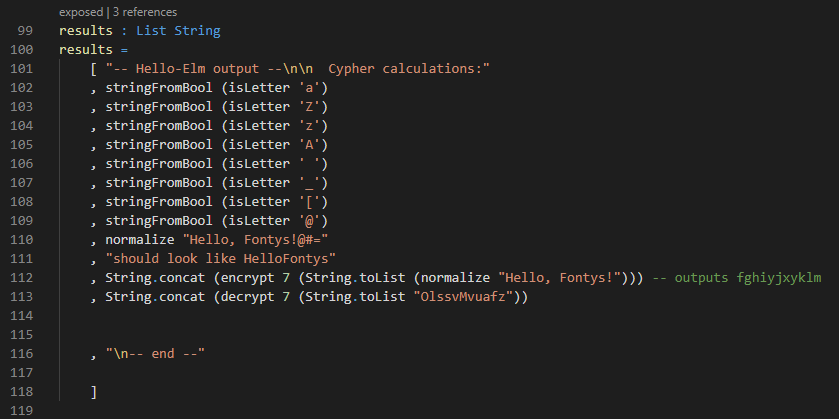
For this, I have decided to use the case distinction in the slide to implement the recursive loops that go char by char through the string. It was a bit hard to understand the implementation of recursion in elm but the slides and internet code snippets helped a lot.

1. Over/under flow in char set.

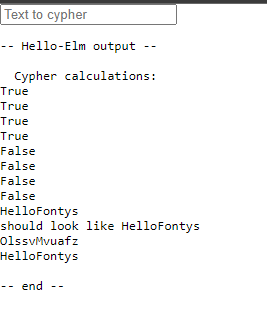
The problem was as described in the introductory paragraph that when applying the offset, the letters could go above/ bellow in the ascii table codes.



That being said, the fix was simple: check if the initial output is withing the charset – if not apply a 26 adjustment up or down to simulate looping over the charset. The number 26 represents the numbers of letters each set has: 26 lowercase and 26 uppercase, as can be seen in the ASCII table.



*Test Cases*



*Output*

Above can be seen the test cases I have written for some edge cases, and the output. I am testing for the boundaries of the isLetter function, see if the normalize function actually handles the string well and also test if the deciphered text brings me back to the input.

# Week 2: Pythagoras Problem

For this week, we had to implement two functions, one that gets a list of tuples and returns a list of tuples of Pythagorean numbers and another one that gets a list of tuples with numbers and remove the tuples that are not Pythagorean numbers. For those two functions we needed to implement once with List.map and List.filter and once with recursion.

O imagine care conține text

Descriere generată automat

List.map and List.filter implementation

For this implementation I made use of the functions created last week.

O imagine care conține text

Descriere generată automat

For the recursion implementation I still made use of some of the old functions created last week.

O imagine care conține text

Descriere generată automat

For the first function my idea was to take one tuple, generate the Pythagorean numbers and append the rest of the list calling the recursive function on it.

For the second function I had to check if the tuple is a Pythagorean tuple and based on that I will append to it the rest of the list calling the recursive function on it. Else If the tuple is not correct just call the function on the rest of the list.

Test cases:

O imagine care conține text

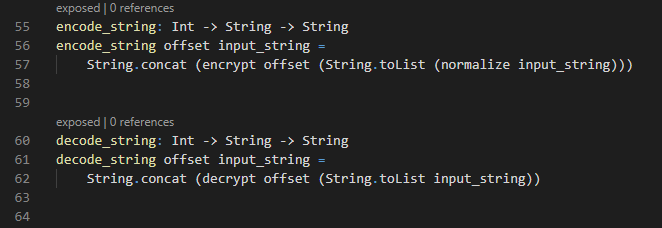
Descriere generată automat

# Week 3: Caesar’s Cypher

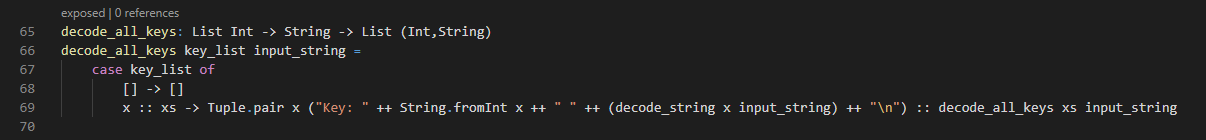
This week’s assignment was to implement a function that can brute force the cypher and look for specific popular words from the English language in the brute force output and return the ones that find matches. This way, you can find the key used for encoding, given your wordlist is good enough to find matches in the original text.

Restrictions: Don’t use list & string functions other than foldr.

First of all, it was important to be able to easily encode and decode a string, so I simplified the week2 functions into

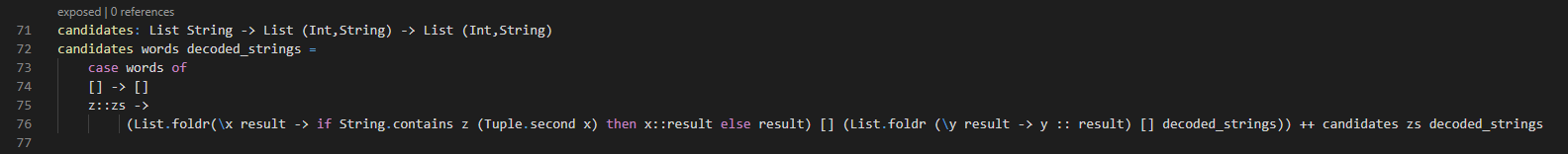


Then, it was mandatory that we could generate all of the possible decodings from an input string. In order to do that, I used recursion to go over a list of numbers (from 1-25 in this case, but it can also be adjusted as needed).



This function returns a list of tuples of structure (encode\_key, cypher)

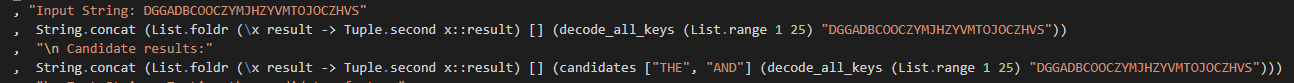
And finally, the candidates function, that takes in as parameters a word list that contains the target key words we should look for in the cyphers, and the 2nd argument the output of the previous function (decode\_all\_keys)



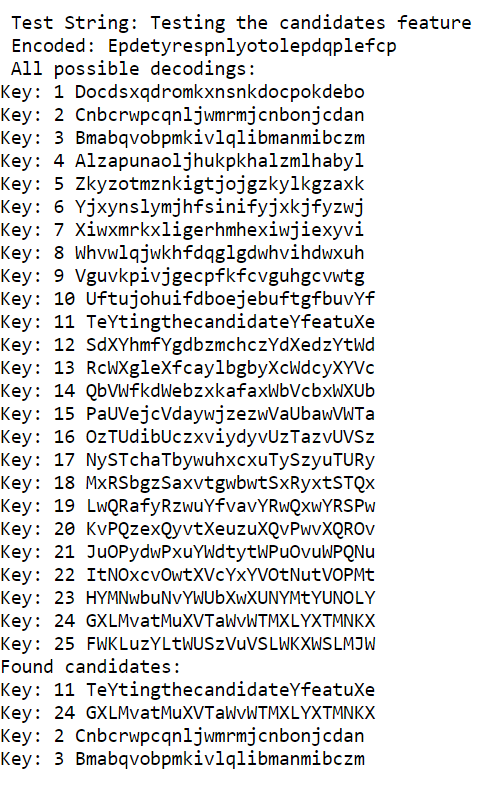
*Example values from exercise*

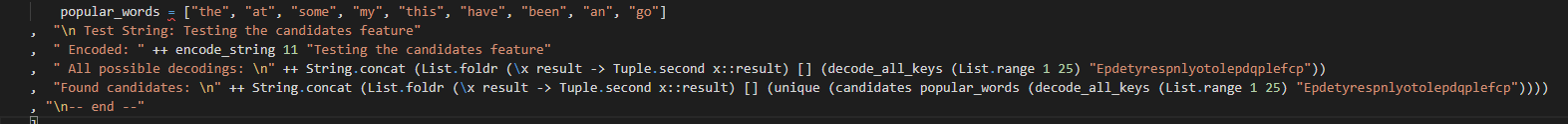


*Code:*



*Another set of test values*



*Code:*

And as we can see, it works! It returns suggestions based on the key words found, and even suggested the right key, 11, that contains the original message.

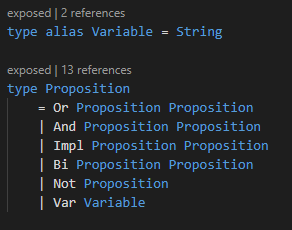
# Week 4: Propositions

Goals: Translate written logic propositions into human readable ones and then using the “switcheroo” rules, replace the => and ⬄ operations with basic ones.

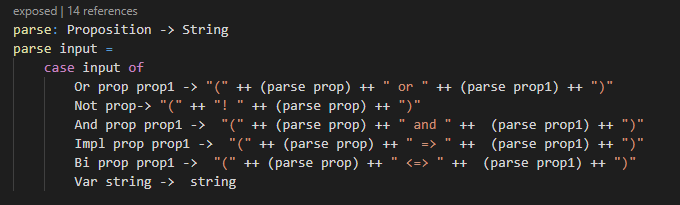
Steps required:

1. Figure out how to use the Proposition type supplied
2. Filter the subfunction payloads from the type somehow
3. Recursively call the end function and create the goal string
4. Apply same principles, this time using the switcheroo rules

First step was relatively easy to understand and use, we define a proposition type that support all the basic logic operations and declare variables as strings

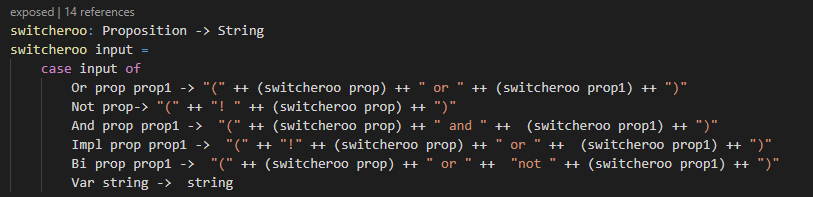


Then, for the second step, I had to figure out how to filter the propositions types at the time they were assigned, so I figured out that the case function should be used here as well. This being said, as the type was declared, all subtypes of propositions take in at least one parameter, that has to recursively be parsed as well because that might be a proposition as well – the only exit point of this recursion being when we don’t have proposition elements anymore, so we have reached a variable in other words.



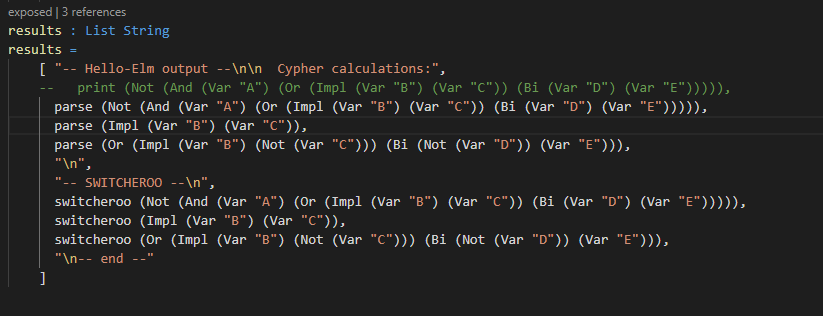
This is already enough to parse the propositions in a human readable way, the rules being defined by us individually for each operation, as can be seen in the previous picture.

Because of that, implementing the “switcheroo” is just a matter of replacing the rules for => and ⬄ with the according replacement rules from logic theory.

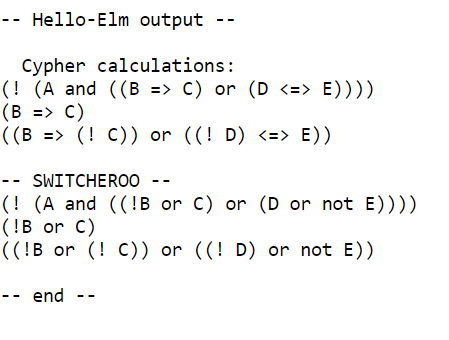


Result:

*Input*



*Output*



# Week 4: Merge Sort

Goal: Implement merge sort

Steps:

1. Function that merges two lists based on elements of each list after ordering them by value
2. Function that splits the list into two lists
3. Function that splits recursively based on left and right of the list
4. Function msort that calls all the other functions and does the merge sort

Step 1:

Text

Description automatically generated

This is a function where we take two lists and merge them into a new list. The merge is done based on the which value from the lists is higher given an already sorted two lists as arguments.

Step 2 and 3:

Text

Description automatically generated

Split takes a list as parameter and returns a tuple of two lists.

On the other hand, split2 takes a list and a Boolean value and two empty lists. Based on the Boolean value split2 knows that it needs to split either the first half of the list sent to the function or the other one. In the end split 2 returns two lists that are made by splitting the initial list.

Step 4:

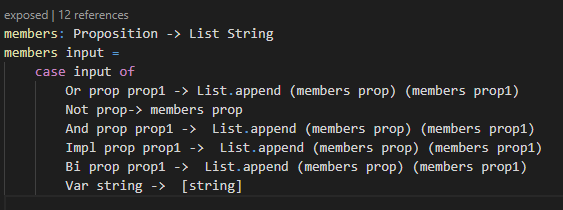
A screenshot of a computer

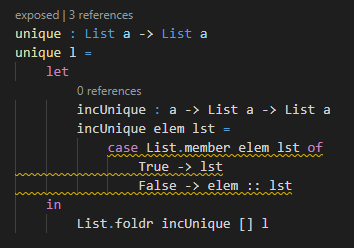
Description automatically generated with medium confidence

Msort is the function that combines all the other function in doing the merge sort from beginning to end. Recursively it calls the split function for splitting the list and then the merge function on the msort of each of the split lists. In the end merging the sorted two lists together in a ordered list.

# Week 5: Propositions

Goal: Write *members* function that shows all unique variable propositions within the input and *demorgan* function that replaces *“all ¬(P Ú Q) and ¬(P Ù Q) into (¬P Ù ¬Q) resp. (¬P Ú ¬Q) according the De Morgan rules (where P and Q are arbitrary propositions)”.*

Members: 

Pretty self explanatory implementation that looks a lot like the one from last week, this function just adds in an output list all the variables it finds. Then, we call the *unique* function on the result to make sure that only unique variables are left in the array.

For demorgan, the same principles apply, we parse the proposition and then handle the edge cases.

If we find a not case that matches the pattern that we are looking for (so a not followed by and/or) we call the demorgan function that applies the De Morgan Laws.

