COL703: Logic for Computer Science
Assignment3

Submission Deadline: Sat 02 Jan 2021, 23:59
Submission Deadline with Late Penalty: Thu 07 Jan 2021, 23:59

Aim : The aim of the assignment is to construct an Analytic Tableau for any given First Order formula.

Problem Statement : In this assignment, you have to write a program which given list of formulae Φ and a formula ψ and constructs Analytic Tableau to check if ψ is a logical consequence of Φ. You have to construct the First Order Tableau using unification.

The formula is given by following datatype:

```
(* Term variable or k-ary function of terms.
A constant can be represented as zero-ary function *)
type term = V of string | F of string * (term list)

(* Formula is k-ary predicate symbol of terms or quantified
   conjunction or disjunction of formulae *)
type form = PRED of string * (term list)
          | NOT of form
          | AND of form * form
          | OR of form * form
          | FORALL of term * form (* This term should be a
              variable only*)
          | EXISTS of term * form (* This term should be a
              variable only*)

(* not well-formed formula. Returns the list terms that are
   not well-formed in the list of formulae *)
exception Not_wff of (term list * form list)

(* not closed formula. Returns the list of formulae that are
   not closed *)
exception Not_closed of formula list
```

You need to create following functions:

1. `wff: form -> bool` returns true the input formula is well-formed, false otherwise. A formula is well-formed if the terms are all well-formed and satisfy the arity constraints.
2. `fv: form -> term list` returns the list of free variables in the input formula. The term list consists of variables only.
3. `closed: form -> bool` returns true if a formula is closed, false otherwise.

4. `create_tableau: form list -> form -> unit` The function takes a list of formulae Φ (first argument) and a formula ψ (second argument) and checks if ψ is a logical consequence of Φ by generating tableau. This function should raise appropriate exceptions and output a dot file named 'tableau.dot' that represents a valid analytic tableau.

Logistics/Instructions :

1. The assignment has to be done individually.
2. The assignment has to be done in Ocaml only.
3. Your program should implement the attached interface.
4. Since the assignment is open ended, we will schedule demos for it. In the demo you are expected to run your code on some test cases provided by us and answer the questions related to what you have done in this assignment.
5. We will employ various plagiarism checks so until and unless you are sure that you are smarter than us, don't cheat.
6. If you any doubts regarding the assignment, please post it on the teams channel of the course. We will **not** be entertaining doubts over mail or any other medium except teams.

Submission : You will be submitting a single file $entryNumber\_A3.ml$. So if your entry number is 2016CS50391, the submitted file should be $2016CS50391\_A3.ml$.