CS2040: POPL: Homework #3

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Logic Programming

PLP

CYU:

2) Axioms are written in a standard form known as:
Horn clause. A Horn clause consists of a head or consequent term H, and a body consisting of terms Bi :

$H \leftarrow B1, B2, \ldots, Bn$

The Head is evaluated to true only if all the term in the body are true.

5) **Clause:** Building blocks of database that include rules, facts, queries, structures, constant among other things.

Terms: may be constants, variables, or structures whose composition forms a clause.
A constant is either an atom or a number. A structure can be thought of as either a logical predicate or a data structure.

Structures: consist of an atom called the functor and a list of arguments.

Facts: Horn clause without a right-hand side.

Rules: A clause with a right-hand side, separated by an indication symbol, :-

Queries: User instantiated execution clauses, a clause with an empty left-hand side. Queries do not appear in Prolog programs.

8)
Two main search strategies of Prolog

a) Start with existing clauses and work forward, attempting to derive the goal.

This strategy is known as forward chaining.

b) Start with the goal and work backward, attempting to "unresolve" it into a set of preexisting clauses. This strategy is known as backward chaining.

The process of returning to previous goals is known as backtracking. It strongly resembles the control flow of generators in Icon.
Association of a variable with a current value is called instantiation of variable.

9)

Cut (!) can be used whenever we want the effect of if... then... else.

A cut makes the interpreter to stop at whatever choices have been made since unifying the parent goal with the left-hand side of the current rule, including the choice of that unification itself.

\+ is actually implemented as a combination of cut and two other built-in predicates, call and fail.

13)

Horn clauses do not capture all of first-order predicate calculus. In particular, they cannot be used to express statements whose clausal form includes a disjunction with more than one non-negated term.

Exercises:

11.6)
The following would fix the problem:

```
classmates (A, B) :- takes (A, C), takes (B, C), not(A == B).
```

11.3)
No. The statements in 2nd and 3rd rule are of form C is expression. Since C is predetermined we cannot assign it to A-B or A+B.

PLCC: Ch #11:

11.2)

a), b) and c)

```
append_list([], Q, Q).
append_list([H|P], Q, [H|R]) :-
append_list(P, Q, R).

third_element(L) :-
append_list([_,_], [X|_], L),
write(X).

reverse_list([],[]).
reverse_list([H|T],L) :-
   reverse_list(T,L1),
   append_list(L1,[H],L).

print_premier([X|Y]) :-
write(X).

last_element(L) :-
reverse_list(L, M),
print_premier(M).

print_list([X|L1]) :-
write(X), nl,
print_list(L1).

except_last(L) :-
append_list(L1, [_], L),
print_list(L1).
```

11.3)
a)

```
fact (0,1).
fact (N,F) :-
        N>0,
        A is N-1,
        fact(A, F1),
        F is N*F1.
```

b)

```
fact (0, X, X).
fact (N, X, Y) :-
        N>0,
        A1 is N*X,
        A2 is N-1,
        fact (A2, C1, Y).
```

Scripting Languages:-
PLP: Ch #13:

CYU:

7.
Filename expansion *can* match dotfiles, but only if the pattern explicitly includes the dot as a literal character.

Wildcard is a character that can be used as a substitute for any of a class of characters in a search, thereby greatly increasing the flexibility and efficiency of searches.

Globbing recognizes and expands wild cards. Globbing interprets the standard wild card characters-- * and ?, character lists in square brackets, and certain other special characters (such as ^ for negating the sense of a match). There are important limitations on wild card characters in globbing, however. Strings containing * will not match filenames that start with a dot. Likewise, the ? has a different meaning in globbing than as part of an Regular Expression.

Globbing is the operation that expands a wildcard pattern into the list of pathnames matching the pattern.

8.
A pipe is a Unix features which allows the chaining of commands together, a pipeline is a set of processes chained by their standard streams combining the output of one with the input of another.

Redirection allows output to be directed to a file, or input be read from a file.

9.
The three standard I/O streams to every Unix process are :

i) standard input (stdin),
ii) standard output (stdout),
iii) standard error (stderr).

14.
The fields of the current input line are available in the pseudo variables $1, $2... The built-in variable NR gives the total number of fields.

Awk is frequently used for field-based one-line programs.

Associative arrays combine the functionality of hash tables with the syntax of arrays.
We can capitalize a title in awk illustrate both fields and associative arrays with an example script that capitalizes each line of its input as if it were a title.

42.
Greedy matching consumes as much of the matching as possible, whereas minimal matching consumes the least.

50.
A tuple is an immutable list. They are more efficient to access than arrays, and their immutability eliminates the need to for most bounds and resizing checks.

Python sets are like dictionaries that don’t map to anything, but simply serve to indicate whether elements are present or not. They support union, intersection, and difference.

53.
To create a multi-dimensional array, one can define arrays of references to hashes, hashes of references to arrays, and so on.
Alternatively, one can create a flattened implementation by using composite objects as keys in a hash.
The use of tuples works well but does not provide the efficiency of multidimensional arrays.