INVESTMENTS IN EDUCATION DEVELOPMENT

1   Box model

Exercise 1.1: Let's have the following program and queries. Demonstrate the processing of the queries using the box model representation.

```
member(X,[X|_]).
member(X,[_|T]) :- member(X,T).

?- member(a,[b]).
?- member(a,[b,a]).
?- member(a,[a,b]), fail.
```

2   Metainterpreters, backward and forward chaining

Exercise 2.1: Write a metainterpreter for backward chaining

- for Prolog clauses with conjunction and disjunction

- for rules in a form rule(LefthandSide, RighthandSide) where LefthandSide is a list of Prolog predicates (a comma means conjunction) and RighthandSide is a predicate.

Exercise 2.2: Write a forward chaining interpreter for rules in a form rule(LHS, RHS).

Exercise 2.3: Rewrite the Prolog rules below into the form for the forward chaining interpreter and simulate its behaviour for these two facts: `d.  e.`

```
a :- d, e, b.
b :- c, e.
b :- a, c.
c :- d.
```

3   SAT: Davis Putnam (DP), DPLL

Exercise 3.1: Is the following set of clauses satisfiable? (Use DP algorithm to find the solution).

$$S = \{\{P,Q,R\}, \{P,\neg Q,\neg R\}, \{P,\neg W\}, \{\neg Q,\neg R,\neg W\}, \{\neg P,\neg Q,R\},$$
$$\{U,X\}, \{U,\neg X\}, \{Q,\neg U\}, \{\neg R,\neg U\}\}$$

Exercise 3.2:   Is the following set of clauses satisfiable? (Use DPLL algorithm to find the solution).

$$S = \{\{P, \neg Q, \neg R\}, \{R, \neg Q\}, \{\neg P, \neg Q\}, \{P, \neg R\}, \{P, R\}, \{R\}, \{Q, \neg P, Q\}\}$$