CSE352 AI

HOMEWORK 1

Homework has 3 PARTS and 6 Problems

SOLVE as many problems as possible.
I will post Solutions so you could compare your solutions with mine.
HMKs PROBLEMS will appear on your TEST

SUBMIT **ONLY ONE PROBLEM** from each PART.

You must **TYPE the statement of each problem** you are solving and must **TYPE** your solutions, otherwise problem will not be considered for correction.

Submit HMK as a TEAM by e-mail to TA
You must include TEAM Number and Names and IDs of all team members on a FRONT page.

PART ONE

1. CONCEPTUALIZATION DEFINITION (NILSON)

- **Conceptualization** – step one of formalization of knowledge in declarative form.
- **C** = (**U**, **F**, **R**)
- **U** – Universe of discourse; it is a FINITE set of objects.
- **F** – Functional Basis Set; Set of functions (defined on **U**). Functions may be partial.
- **R** – Relational Basis Set; Set of relations defined on **U**.
- Remark: sets **R**, **F** are FINITE.

PROBLEM 1

Conceptualize the following situation using the above definition.

In a room there are 3 girls, 4 boys, and 2 cars – one red and one blue. **The following properties must be true.**

1. *Each girl likes exactly one boy.*

2. *Some boys like some girls.*
3*. Everybody (boys and girls) like some car.*
4*. Three boys like a red car.*
5. *Two girls like a blue car.*
Use the following notation

U – Universe of discourse is the set

U ={ o1, o2, o3, o4, o5, o6, o7, o8, o9 }

R – Relational Basis Set; Set of relations

R = { GIRL, BOY, CAR, REDCAR, BLUECAR, LIKE}

USE **INTENDED Interpretation, i.e.**

Relation **GIRL** is defined by a property x is a girl
Relation **BOY** is defined by a property x is a boy

Relation **CAR** is defined by a property x is a car

Relation **CAR** is defined by a property x is a car

Relation **REDCAR** is defined by a property x is a red car

Relation **BLUECAR** is defined by a property x is a blue car

Relation **LIKE** is defined by a property x likes y

Remark that the relations **GIRL, BOY, CAR, REDCAR, BLUECAR** are one argument relations and the relation

LIKE is a two argument relation and all of them are defined on the Universe **U**

PART TWO

PREDICATE LOGIC CONCEPTUALIZATION

1. Translations from Natural Language

PROBLEM 2

P1. Translate into plain English predicate logic examples from our MAIN **BOOK, page 23**
P2. Write a FULL solution following the Predicate Logic (1) Lecture Notes, with explanation and justification of correctness for the examples on the main **book page 24**, i.e. follow the steps:

1. **Identify** the domain: always a set $X \neq \varphi$
2. **Identify** predicates (simple: atomic)
3. **Identify** functions (if needed)
4. **Identify** the connectives
5. **Identify** the quantifiers $\forall x$, $\exists x$ or Restricted Quantifiers $\forall P(x)$, $\exists Q(x)$
6. **Write** a formula using symbols from **2,3, 4, 5**
   Use restricted domain quantifier translation rules, where needed
7. **Write LOGIC formula** – without Restricted Quantifiers

P3. This Problem is about different Knowledge representations

FOLLOW PROBLEM 2 steps to write detailed solution to part b) of **problems 2 , 3** from our MAIN BOOK, **page 39.** Follow the Book or Busse Notes to write solution of part a)

PREDICATE LOGIC CONCEPTUALIZATION

2. Translations from Mathematics Language

PROBLEM 3

Here is a mathematical statement **S**:

For all natural numbers n the following implication holds:

IF n < 0, then there is a natural number m, such that

m+n <0

1. Re-write S as a "formula" **MF** that only uses mathematical and logical symbols
2. Translate your **MF** to a correct **logic formula LF**
3. Argue whether the statement **S** it true of false

PART THREE

RULE BASED SYSTEMS

PROBLEM 4

P1. CONCEPTUALIZE problem 5 from our MAIN BOOK, page 39 in **Propositional Logic** and solve it using Conflict Resolution.

P2. CONCEPTUALIZE problem 5 from our BOOK, page 39 in **Predicate Logic convention** using predicates
attribute(x, value of attribute),
attribute(object, value of attribute)

WRITE a format of a database TABLE needed for solution of **P2**

PROBLEM 5

CONCEPTUALIZE the EXAMPLE (Rules R1- R4) on page 47 of the BOOK in **Propositional Logic.**

EXPLAIN the role of Questions posed to the system (in your conceptualization) and use backward chaining to solve the problem depending on the answers given to the system.

PROBLEM 6

P1. Write detailed solution to problems 2 from BUSSE BOOK

P2. Write detailed solution to problems 4 from BUSSE BOOK