Heaven's Light is Our Guide

Computer Science & Engineering
Rajshahi University of Engineering & Technology

Lab Manual

Module- 01

Course Title: Sessional based on CSE 2101

Course No. : CSE 2102

Experiment No. 1

Name of the Experiment: The Foundations: Logic and Proof

Duration: 2 Cycle

Experiments/Problems:

[1] Generate Truth Table for the propositional value of p and q find the negation of p and q, conjunction ($p \wedge q$), disjunction ($p \vee q$), Exclusive OR($p \oplus q$), Conditional Statement ($p \rightarrow q$), Bi-conditional ($p \leftrightarrow q$) Statement.

[2] Generate Truth Table for Compound Proposition(Note: first try only for three propositional variable, and then you can try more than 3 propositional variable)

[3] Given two bit strings of length n, find the bitwise AND, bitwise OR and bitwise XOR of these strings.

[4] Given the Propositional Value for p, q and r, now check two given compound proposition are equivalent or not (i.e. $\neg(p \wedge q) \wedge r$ and $\neg p \vee \neg \wedge r$ are logical equivalent or not.

[5] Consider a C/C++/JAVA program given facts telling it the instructor of each class and in which classes students are enrolled. The program uses these facts to answer queries concerning the professors who teach particular students. Such a program could use the predicates instructor (p,c) and enrolled(s,c) to represent that professor p is the instructor of course c and that student s is enrolled in course c, respectively . For example, the facts in such a program might include:

```
instructor(chan,math273)
instructor(patel,ee222)
instructor(grossman,cs301)
enrolled(kevin,math273)
enrolled(juana,ee222)
enrolled(juana,cs301)
enrolled(kiko,math273)
enrolled(kiko,cs301)
```

** Learning Fact will be end by a word “END”

A new predicate teaches (p,s), representing that professor p teaches student s, can be defined using the Programming rule

```
teaches(P,S) :- instructor(P,C), enrolled(S,C)
```

Which means that teaches (p,s) is true if there exists a class c such that professor p is the instructor of class c and student s is enrolled in class c.(Note that a comma is used to represent a conjunction of predicates in Program. Similarly, a semi colon is used to represent a disjunction of predicates.)

Program answers queries using the facts and rules it is given. For example, using the facts and rules listed, the query

```
?enrolled(kevin,math273)
```

produces the response

```
yes
```

Because the fact enrolled (kevin,math273) was provided as input. The query

```
?enrolled(X,math273)
```

produces the response

```
kevin
kiko
```

To produce this response, Proram determines all possible values of X for which enrolled(X,math273) has been included as a Program fact. Similarly, to find all

the professors who are instructors in classes being taken by Juana, we use the query

```
?teaches(X,juana)
```

This query returns

```
patel
grossman
```

[6] Given two set A and B, a proposition p(x,y) where x ε A and y ε B, Find the propositional value of $\forall_x \forall_y p(x,y)$, $\forall_x \exists_y p(x,y)$, $\exists_x \forall_y p(x,y)$ and $\exists_x \exists_y p(x,y)$.

[7] Given Position integers m and n, interactively play the game of Chomp.

[8] Find the pair of (x,y) where $x^2+y^2=z^2$, z is given, x, y and z are integers. [Note: could you check $x^3+y^3=z^3$, have a solution where x, y and z are integers?]

[9] The 3x+1 Conjecture: Let T be the transformation that sends an even integer x to x/2 and an odd integer x to 3x + 1. A famous conjecture, sometimes known as the 3x + 1 conjecture, states that for all positive integers x, when we repeatedly apply the transformation T, we will eventually reach the integer 1. For example, starting with x = 13, we find T(13)=3 · 13 + 1 = 40, T(40) = 40/2 = 20, T(20) = 20/2 = 10, T(10) = 10/2 = 5, T(5) = 3 · 5 + 1 = 16, T(16) = 8, T(8) = 4, T(4) = 2,and T(2) = 1.

Explain:

[1] For Example

p	**q**	**p∧q**
T	T	T
T	F	F
F	T	F
F	F	F

[2] For Example

Pre-defined↓			**User input↓**
P	**q**	**r**	**⌐(p∧q)∧r**
T	T	T	F
T	T	F	F
T	F	T	T
T	F	F	F
F	T	T	T
F	T	F	F
F	F	T	T
F	F	F	F

[3] For Example

A = (0111) and B = (1000),
then R = A (bitwise AND) B

```
          0 1 1 1
          1 0 0 0
----------------------
(AND)     0 0 0 0
```

[4] For Example

Pre-defined↓			**User input↓**	**User input↓**
P	**q**	**r**	**⌐(p∧q)∧r**	**^p∨⌐q∧r**
T	T	T	F	F
T	T	F	F	F
T	F	T	T	T
T	F	F	F	F
F	T	T	T	T
F	T	F	F	F
F	F	T	T	T
F	F	F	F	F
Given Proposition are Equivalent				

[5] Not necessary (In AI Class, it will be done using Prolog Program)

[6] Given two set A = {1, 2, 3} and B = {1, 4, 9| and a proposition p(x,y) is $x^2=y$

$\forall_x \forall_y p(x,y)$ ➔ F

$\forall_x \exists_y p(x,y)$ ➔ T

$\exists_x \forall_y p(x,y)$ ➔ F

$\exists_x \exists_y p(x,y)$ ➔ T

[7] See the Book.

[8] Given z = 5, then $x^2+y^2=z^2$ =25, one solution is (3, 4) or (4, 3), Remember x≥ z and y ≥z.

[9] It already has been verified for all integers x up to $5.6x10^{13}$ [Ref. 1]. Your work is to verify this conjecture for large positive integers x.

Report:

Your completed work must submit through a LAB REPORT.

Reference:

[1] Kenneth H. Rosen, "Discrete Mathematics and its Application" , 7th Edition: Chapter 1 (The Foundation: Logic and Proof).