CISC 2100/2110 — Discrete Structure II
Fall, 2015

Homework Assignment #1

1 Problems from book (5 points for each question):

(a) Assume x is a particular real number and use De Morgan's laws to write negations for the two mathematical statements:

$$-10 < x < 2$$

$$x \leq -1 \textbf{ or } x > 1$$

(b) Use truth tables to establish which of the statement forms are tuatologies and which are contradictions.

$$(p \wedge q) \vee (\sim p \vee (p \wedge \sim q))$$

$$(p \wedge \sim q) \wedge (\sim p \vee q)$$

(c) Use Theorem 2.1.1 to verify the logical equivalence in the following:

$$\sim (p \vee \sim q) \vee (\sim p \wedge \sim q) \equiv \sim p$$

(d) Use truth tables to determine whether the argument form below is valid. Indicate in your truth table which columns represent the premises and which represent the conclusion, and include a sentence explaining how the truth table supports your answer.

$$\begin{aligned} p \\ p \to q \\ \sim q \vee r \\ \therefore r \end{aligned}$$

(e) Given the following information about a computer program, find the mistakes in the program.

i. There is an undeclared variable or there is a syntax error in the first five lines.

ii. there is a syntax error in the first five lines, then there is a missing semicolon or a variable name is misspelled.

iii. There is not a missing semicolon.

iv. There is not a misspelled variable name.

(f) A set of premises and a conclusion are given below. Use the valid argument forms listed in Table 2.3.1 to deduce the conclusion from the premises, giving a reason for each step. Assume all variables are statement variables.

i. $\sim p \vee q \rightarrow r$
ii. $s \vee \sim q$
iii. $\sim t$
iv. $p \rightarrow t$
v. $\sim p \wedge r \rightarrow \sim s$
vi. $\therefore \sim q$

2 (10pts) Given the following pseudocode for testing leap year, write a logic expression (compound statement) to test leap year; and write a logic expression to test non-leap year.

```
if (y is not divisible by 4)
     then y is not a leap year
else if (y is not divisible by 100)
      then y is a leap year
else if (y is not divisible by 400)
     then y is not a leap year
else
      y is a leap year
```

Note that you can write a C/C++ code as follows:

```
bool IsLeap = ...
bool NotLeap = ...
```

Or you can using the statement variables, and logic connectives as learnt in class:

```
Let p stands for y is not divisible by 4, q stands for ...

Then "y is leap year" = ...
```

3 (10 pts) You are asked to write a funcion to test whether a given date is valid or not, and you should also include some comments which show your reasoning to convince yourself that you have cover all possible inputs correctly. Note, you can assume a function has been provided to you for testing leap year.

```
/* Test valid date
 @param year: The three parameters are int value used to specify year, month and day part of the
 @param month: input date
 @param day:
 @return: true if the date is valid
  i.e., year is any integer (can be negative value)
        month is between 1 and 12
        day is between 1 and 30 if the month is  4, 6, 9, 11
       between 1 and 31 if the month is 1, 3, 5, 7, 8, 10, 12
       between 1 and 29 if it's a leap year and month is 2
       between 1 and 28 if it's month 2 and non-leap year
*/
bool IsValidDate (int year, int month, int day)
{

}
```