

**Problem 1:** Determine if the below conditional statements are True or False.

- (a) If  $2 + 7 = 6$ , then crocodiles can fly.
- (b) If  $5 + 5 = 10$ , then dogs can talk like humans.
- (c) If  $-3$  is a negative number, then birds can fly.
- (d) If  $1 + 1 = 2$ , then  $5 + 7 = 12$ .

**Problem 2:** Let us assume that  $p$  and  $q$  are two propositions. Using  $p$  and  $q$  you are asked to form a number of compound proposition as shown in Table 2. Fill up the Truth Table for all the propositions.

$p$	$q$	$\neg(\neg p \wedge q)$	$(p \vee q) \leftrightarrow \neg(\neg p \wedge q)$	$\neg(p \wedge \neg q)$	$(p \rightarrow q) \leftrightarrow \neg(p \wedge \neg q)$
$T$	$T$				
$T$	$F$				
$F$	$T$				
$F$	$F$				

Table 1: Problem 2

**Problem 3:** Translate the bellow English sentences into propositional logics, making the propositional variables as clear as possible.

- (a) Neither the thunderstorm nor the heavy rain did any damage to the house.
- (b) If global warming is not controlled, low-lying land will go under water within the next few decades.
- (c) Uber/Pathao driver should not drive more than 60 miles per hour nor violate traffic signals, or they will be penalized.

**Problem 4:** Show if the compound proposition  $(p \vee q) \wedge (\neg p \vee r) \rightarrow (q \vee r)$  is a tautology or a contradiction.

**Problem 5:** Suppose that you are doing a part-time job at the library at NSU. Students visited the library often leave books on tables. Librarians asked you to check the condition of all the books, and the below statements are made available for you. Use Predicate, Quantifiers, and Logical Operators to represent the statements made by the librarians:

- (a) Some books are not at the right place.
- (b) All books are at the right place and are in excellent condition.
- (c) Everybook is in the right place and is in excellent condition.
- (d) Nothing in the library is at the right place and is in excellent condition.
- (e) One of the books is not in the right place, but it is in excellent condition.

**Problem 6:** Write a compound proposition involving the propositional variables  $p$ ,  $q$  and  $r$  that is true when  $p$  or  $q$  are true and  $r$  is false; the proposition is false otherwise.