1.Construct a truth table for each of these compound propositions.

a) p → (¬q ∨ r)

b) ¬p → (q → r)

c) p ⊕ (p ∨ q)

d) (p → q) ∧ (¬p → r)

e) (p ↔ q) ∨ (¬q ↔ r)

f ) (¬p ↔ ¬q) ↔ (q ↔ r)

2. Construct a truth table for ((p → q) → r) → s

3. Construct a truth table for (p ↔ q) ↔ (r ↔ s)

4.Let p and q be the propositions

p : It is below freezing.

q : It is snowing.

Write these propositions using p and q and logical connectives (including negations).

1. It is below freezing and snowing.

P ^ q

1. It is below freezing but not snowing.

P ^ ~q

1. It is not below freezing and it is not snowing.

~p ^ ~q

1. It is either snowing or below freezing (or both).

P v q

1. If it is below freezing, it is also snowing.

P → q

f ) Either it is below freezing or it is snowing, but it is

not snowing if it is below freezing.

(P v q) ^ (p → ~q)

g) That it is below freezing is necessary and sufficient

for it to be snowing.

p↔q

5. Let p, q, and r be the propositions

p : You have the flu.

q : You miss the final examination.

r : You pass the course.

Express each of these propositions as an English sentence.

1. p → q

if you have flu you miss the final examinations

1. ¬q ↔ r

You pass the course if and only if You will not miss the final examination.

1. q → ¬r

if you will miss the final examination then you will not pass the course.

1. p ∨ q ∨ r

you have the flu or you miss the final examination or you pass the course.

1. (p → ¬r) ∨ (q → ¬r)

Either If you have the flu then you will not pass the course or if you miss the final examination then you will not pass the course.

f ) (p ∧ q) ∨ (¬q ∧ r)

either if you have the flu and you miss the final examination or if you do not miss the final examination and you pass the course.

6. Let p and q be the propositions

p : You drive over 65 miles per hour.

q : You get a speeding ticket.

Write these propositions using p and q and logical connectives (including negations).

1. You do not drive over 65 miles per hour.

~p

b) You drive over 65 miles per hour, but you do not get

a speeding ticket.

P ^ ~q

c) You will get a speeding ticket if you drive over

65 miles per hour.

P → q (consequence and antecedent)

d) If you do not drive over 65 miles per hour, then you

will not get a speeding ticket.

~p → ~q

e) Driving over 65 miles per hour is sufficient for getting

a speeding ticket.

P → q

f ) You get a speeding ticket, but you do not drive over

65 miles per hour.

q ^ ~ p

g) Whenever you get a speeding ticket, you are driving

over 65 miles per hour.

Q → p (whenever means if)

(But means and)

7. Let p and q be the propositions “The election is decided”

and “The votes have been counted,” respectively. Express

each of these compound propositions as an English sentence.

a) ¬p b) p ∨ q

c) ¬p ∧ q d) q → p

e) ¬q → ¬p f ) ¬p → ¬q

g) p ↔ q h) ¬q ∨ (¬p ∧ q)

8. Let p and q be the propositions p : I bought a lottery ticket this week. q : I won the million dollar jackpot. Express each of these propositions as an English sentence.

a) ¬p b) p ∨ q c) p → q d) p ∧ q e) p ↔ q f ) ¬p → ¬q g) ¬p ∧ ¬q h) ¬p ∨ (p ∧ q)

h)I did not buy a lottery ticket this week and I bought a lottery ticket this week or I did not win the million dollar jackspot.

9. Let p and q be the propositions “Swimming at the New Jersey shore is allowed” and “Sharks have been spotted near the shore,” respectively. Express each of these compound propositions as an English sentence.

a) ¬q b) p ∧ q c) ¬p ∨ q d) p → ¬q e) ¬q → p f ) ¬p → ¬q g) p ↔ ¬q h) ¬p ∧ (p ∨ ¬q)

g) Swimming at the New Jersey shore is allowed if and only if sharks have not been spotted near the shore

h) Swimming at the New Jersey shore is not allowed, and either swimming at the New Jersey shore is allowed or sharks have not been spotted near the shore.

10. State the converse, contrapositive, and inverse of each of these conditional statements.

a) If it snows tonight, then I will stay at home. b) I go to the beach whenever it is a sunny summer day. c) When I stay up late, it is necessary that I sleep until noon.