Assignment 01

Date

NAME : AHSAN SAJJAD
ENR NO : 02-131212-049
PROGRAM : BSE
SECTION : 2B
COURSE : DISCRETE STRUCTURE

Ex # 1.1

Q # 01

Q Which of the following sentences are proposition? What are the truth values of those are propositions?

Sentences	Proposition	Truth Value.
a) Boston is the capital of Massachusettes	T	T
b) Miami is the capital of Florida.	T	F
c) $2 + 3 = 5$	T	T
d) $5 + 7 = 10$	T	F
e) $x + 2 = 11$	F	-
f) Answer the question.	F	-

Q # 03

Q What is the negation of each of these proposition?

a) Mei has an MP3 player

A Mei has not an MP3 player.

b) There is no pollution in new Jessey.

A There is pollution in new Jessey.

c) $2 + 1 = 3$

A $2 + 1 \neq 3$

d) The Summer in Maine is hot and Sunny.
A It is not the case that the Summer in Maine is hot Sunny.

Q # 9

Let
- ☆ P = Swimming at the new Jersy Shore is allowed.
- ☆ q = Sharks have been spotted near the Shore.

a) $\neg q$
Sharks have not been spotted near the Shore.

b) $P \wedge q$
Swimmy at the new Jersy Shore is allowed and Sharks have ben spotted near the Shore.

c) $\neg P \vee q$
Swimming at the new Jersy Shove is not allowed, or Shark have been Spotted near the Shore.

d) $P \rightarrow \neg q$
If Swimming at the new Jersy Shore is allowed, then Shark have not been. Spotted near the Shore.

e) $\neg q \rightarrow P$
If Shark have not been spotted near the Shore, then Swimming at the new Jersy Shore is allowed.

Date

f) $\neg p \rightarrow \neg q$

If swimming at the new jersy shore is not allowed, then Shark have not been spotted near the shore.

g) $p \leftrightarrow \neg q$

Swimming at the new jersy shore is allowed if and only if Shark have not been spotted near the Shore.

h) $\neg p \wedge (p \vee \neg q)$

Swimming at the new jersy shore is not allowed and either Swimming at the new jersy shore is allowed or Shark have not been spotted near the shore.

Q # 11

Q Let p and q be the proposition

+ p: It is below freezing
+ q: It is snowing.
- Write the proposition using p and q and logical connective (include negation).

a) It is below freezing and Snowing.
$p \wedge q$

b) It is below freezing but not Snowing.
$p \wedge \neg q$

c) It is not below freezing and it is not Snowing.
$\neg p \wedge \neg q$

d) It is either Snowing or below freezing (or both).
$p \vee q$

e) If it is below freezing, it is also Snowing.
$p \rightarrow q$

f) Either it is below freezing or it is snowing but it is not snowing if it is below freezing.

$(p \vee q) \wedge (p \rightarrow \neg q)$

g) That it is below freezing is necessary and sufficient for it to be snowing.

$p \leftrightarrow q$

Q # 13

Q Let p and q be the proposition
p: you drive over 65 mile per hour.
q: you get a speeding ticket.

* write these propostion using p and q and logical connective (Including negation)

a) You do not drive over 65 mile per hour.

$\neg p$

b) you drive over 65 mile per hour, but you do not get a speeding ticket.

$p \wedge \neg q$

c) you will get a speeding ticket, if you drive over 65 miles per hour.

$p \rightarrow q$

d) If you do not drive ove 65 miles per hour, then you will not get speeding ticket.

$\neg p \rightarrow \neg q$

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

$p \rightarrow q$

f) you get a speeding ticket, but you do not drive over 65 miles per hour.

$q \wedge \neg P$

g) whenever you get a speeding ticket, you are driving over 65 miles per hour.

$q \rightarrow P$

Q#15

Q15 Let p, q and r be the proposition
- p :- Grizzly bears have been seen in the area
- q :- Hiking is safe on the trial.
- r :- Berries are ripe along the trial.

* write the proposition using p, q, r and logical connectives (including negation).

Answers :-

a) $r \wedge \neg P$

b) $\neg P \wedge q \wedge r$

c) $r \rightarrow (q \leftrightarrow \neg P)$

d) $\neg q \wedge \neg P \wedge r$

e) $(q \rightarrow (\neg r \wedge \neg P)) \wedge \neg((\neg r \wedge \neg P) \rightarrow q)$

f) $(P \wedge r) \rightarrow \neg q$

Q # 17

Q17 Determine whether each of these Conditional Statement is true or false

$T \to F = F$ otherwise True.

a) If $1+1=2$, then $2+2=5$
b) If $1+1=3$, then $2+4=4$
c) If $1+1=3$, then $2+2=5$
d) If monkey can fly, then $1+1=3$

Conditional Statement
False
True
True
True

Q # 19

Q19 For each of these Sentences, determine wether an Inclusive or, an exclusive or, is Intended. Explain answers.

a) Coffee or tea comes with dimer.

Ans Exclusive OR :-

Because only one of him is req to be true i.e. only one thing is required.

b) A password must have at least three digits or be at least eight charcters long.

Ans Inclusive Or:

Because both the Situation must be true for that time

c) The prerequisites for the course is a course in number theory or a course in cryptography.

Inclusive Or:

Because the Student with both course can be eligible.

d) You can pay using US dollars or euros.
Inclusive or:
Because we can pay either in US dollar or euros or by both.

Q # 25

Q25 Write each of these propositions in the form "p if and only if q" in english
Answers:

a) you buy an ice cream if and only if it is hot outside.

b) you win the contest if and only if you have the winning ticket

c) you get promoted if and only if you have connections.

d) your mind will decay if and only if you watch television

e) The trains run late if and only if the days I take it.

Q # 27

Q27 State the converse, contrapositive and inverse of each of the conditional statements.

(8)

a) If it snows today, I will SKi tomorrow.

→ Converse :- I will SKi tomorrow only if it Snow today.
→ Contrapositive :- If I will not SKi tomorrow, then it will not have Snows today.
→ Inverse :- If it does not Snows today, then i will not SKi tomorrow.

b) I come to class whenever there is going to be a quiz.

→ Converse :- I come to class only if there is going to be quiz.
→ Contraposilive :- If I do not come to class, then there will not be a quiz.
→ Inverse :- If there is not going to be a quiz, then I don't come to a class.

(c) A positive integer is a prime only if it has no divison other then 1 and itself.

→ Converse :- positive integer is a prime if it has no division other then 1 and itself :-
→ Contrapositive If a positive integer has a division other then 1 and itself, then it is not prime
→ Inverse :- If positive integer is not prime, then it has a divisor other then 1 and itself.

(c) A positive integer is a prime only if it has no division other then 1 and itself

→ Converse :- If it has no division other then 1 and itself then a positive integer is a prime

→ Contrapositive :- If it has a division other then 1 and itself then a positive integer is not a prime

→ Inverse : If positive integer is not a prime then it has a division other then 1 and itself.

Q # 29

Q How many rows appear in a truth table for each of these compound proposition.

a) $P \rightarrow \neg P$

P	¬P	P → ¬P
T	F	F
F	T	T

Formula = 2^n where n is a number of variable.

$\Rightarrow 2^1$

$\Rightarrow$ 2 Rows.

(b) $(P \vee \neg s) \wedge (q \vee \neg s)$

Sol

2^4

16 rows.

c) $q \vee p \vee \neg s \vee \neg s \vee \neg t \vee u$

Sol

2^6

64 rows Ans

d) $(p \wedge r \wedge t) \leftrightarrow (q \wedge t)$

Sol

2^4

16 rows Ans

Q # 31

Q Construct a truth table for each of these compound proposition.

a) $p \wedge \neg p$

p	$\neg p$	$p \wedge \neg p$
T	F	F
F	T	F

b) $p \vee \neg p$

p	$\neg p$	$p \vee \neg p$
T	F	T
F	T	T

c) $(P \vee \neg q) \rightarrow q$

P	q	¬q	P ∨ ¬q	(P ∨ ¬q) → q
T	T	F	T	T
T	F	T	T	F
F	T	F	F	T
F	F	T	T	F

d) $(P \vee q) \rightarrow (P \wedge q)$

P	q	P ∨ q	P ∧ q	(P ∨ q) → (P ∧ q)
T	T	T	T	T
T	F	T	F	F
F	T	T	F	F
F	F	F	F	T

e) $(P \rightarrow q) \leftrightarrow (\neg q \rightarrow \neg P)$

P	q	¬P	¬q	P → q	¬q → ¬P	(P → q) ↔ (¬q → ¬P)
T	T	F	F	T	T	T
T	F	F	T	F	F	T
F	T	T	F	T	T	T
F	F	T	T	T	T	T

f) $(P \rightarrow q) \rightarrow (q \rightarrow P)$

P	q	P → q	q → P	(P → q) → (q → P)
T	T	T	T	T
T	F	F	T	T
F	T	T	F	F
F	F	T	T	T

Q#33

Q Construct a truth table for each of these compound propositions

(a) $(P \vee q) \rightarrow (P \oplus q)$

P	q	$P \vee q$	$P \oplus q$	$P \vee q \rightarrow P \oplus q$
T	T	T	F	F
T	F	T	T	T
F	T	T	T	T
F	F	F	F	T

(b) $(P \oplus q) \rightarrow (P \wedge q)$

P	q	$P \oplus q$	$P \wedge q$	$P \oplus q \rightarrow P \wedge q$
T	T	F	T	T
T	F	T	F	F
F	T	T	F	F
F	F	F	F	T

(c) $(P \vee q) \oplus (P \wedge q)$

P	q	$P \vee q$	$P \wedge q$	$(P \vee q) \oplus (P \wedge q)$
T	T	T	T	F
T	F	T	F	T
F	T	T	F	T
F	F	F	F	F

(d) $(P \leftrightarrow q) \oplus (\neg P \leftrightarrow q)$

P	q	$\neg P$	$P \leftrightarrow q$	$\neg P \leftrightarrow q$	$(P \leftrightarrow q) \oplus (\neg P \leftrightarrow q)$
T	T	F	T	F	T
T	F	F	F	T	T
F	T	T	F	T	T
F	F	T	T	F	T

(e) $(P \leftrightarrow q) \oplus (\neg P \leftrightarrow \neg r)$

P	q	r	¬r	P↔q	¬P	¬P↔¬r	(P↔q)⊕(¬P↔¬r)
T	T	T	F	T	F	T	F
T	T	F	T	T	F	F	T
T	F	T	F	F	F	T	T
T	F	F	T	F	F	F	F
F	T	T	F	F	T	F	F
F	T	F	T	F	T	T	T
F	F	T	F	T	T	F	T
F	F	F	T	T	T	T	F

(f) $(P \oplus q) \rightarrow (P \oplus \neg q)$

P	q	¬q	P⊕q	P⊕¬q	(P⊕q)→(P⊕¬q)
T	T	F	F	T	T
T	F	T	T	F	F
F	T	F	T	F	F
F	F	T	F	T	T

Q#37

Q Construct a truth table for each of these compound propositi

a) $P \rightarrow (\neg q \vee r)$

P	q	r	¬q	¬q∨r	P→(¬q∨r)
T	T	T	F	T	T
T	T	F	F	F	F
T	F	T	T	T	T
T	F	F	T	T	T
F	T	T	F	T	T
F	T	F	F	F	T
F	F	T	T	T	T
F	F	F	T	T	T

(b) $\neg p \rightarrow (q \rightarrow r)$

p	q	r	$\neg p$	$q \rightarrow r$	$\neg p \rightarrow (q \rightarrow r)$
T	T	T	F	T	T
T	T	F	F	F	T
T	F	T	F	T	T
T	F	F	F	T	T
F	T	T	T	T	T
F	T	F	T	F	F
F	F	T	T	T	T
F	F	F	T	T	T

(c) $(p \rightarrow q) \vee (\neg p \rightarrow r)$

p	q	$p \rightarrow q$	$\neg p$	r	$\neg p \rightarrow r$	$(p \rightarrow q) \vee (\neg p \rightarrow r)$
T	T	T	F	T	T	T
T	T	T	F	F	T	T
T	F	F	F	T	T	T
T	F	F	F	F	T	T
F	T	T	T	T	T	T
F	T	T	T	F	F	T
F	F	T	T	T	T	T
F	F	T	T	F	F	T

(d) $(p \rightarrow q) \wedge (\neg p \rightarrow r)$

p	q	r	$\neg p$	$(p \rightarrow q)$	$(\neg p \rightarrow r)$	$(p \rightarrow q) \wedge (\neg p \rightarrow r)$
T	T	T	F	T	T	T
T	T	F	F	T	T	T
T	F	T	F	F	T	F
T	F	F	F	F	T	F
F	T	T	T	T	T	T
F	T	F	T	T	F	F
F	F	T	T	T	T	T
F	F	F	T	T	F	F

(e) $(P \leftrightarrow q) \vee (\neg q \leftrightarrow r)$

P	q	¬q	r	P ↔ q	¬q ↔ r	(P ↔ q) ∨ (¬q ↔ r)
T	T	F	T	T	F	T
T	T	F	F	T	T	T
T	F	T	T	F	T	T
T	F	T	F	F	F	F
F	T	F	T	F	F	F
F	T	F	F	F	T	T
F	F	T	T	T	T	T
F	F	T	F	T	F	T

(f) $(\neg P \leftrightarrow \neg q) \leftrightarrow (q \leftrightarrow r)$.

P	q	r	¬p	¬q	¬P ↔ ¬q	q ↔ r	(¬P ↔ ¬q) ↔ (q ↔ r)
T	T	T	F	F	T	T	T
T	T	F	F	F	T	F	F
T	F	T	F	T	F	F	T
T	F	F	F	T	F	T	F
F	T	T	T	F	F	T	F
F	T	F	T	F	F	F	T
F	F	T	T	T	T	F	F
F	F	F	T	T	T	T	T

Ex 1.2 Q#02

Q#1

Answer

$e \rightarrow q$, $\neg q \rightarrow \neg e$

Q#7

Q Express the System Specification.

p: The msg is Scanned for viruses.

q: The message was sent from an unknown System.

Answers:-

a) $q \rightarrow p$

b) $q \wedge \neg p$

c) $q \rightarrow p$

d) $\neg q \rightarrow \neg p$

Q#9

The System is inConsistent

Q#11

The System is Consistent.

Q#03

Q Show that the following propositions are logicaly equivalent to each other

(1) $p \leftrightarrow q \equiv (p \wedge q) \vee (\neg p \wedge \neg q)$.

Taking L.H.S.

$(p \leftrightarrow q)$.

$(p \rightarrow q) \wedge (q \rightarrow p)$

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

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

$(\neg p \wedge \neg q) \vee (F) \vee (F) \wedge (q \wedge p)$.

$(\neg p \wedge \neg q) \vee (q \wedge p)$.

$(\neg p \wedge \neg q) \vee (p \wedge q)$.

$(p \wedge q) \vee (\neg p \wedge \neg q) = R.H.S$

proved.

(2) $(p \rightarrow q) \wedge (p \rightarrow r) \equiv p \rightarrow (q \wedge r)$.

Taking L.H.S.

$(p \rightarrow q) \wedge (p \rightarrow r)$.

$(\neg p \vee q) \wedge (\neg p \vee r)$.

$\neg p \vee \underbrace{(q \wedge r)}_{a}$

$\neg p \vee a$

$p \rightarrow a$

$p \rightarrow (q \wedge r) = R.H.S$

proved.