INFORMATION TECHNOLOGY UNIVERSITY

Quiz # 01

Course Name	Discrete Structure	Semester	Spring 2024
Total Time	20 mins	Total Marks	10
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Student Name		Student Roll No	

[CLO-1] Question: 01 [2]

Construct the truth table of the compound proposition $(p \vee \neg q) \rightarrow (p \wedge q)$.

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

[CLO-1] Question: 02 [1+1]

a. Use De Morgan's laws to express the negation of "Jan is rich and happy "and "Mei walks ortakes the bus to class."

) Jan is rich and happy.

p = "Jan is rich"

q = "Jan is happy"

$p \wedge q$

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

"Jan is not rich, or not happy."

b) Mei walks or takes the bus to class.

p = "Mei walks to class"

q = Mei takes the bus to class."

$p \vee q$

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

"Mei does not walk to class, and Mei does not take the bus to class."

b. **The negation of this statement is Vandana's smartphone has at least 32GB of memory**

Vandana's smartphone does not have at least 32GB of memory

[CLO-1] Question: 03 [1+1]

a. Let Q(x,y) denote the statements "x=y+3".What are truth values of the propositions Q(1,2) and Q(3,0)

To obtain Q(1, 2), set x = 1 and y = 2 in the statement Q(x, y). Hence, Q(1, 2) is the statement "1 = 2 + 3," which is false. The statement Q(3, 0) is the proposition "3 = 0 + 3," which is true.

b. What are the contrapositive and the inverse of the conditional statement. "The honey teamwins whenever it is raining."?

Statmets:Its raining then home team win
Contrapositive :p $\rightarrow$ q is $\neg$q $\rightarrow$ $\neg$p " if hometeam does not win then it is not raining"
Inverse: p $\rightarrow$ q is $\neg$p $\rightarrow$ $\neg$q "if it is not raining then hometeam does not win".

[CLO-1] Question: 04 [2]

Show that each conditional statement is a tautology without using truth tables $(p \land q) \rightarrow (p \rightarrow q)$.

$(p \land q) \rightarrow (p \rightarrow q)$
$\equiv \neg(p \land q) \lor (p \rightarrow q)$ Law of Implication
$\equiv \neg(p \land q) \lor (\neg p \lor q)$ Law of Implication
$\equiv (\neg p \lor \neg q) \lor (\neg p \lor q)$ De Morgan's Law
$\equiv (\neg p) \lor (\neg q \lor (\neg p \lor q))$ Associative Law
$\equiv (\neg p) \lor ((\neg p \lor q) \lor \neg q)$ Commutative Law
$\equiv (\neg p) \lor (\neg p \lor (q \lor \neg q))$ Associative Law
$\equiv (\neg p) \lor (\neg p \lor T)$ Negation Law
$\equiv (\neg p) \lor (T)$ Domination Law
$\equiv T$ Domination Law

[CLO-1] Question: 05 [1+1]

Build a Digital circuit that produce the output xyz + x$\bar{y}$z when given input bits x,y,and z.

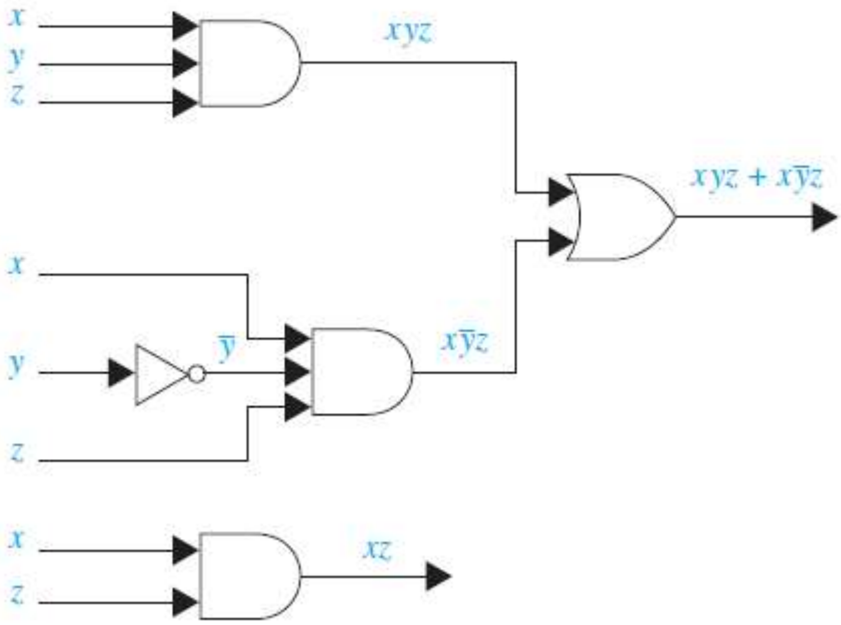

FIGURE 1 **Two Circuits with the Same Output.**