North South University

Department of Electrical and Computer Engineering

Homework 1

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Course No : CSE 173

Course Title : Discrete Mathematics

Section : 1

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Homework 0

Ans. to the ques. no. 01

a)

Given statement:

If you are happy and watch movies, then your parents ask you to study.

Propositions:

p: You are happy.

q: You watch movies.

r: Your parents ask you to study.

Relation:

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

b)

Given statement:

You are a Bangladeshi or if you are not a Bangladeshi, then your friend is European.

Propositions:

p: You are Bangladeshi.

q: Your friend is European.

Relation:

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

Ans. to the ques. no.: 02

Given that,

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

$\equiv (p \wedge (\neg p \vee q)) \rightarrow q$ [Def^n of implication]

$\equiv ((p \wedge \neg p) \vee (p \wedge q)) \rightarrow q$ [Distributive Law]

$\equiv (F \vee (p \wedge q)) \rightarrow q$ [Negation]

$\equiv (p \wedge q) \rightarrow q$ [Identity]

$\equiv \neg(p \wedge q) \vee q$ [Def^n of implication]

$\equiv \neg p \vee \neg q \vee q$ [de Morgan Law]

$\equiv \neg p \vee T$ [Negation]

$\equiv T$ [Identity]

Therefore, the given propositions is tautology.

Ans. to the ques. no. 03

Given propositions,

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

Truth table:

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

Ans. to the ques. no. 04

Given statement:

For you to get a good job in Pathao, it is sufficient for you to learn CSE173.

Propositions:

p: You get a good job in Pathao.

q: You learn CSE173.

Relations:

$$q \rightarrow p$$

Homework 1

Ans. to the ques. no. 1

a)

If $2+7=6$, then crocodiles can fly.

$\Rightarrow$ True.

b)

If $5+5=10$, then dogs can talk like humans.

$\Rightarrow$ False.

c)

If -3 is a negative number, then birds can fly.

$\Rightarrow$ True.

d)

If $1+1=2$, then $5+7=12$.

$\Rightarrow$ True.

Ans. to the ques. no. 02

Truth table:

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	T	T	T
T	F	T	T	F	T
F	T	F	F	T	T
F	F	T	F	T	T

Ans. to the ques. no. :03

a)

Given statement:

Neither the thunderstorm nor the heavy rain did any damage to the house.

Propositions:

p: Thunderstrom did damage to the howse.

q: Heavy rain did damage to the howse.

r: House is damaged.

Relation:

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

b)

Given statement:

If global warming is not controlled, low-lying land will go under water within the next few decades.

Propositions:

p: Global warming is controlled.

q: Low-lying land will go under water within the next few decades.

Relation:

$$\neg p \rightarrow q$$

c)

Given statement:

Uber/Pathao drivers should not drive more than 60 miles per hour nor violate traffic signals, or they will be penalized.

Propositions:

p: Uber/Pathao driver drive more than 60 miles per hour.

q: Uber/Pathao driver violate traffic signals.

r: They will be penalized.

Relation:

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

Ans. to the ques. no. 04

Given proposition,

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

Truth table:

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

Here, all the outputs are 'true'.

So, the given proposition is tautology.

Ans. to the ques. no. 05

a)

Given statement:

Some books are not at the right place.

Predicate:

$R(x)$: Book 'x' is at the right place.

$B(x)$: Books of NSU Library.

Relation :

$$\exists x \ (B(x) \wedge \neg R(x))$$

b)

Given statement:

All books are at the right place and are in excellent condition.

Predicate :

$R(x)$: Book 'x' is at the right place.

$E(x)$: Book 'x' is in excellent condition.

$B(x)$: Books from NSU Library.

Relation:

$$\forall x \left(B(x) \rightarrow (R(x) \wedge E(x)) \right)$$

c)

Given statement:

Everybook is in the right place and is in excellent condition.

Predicate:

R(x): Book 'x' is in the right place.

E(x): Book 'x' is in excellent condition.

B(x): Books from NSU Library.

Relation:

$$\forall x \left(B(x) \rightarrow (R(x) \wedge E(x)) \right)$$

d)

Given statement:

Nothing in the library is at the right place and is in excellent condition.

Predicate:

$R(x)$: 'x' is at the right place.

$E(x)$: 'x' is in excellent condition.

$A(x)$: Anything from NSU Library.

Relation:

$$\forall x \left(A(x) \rightarrow \neg(R(x) \wedge E(x))\right)$$

e)

Given statement:

One of the books is not in the right place, but it is in excellent condition.

Predicate:

$R(x)$: Book 'x' is at right place.

$E(x)$: Book 'x' is in excellent condition.

$B(x)$: Books from NSU Library.

Relation:

$$\exists x \left(B(x) \wedge \neg R(x) \wedge E(x)\right)$$

Ans. to the ques. no. : 06

The compound proposition will be,

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

P.T.O.

Truth table:

p	q	r	¬r	(p ∨ q)	(p ∨ q) ∧ (¬r)
T	T	T	F	T	F
T	T	F	T	T	T
T	F	T	F	T	F
T	F	F	T	T	T
F	T	T	F	T	F
F	T	F	T	T	T
F	F	T	F	F	F
F	F	F	T	F	F

From the truth table, we can see that, in 2nd, 4th and 6th row, p or q are true and r is false and output is true. For other cases, the output is false.

Therefore, the compound proposition is (p ∨ q) ∧ (¬r)