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Class: DMA-B05

HOMEWORK
DISCRETE MATHEMATICS
PROBLEMSET 01

Problem 1

p: "Swimming at the New Jersey shore is allowed"

q: "Sharks have been spotted near the shore"

- a. Sharks have not been spotted near the shore.
- b. Swimming at the New Jersey shore is allowed and Sharks have been spotted near the shore.
- c. Swimming at the New Jersey shore is not allowed or Sharks have been spotted near the shore.
- d. If swimming at the New Jersey shore is allowed, then sharks have not been spotted near the shore.
- e. If sharks have not been spotted near the shore, then swimming at the New Jersey is allowed.
- f. If sharks have not been spotted near the shore, then swimming at the New Jersey shore is not allowed.
- 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 swimming at the New Jersey shore is allowed or swimming at the New Jersey shore is not allowed and sharks have not been spotted near the shore.

Problem 2:

Let p : " A is knight"

q : " B is knight"

Make the truth table:

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

\Rightarrow A is knight, B is knave

Problem 3:

Use the truth table:

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

Since $(p \rightarrow r) \wedge (q \rightarrow r) \equiv (p \vee q) \rightarrow r$ in all cases, therefore they are logically equivalent.

Problem 4:

Use the truth table:

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

Since $(p \rightarrow q) \vee (p \rightarrow r) \equiv p \rightarrow (q \vee r)$ in all cases, therefore they are logically equivalent.

Problem 5:

Use the truth table:

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

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

Since $(p \rightarrow r) \vee (q \rightarrow r) \equiv (p \wedge q) \rightarrow r$, therefore they are logically equivalent.

Problem 6:

S: all students at your school

- $\exists x \in S: P \wedge Q$
- $\exists x \in S: P \wedge \neg Q$
- $\forall x \in S: P \vee Q$
- $\neg (\forall x \in S: P \vee Q)$

Problem 7:

- If there is a p for which printer p is out of service and printer p is busy, then there is a p for which printer job j is lost.
- If all printer p are busy, then there is a j for which printer job is queued.
- If there is a j for which printer job j is lost and printer job j is queued, then there is a p for which printer p is out of service.
- If all p in printer p is busy and there is a j for which printer job j is queued, then there is a j for which printer job j is lost.

Problem 8:

- T
- F
- T

Problem 9:

- $\forall x, L(x, Jerry)$
- $\forall x \exists y, L(x, y)$
- $\exists y \forall x, L(x, y)$
- $\neg \forall x \exists y, L(x, y) \equiv \forall x \exists y, \neg L(x, y)$
- $\exists y, L(Lydia, y)$
- $\exists y \forall x, L(x, y)$
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- $\forall x, L(x, x)$
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Problem 10:

- a. T
- b. T
- c. T
- d. T
- e. T
- f. F
- g. F
- h. T
- i. F

Problem 11:

1. There is a student in this class who has not taken exactly two mathematics classes at this school.
2. Every student has not visited every country in the world except Libya.
3. There is someone who has climbed every mountain in the Himalayas.
- 4.