COMP232 - Mathematics for Computer Science

Tutorial 2

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Exercise 4

What is negation of each of these propositions?

- a) Jenifer and Teja are friends.
  Jenifer and Teja aren't friends
- b) There are 13 items in a baker's dozen
  There aren't 13 items in a baker's dozen
- c) Abby sent more than 100 text messages every day.
  Abby didn't send more than 100 text messages every day
  or
  Abby sent less than 100 text messages every day.
- d) 121 is a perfect square
  121 isn't a perfect square

Exercise 6

	Smartphone A	Smartphone B	Smartphone C
RAM	256 MB	288 MB	128 MB
ROM	32 GB	64 GB	32 GB
Camera resolution	8 MP	4 MP	5 MP

Determine the truth value of each of these propositions.

- a) Smartphone B has the most RAM of these three smartphones
  TRUE
- b) Smartphone C has more ROM or a higher resolution camera than Smartphone B
  First identify propositions:
  p: C has more ROM than B FALSE
  q: C has a higher resolution camera than B TRUE
  p or q=TRUE

Exercise 6 (Cont...)

	Smartphone A	Smartphone B	Smartphone C
RAM	256 MB	288 MB	128 MB
ROM	32 GB	64 GB	32 GB
Camera resolution	8 MP	4 MP	5 MP

- c) Smartphone B has more RAM, more ROM, and a higher resolution camera than Smartphone A

  First identify propositions:

  p: B has more RAM than A TRUE

  q: B has more ROM than A TRUE

  r: B has a higher resolution camera than A FALSE

  p and q and r=FALSE
- d) If Smartphone B has more RAM and more ROM than Smartphone C, then it also has a higher resolution camera

  p: B has more RAM than C TRUE

  q: B has more ROM than C TRUE

  r: B has a higher resolution camera than C FALSE

  if (p and q) then r=FALSE

Exercise 6 (Cont...)

	Smartphone A	Smartphone B	Smartphone C
RAM	256 MB	288 MB	128 MB
ROM	32 GB	64 GB	32 GB
Camera resolution	8 MP	4 MP	5 MP

- e) Smartphone A has more RAM than Smartphone B if and only if Smartphone B has more RAM than Smartphone A

  p: A has more RAM than B FALSE

  q: B has more RAM than A TRUE

  p if and only if q = FALSE

Exercise 9

Propositions:

p: Swimming at the New Jersey shore is allowed

q: Sharks have been spotted near the shore

Compound proposition	Equivalent English sentence
$\neg q$	Sharks have not been spotted near the shore
$p \wedge q$	Swimming at the New Jersey shore is allowed but sharks have been spotted near the shore
$\neg p \vee q$	Either swimming at he New Jersey shore is not allowed or sharks have been spotted near the shore
$p \rightarrow \neg q$	A necessary condition for swimming at the New Jersey shore being allowed is that sharks have not been spotted near the shore
$\neg q \rightarrow p$	if sharks have not been spotted near the shore then Swimming at he New Jersey shore is allowed

Exercise 9(Cont...)

Propositions:

p: Swimming at the New Jersey shore is allowed

q: Sharks have been spotted near the shore

Compound proposition	Equivalent English sentence
$\neg p \rightarrow \neg q$	If swimming at the New Jersey shore is not allowed then sharks have not been spotted near the shore
$p \leftrightarrow \neg q$	Swimming at the New Jersey shore is allowed if and only if sharks have not been spotted near the shore
$\neg p \wedge (p \vee \neg q)$	Swimming at the New Jersey shore is not allowed and either Swimming at he New Jersey shore is allowed or sharks have not been spotted near the shore

Exercise 14

- p: You get an A on the final exam
- q: You do every exercise in this book
- r: You get an A in this class

English sentence	Compound propositions
You get an A in this class, but you do not do every exercise in this book	$r \wedge \neg q$
You get an A on the final, you do every exercise in this book, and you get an A in this class	$p \wedge q \wedge r$
To get an A in this class, it is necessary for you to get an A on the final	$r \rightarrow p$
You get an A on the final but you don't do every exercise in this book; nevertheless, you get an A in this class	$p \wedge \neg q \wedge r$

Exercise 14 (Cont..)

- p: You get an A on the final exam
- q: You do every exercise in this book
- r: You get an A in this class

English sentence	Compound propositions
Getting an A on the final and doing every exercise in this book is sufficient for getting an A in this class	$(p \wedge q) \rightarrow r$
You will get an A in this class if and only if you either do every exercise in this book or you get an A on the final	$r \leftrightarrow (q \vee p)$

Exercise 19

For each of these sentences, determine whether an inclusive or, or an exclusive or, is intended. Explain your answer.

a) Coffee or tea comes with dinner.
Answer: Exclusive. One of the hot drinks can be served with dinner.

b) A password must have at least three digits or be at least eight characters long.
Answer: Inclusive. A password can contain both digits and characters.

c) The prerequisite for the course is a course in number theory or a course in cryptography.
Answer: Inclusive. Student willing to take the course has to passed one of them. It is possible that he/she passed both.

d) You can pay using U.S. dollars or Euros.
Answer: Exclusive. Combination of currencies is not acceptable. Customer can pay either using U.S. dollars or Euros

Exercise 31

Construct truth table for $p \wedge \neg p$

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

Construct truth table for $p \vee \neg p$

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

Exercise 31(Cont..)

Construct truth table for $(p \vee \neg q) \rightarrow q$

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

Exercise 31 (Cont..)

Construct truth table for $(p \vee q) \rightarrow (p \wedge q)$

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

Exercise 31 (Cont..)

Construct truth table for $(p \rightarrow q) \leftrightarrow (\neg q \rightarrow \neg p)$

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

Exercise 31 (Cont..)

Construct truth table for $(p \to q) \to (q \to p)$

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

Exercise 34

Construct truth table for $p \oplus p$

p	$p \oplus p$
T	F
F	F

Construct truth table for $p \oplus \neg p$

p	$\neg p$	$p \oplus \neg p$
T	F	T
F	T	T

Construct truth table for $p \oplus \neg q$

p	q	$\neg q$	$p \oplus \neg q$
T	T	F	T
T	F	T	F

Exercise 34(Cont..)

Construct truth table for $\neg p \oplus \neg q$

p	q	$\neg p$	$\neg q$	$\neg p \oplus \neg q$
T	T	F	F	F
T	F	F	T	T
F	T	T	F	T
F	F	T	T	F

Exercise 34 (Cont..)

Construct truth table for $(p \oplus q) \vee (p \oplus \neg q)$

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

Exercise 34 (Cont..)

Construct truth table for $(p \oplus q) \wedge (p \oplus \neg q)$

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