Chapter 2

logic of Compound Statment

Chapter 2.1

Statement

A **statement** (or **proposition**) is a sentence that is true or false but not both.

For example, "Two plus two equals four" and "Two plus two equals five" are both statements, the first because it is true and the second because it is false. "He is a KCST student" is not a statement because for some he the sentence is true; for others it is false.

Indicate which of the following sentences are statements.

a. 1,024 is the smallest four-digit number that is a perfect square. Statment

b. She is a mathematics major. not statment

c. $128 = 2^6$ Statment

d. $x = 2^6$ not statment

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الروابط connectives

truth table

① Negation (النفي) $\sim$

Truth table for $\sim p$

p	$\sim p$
T	F
F	T

② Conjunction (and) $\wedge$

Truth table for $p \wedge q$

p	q	$p \wedge q$
T	T	T
T	F	F
F	T	F
F	F	F

T+T → T
وغيرذلك F

③ Disjunction (or) $\vee$

Truth table for $p \vee q$

p	q	$p \vee q$
T	T	T
T	F	T
F	T	T
F	F	F

F+F → F
وغيرذلك T

ترتيب الروابط داخل truth table

① الأقواس

② $\sim$

③ $\wedge$, $\vee$

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Write truth tables for the statement forms in 12-15.

12. $\sim p \wedge q$

13. $\sim(p \wedge q) \vee (p \vee q)$

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

15. $p \wedge (\sim q \vee r)$

$\sim p \wedge q$

p	q	$\sim p$	$\sim p \wedge q$
T	T	F	F
T	F	F	F
F	T	T	T
F	F	T	F

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

p	q	$p \wedge q$	$p \vee q$	$\sim(p \wedge q)$	$\sim(p \wedge q) \vee (p \vee q)$
T	T	T	T	F	T
T	F	F	T	T	T
F	T	F	T	T	T
F	F	F	F	T	T

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$p \wedge (q \wedge r)$

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

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

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

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De morgan law

De Morgan's Laws

$$\sim(p \wedge q) \equiv \sim p \vee \sim q \qquad \sim(p \vee q) \equiv \sim p \wedge \sim q$$

Use De Morgan's laws to write negations for the statements in 25–31.

25. Hal is a math major and Hal's sister is a computer science major.

Hal is not a math major or Hal's sister is a computer

26. Sam is an orange belt and Kate is a red belt.

Sam is not an orange belt or kate is not a red belt

27. The connector is loose or the machine is unplugged.

the Connector is not loose and the machine is plugged

28. The units digit of 4^{67} is 4 or it is 6.

The units of 4^{67} is not 4 and it is not 6

29. This computer program has a logical error in the first ten lines or it is being run with an incomplete data set.

This computer program has not a logical error in the first ten lines and it is not being run with a complete data set.

30. The dollar is at an all-time high and the stock market is at a record low.

The dollar is not at an all-time high or the stock is not at a record low

31. The train is late or my watch is fast.

the train is not late and my watch is not fast

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