Chang Li

CS-255: Discrete Structures in CS

Homework 1, Part 1

5.

a. The sentense is statement because it is the fact that "1024 is the smallest four-digit number that is a perfect square." The value is true.

b. The sentense is NOT a statement. Because "she is a mathmatics major" either can be true and false. In addition, the word "she" cannot indicate to both a specific person.

c. "$128 = 2^6$" is a statement. It can be see, the statement is true and there is no ambiguity.

d. "$x = 2^6$" is not a statement. Because x can be any value and this sentense can be true and false depends on the value of the x. (x value is unknown).

10.

P: "DATAENDFLAG is off."

q: "ERROR equals 0."

r: "SUM is less than 1,000."

a). $P \wedge q \wedge r$.

b). $P \wedge \neg q$

c). $P \wedge (\neg q \vee \neg r)$

d) $(\neg P \wedge q) \wedge \neg r$

e) $\neg P \vee (q \wedge r)$

25.

De Morgan's Laws: $\neg(P \vee q) \equiv \neg P \wedge \neg q$

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

Therefore, the negation statement is:
Hal is not a math major or Hal's sister is not a Computer science major.

Chang Li
CS-225: Discrete Structure in CS.
Homework 1, Part 1

26. De Morgan's Laws:
$\neg(p \wedge q) \equiv \neg p \vee \neg q$
$\neg(p \vee q) \equiv \neg p \wedge \neg q$

The negation statement is:
Sam is not an orange belt or Kate is not a red belt.

27. The negation statement is:
The connector is not loose and the machine is plugged (not unplugged)

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

29. ~~This Computer Program~~
It is not the case that this computer program has a logic error in the first ten line and it is not being run with an incomplete date set.

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

31. The train is not late and my watch is not fast.

52. ~~LHS = C ∧ P~~
LHS $\equiv (\neg p \wedge \neg(\neg q)) \vee (\neg p \wedge \neg q)$ # De Morgan's Law
$\equiv (\neg p \wedge q) \vee (\neg p \wedge \neg q)$ Double negation Law
$\equiv \neg p \wedge (q \vee \neg q)$ Distributive Law
$\equiv \neg p \wedge (t)$ Negation Law
$\equiv \neg p \equiv$ RHS Identity Law

Chang Li
CS-225: Discrete Structures in CS
Homework 1, Part 1

54.

~~LHS ≡ (P ∧ (~~

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LHS ≡ (P ∧ (¬(¬P) ∧ ¬Q)) ∨ (P ∧ Q) De Morgan's Law

≡ (P ∧ (P ∧ ¬Q)) ∨ (P ∧ Q) Double negative Law

≡ P ∧ ((P ∧ ¬Q) ∨ (P ∧ Q)) Associative Law

≡ P ∧ (P ∧ (¬Q ∨ Q)) Distribute Law

≡ P ∧ (P ∧ (T)) Negation Law

≡ P ∧ P Identity Law

≡ P ≡ RHS Idempotent Law