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CS-225: Discrete Structures in CS
Homework 1, Part 1
Exercise Set 2.1: Problem # 5, 10, (25-31), 52, 54

- HW 1, part 1: Set 2.1 – Q#5

Sentence a and sentence c are propositions.
A proposition is a sentence that is true or false but not both.
So sentence b is not a proposition because the truth of “She is a mathematics major” depends on the reference pronoun “she”. For some values of “she” the sentence is true; for others it is false. And in this sentence, the pronoun “she”’s reference is not clear, so the sentence is neither true or false. So it’s not a proposition.
Sentence d is not a proposition, either, because the truth of “x = $2^6$” depends on the reference pronoun “x”. For some values of “x” the sentence is true; for others it is false. And in this sentence, the pronoun “x”’s reference is not clear, so the sentence is neither true or false. So it’s not a proposition.

- HW 1, part 1: Set 2.1 – Q#10

Let “p” be the statement “DATAENDFLAG is off”, “q” the statement “ERROR equals 0”, and “r” the statement “SUM is less than 1,000”.
a. p∧q∧r
b. p∧~q
c. p∧(~q∨~r)
d. ~p∧q∧~r
e. ~p∨(p∧r)

- HW 1, part 1: Set 2.1 – Q#25 - 31

25. Hal is not a math major or Hal’s sister is not a computer science major.
26. Sam is not an orange belt or Kate is not a red belt.
27. The connector is not loose and the machine is not unplugged.
28. The units digit of $4^{67}$ is not 4 and it isn’t 6.
29. This computer program doesn’t have a logical error in the first ten lines and it isn’t being run with incomplete data 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.

- HW 1, part 1: Set 2.1 – Q#52

~(p∨~q) ∨(~p∧~q)
≡(~p∧q)∨(~p∧~q)  by the De Morgan’s law

≡~p∧(q∨~q)  by the Distributive law
≡~p∧t  by the Negation law
≡~p  by the Identity law

- HW 1, part 1: Set 2.1 – Q#54

(p∧(~(~p∨q)))∨(p∧q)
≡(p∧(p∧~q))∨(p∧q)  by the De Morgan's law
≡((p∧p)∧~q))∨(p∧q)  by the Associative law
≡(p∧~q)∨(p∧q)  by the Idempotent law
≡p∧(~q∨q)  by the Distributive law
≡p∧t  by the Negation law
≡p  by the Identity law