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3.1 #18 and 3.2 #2 and #4

3.1 # 18:

Let D be the set of all students in your school, and let M(s) be "s is a math major," let C(s) be "s is a computer science student," and let E(s) be "s is an engineering student." Express each of the following statements using quantifiers, variables, and the predicates M(s), C(s), and E(s),

a. There is an engineering student who is a math major.

∃ s ∈ D, such that M(s) and E(s)

Meaning, "There is at least one student in the set of all students in the school, such that they are both a math student and an engineering student."

b. Every computer science student is an engineering student.

∀ s ∈ D, if C(s) then E(s).

Meaning "for all students in the set of all students in the school, if a student is a computer science student, they are also an engineering student."

c. No computer science students are engineering students.

∀ C(s) ∈ D, ~E(s)

Meaning "for all computer science students in the set of all students in the school, none are engineering students.

d. Some computer science students are also math majors.

∃ s ∈ D such that C(s) and M(s).

Meaning "There are some students in the set of all students in the school such that they are both computer science majors and math majors." This statement is the same as number part A, but I believe that they could both mean some students, regardless if it is plural or not.

e. Some computer science students are engineering students and some are not.

∃ s ∈ D such that C(s) ^ E(s) ^ ∃ s ∈ D such that C(s) ^ ~E(s).

Meaning "There exists at least one student in the set of all students in the school such that they are both computer science students and math majors. AND there exists at least one

student in the set of all students in the school such that they are a computer science student but not an engineering student."

Basically I am taking the statement of D, changing math major to engineering, and chaining that to the negation of engineering to show that "some are not".

3.2 #2

Which of the following is a negation for "All dogs are loyal"? More than one answer may be correct.

a. All dogs are disloyal

b. No dogs are loyal

C. Some dogs are disloyal

D. Some dogs are loyal

E. There is a disloyal animal that is not a dog.

F. There is a dog that is disloyal.

G. No animals that are not dogs are loyal

H. some animals that are not dogs are loyal.

The original statement takes the form $\forall$D, L, meaning all dogs are loyal.

The negation is $\exists$ D, ~L meaning, there exists dogs that are not loyal. This means that the statement about dogs needs to be existential, not universal, and it needs to negate loyalty. There are only two statements that fulfill this.

3.2 #4.

Write an informal negation for each of the following statements. Be careful to avoid negations that are ambiguous.

a. All dogs are friendly.

There are some dogs that are not friendly. OR there exists at least one dog that is not friendly.

Universal friendly negates to existential and NOT friendly.

b. All people are happy.

There are some people that are not happy. OR there exists at least one person who is not happy.

Universal happy negates to existential and NOT happy.

c. Some suspicions were substantiated.

No suspicions were substantiated OR all suspicions were unsubstantiated.

Existential and substantiated negates to universal and NOT substantiated.

d. Some estimates are accurate.

No estimates are accurate. OR all estimates were inaccurate.

Existential and accurate negates to universal and NOT accurate.