Homework 0

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Problem 1 Basic Stuff.

1.1) Write down the set of integers that is less than 8 and greater than 2.

1.2) Write down the members of $\{x \in I | x^2 < 10\}$.

1.3) Write down the members of

$$\{x \in I^+ | x^2 < 10\} \cup \{x \in I^+ | 2 < x < 8\}.$$

1.4) Write down the members of

$$\{x \in I^+ | x^2 < 10\} \cap \{x \in I^+ | 2 < x < 8\}.$$

Problem 2 Notation Exercise.

- Let M be the set of all MUIC students.
- Let $P(x)$ be the predicate for student x takes Discrete Math class this term.
- Let $Q(x)$ be the predicate for student x taks Data Structure this term.
- Let $F(x, y)$ be the predicate for student x and student y are friends on facebook.
- Let $\mathbb{A} = \{x \in M | P(x)\}$
- Let $\mathbb{B} = \{x \in M | Q(x)\}$

Write the following propositions in mathematical form using $\cap$, $\cup$, $\rightarrow$, $\forall$, $\exists$ and all those set notations.

2.1) There are some students at MUIC who take Discrete Math is term. (Ex: $\exists x \in M$ such that $P(x)$)

2.2) There are some students who take both Discrete Math and Data Structure this term.

2.3) There exists some students who take Discrete math but not Data Structure.

2.4) Everyone takes Discrete Math.

2.5) No one takes Data Structure.

2.6) All students who takes discrete math this term also take Data structure. (Ex: $\forall x \in \mathbb{A}, Q(x)$ or you can use $\forall x \in M, P(x) \rightarrow Q(x)$)

2.7) There exists some students who take Data Structure but not Discrete Math.

2.8) There exists a student in Discrete Math who is friend to every one in Data structure.

2.9) Everyone in Data Structure has at least one friend in Discrete Math.

2.10) There exists a student in Discrete Math who is friend to no one in Data Structure.

Problem 3 Write down truth table for the following statements:

3.1) $P \implies (\neg Q \vee P)$

3.2) $P \implies (P \wedge Q)$

3.3) $(P \wedge R) \vee (\ Q \wedge R)$

Problem 4 Fun With Quantifiers.

4.1) Are the following two propositions equivalent?

A) $\forall x \in I, \exists y \in I$ such that $x + y = 23$

B) $\exists y \in I$ such that $x + y = 23\ \forall x \in I$

4.2) Let X be the set of all boys in the class and Y be the set of all girl in teh class $P(a, b)$ be a predicate that is true only if a secretly likes b.

Translate these confusing symbols in to plain english and determine whether follwing propositions true. Explain/Prove/Disprove it.

A) $\forall x \in X, \exists y \in Y$ such that $P(x, y) \implies \exists y \in Y$ such that $P(x, y)\ \forall x \in X$

B) $\exists y \in Y$ such that $P(x, y) \forall x \in X \implies \forall x \in X, \exists y \in Y$ such that $P(x, y)$