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Assignment 2 - Discrete Mathematics
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- Section 1.4
  - Problem 2
    * a) There exists a real number x such that for all real numbers y, $xy = y$ is true.
    * b) For all real numbers x and for all real numbers y, if x is greater than or equal to zero and y is greater than or equal to zero, then $xy \geq 0$ is true.
    * c) For all real numbers x and for all real numbers y there exists a real number z where $x = y + z$ is true.
  - Problem 4
    * a) There exists a student in my class that has taken a computer science course in my school.
    * b) There exists a student in my class that has taken all the computer science courses in my school.
    * c) All the students in my class have taken a computer science course in my school.
    * d) There exists a computer science course in my school that all the students in my class have taken.
    * e) All the computer science courses in my school have been take by a student in my class.
    * f) All the students in my class have taken all the computer science courses in my school
  - Problem 8
    * a) $\exists x \exists y Q(x, y)$
    * b) $\neg \exists x \exists y Q(x, y)$
    * c) $\exists x Q(x, (Jeopardy, Wheel\ of\ Fortune))$
    * d) $\forall y \exists x Q(x, y)$
    * e) $\exists x Q(x \geq 2, Jeopardy)$
- Section 1.5
  - Problem 2
    * The argument is valid by Modus Tollens. We can conclude the conclusion to be true if the premise is true.
  - Problem 4
    * a) Simplificiton
    * b) Disjunctive Syllogism
    * c) Modus Ponens
    * d) Addition
    * e) Hypothetical Syllogism

- Problem 10
  * a) "I did not play hockey yesterday." Modus Tollens
  * b) "If worked last Friday then Friday was sunny"
  * c) "Dragonflies have six legs" Modus Ponens
    "Spiders are not insects" Modus Tollens
  * d) "Homer is not a student" Modus Tollens
  * e) "Tofu does not taste good" Modus Ponens
    "I do not eat healthy food" Modus Tollens
  * f)

- Section 1.6
  - Problem 2
    $a = 2x,\ b = 2y$ Where a, b, x and y are integers.
    $a + b = 2x + 2y = 2(x + y)$
  - Problem 4
    $a + b = 0$ Where a and b are even integers and thus ...
    $a = 2x$ ...x is an integer.
    $2x = -b$
    $x = -b/2$ Since x is an integer, b has to be an even integer.
  - Problem 10
    $a = w/x$ Where $a \in \mathbb{Q}$, and w and z $\in \mathbb{Z}$.
    $b = y/z$ Where $b \in \mathbb{Q}$, and y and z $\in \mathbb{Z}$.
    $ab = (wy)/(xz)$ By definition, $ab \in \mathbb{Q}$.
  - Problem 18
    * a) Contraposition:
      Prove:If n is not even, then n is not an integer or $3n + 2$ is odd.
      $n = 2a + 1$ if n is an odd integer, then and a $\in \mathbb{Z}$
      $3(2a + 1) + 2 = 6a + 5$ Any integer multiplied by an even number and added by an odd number is odd, therefore $3n + 2$ is odd.

    * b) Contradiction:
      If n is not even, then n is an integer and $3n + 2$ is even.
      Given: n is not even
      Prove: n is not an integer or $3n + 2$ is odd.
      $n = 2a + 1$ if n is an odd integer, then and a $\in \mathbb{Z}$
      $3(2a + 1) + 2 = 6a + 5$ Any integer multiplied by an even number and added by an odd number is odd, therefore $3n + 2$ is odd.

  - Problem 20
    1 is a positive integer.
    $1^2 = 1$
    $1 \geq 1$
    Direct Proof.