CS2022/MA2201
HW#1

DUE: Thursday, September 6

1. (2 points) Write the contrapositive and the converse of the statement:
   “If I’m having fun, then I must be in Discrete Math.”

2. (4 points) Let $P(m,n)$ be the statement “$n \geq m$”, where the universe of discourse for $m$ and $n$ is
   $\mathbb{N} = \{0,1,2,3,\ldots\}$, the set of nonnegative integers. What is the truth value of the following statements?
   
   a. $(\forall n) P(0,n)$
   b. $(\exists n)(\forall m) P(m,n)$
   c. $(\forall m)(\exists n) P(m,n)$
   d. $(\forall m)(\exists n) P(42,n)$

3. (11 points) Suppose the variable $x$ represents students and $y$ represents courses, and:
   
   $U(y)$: $y$ is an upper-level course
   $C(y)$: $y$ is a CS course
   $F(x)$: $x$ is a first year student
   $A(x)$: $x$ is a part-time student
   $B(x)$: $x$ is a full-time student
   $T(x,y)$: student $x$ is taking course $y$.

   Write each of the following statements using the above predicates and any needed quantifiers:
   
   a. Ben is taking CS2022.
   b. All students are first year students
   c. Every first year student is a full-time student
   d. No CS course is upper-level
   e. Every student is taking at least one course
   f. There is a part-time student who is not taking any CS course
   g. Every part-time first year student is taking some upper-level course
   h. $F(Maia)$
   i. $\neg(\exists y) T(\text{Isaac}, y)$
   j. $(\exists x) A(x) \land \neg F(x)$
   k. $(\forall x) T(x, \text{CS2022})$

4. (3 points) Let the Universe of Discourse be the students in CS2022/MA2201, and assume that the following two statements are true:
   
   • Everybody who cheats sits in the back row.
   • George sits in the back row.

   Phrase these statements as logical propositions and then discuss what implications we can draw about George’s honesty from these two statements.

5. (6 points) Do Exercise 1.3.12 a, b, c, d, e and f.