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 $\mathbb{N} = \{0,1,2,3,...\}$, 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

Write each of the following in good English without using variables in your answers.
h *F*(*Maia*)
i $\neg(\exists y) T(Isaac, y)$
j $(\exists x) A(x) \wedge \neg F(x)$
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.***