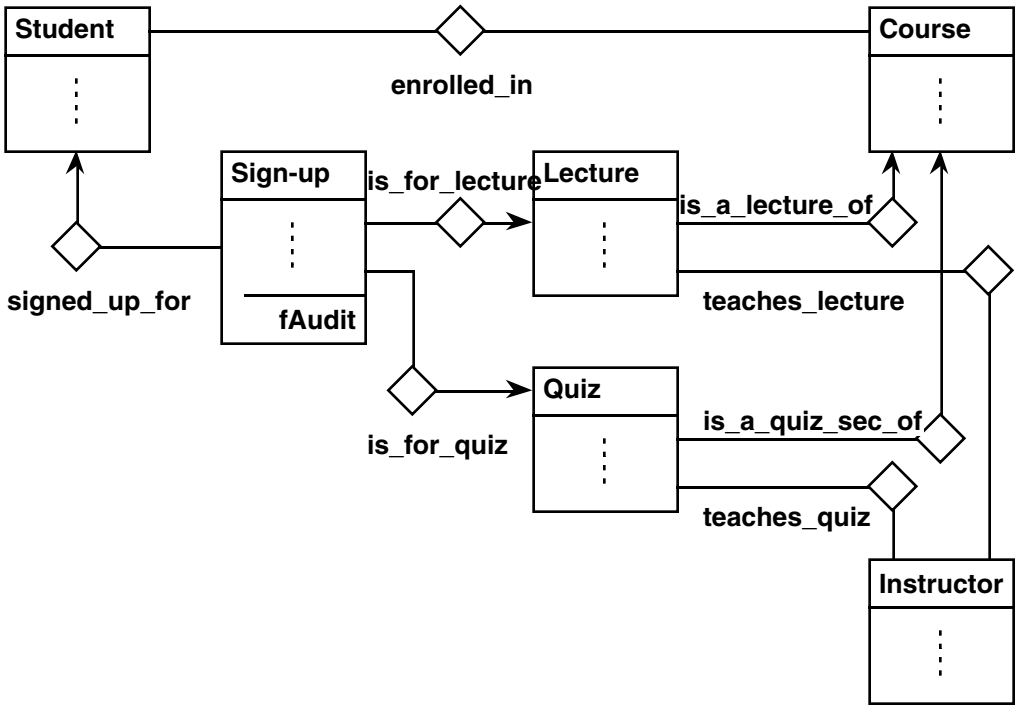
ER Modeling Example Solution

Proving the difficulty of formalizing constraints stated in natural language, the ER modeling exercise on Monday turned out to be a little bit more involved than I imagined. Ugh. Sooooo, let me try it again off from the ER model shown below:



First, let's define a short-hand notation to cut down on the clutter. In the textbook, they use a tuple notation to denote a specific instance of a relation, **R**, i.e., $\langle x, y \rangle \in \mathbf{R}$. Instead, we will use an infix notation, i.e., x **R** y. Naturally, $\langle x, y \rangle \in \mathbf{R} \equiv x$ **R** y.

Also, we define an induced relation, **is_for_course**, to relate **Sign-up** to **Course**, in terms of **is_for_lecture** and **is_a_lecture_of**. That is *su* **is_for_course** $c \equiv \exists l \in$ **Lecture**.(*su* **is_for_lecture** l & l **is_a_lecture_of** c).

Armed with these convenience, let's look at the constrains we must express. The first two constraints are:

1. A student who is enrolled in a course must sign up on one lecture section and one recitation section.
2. A student who is auditing a course may just sign up on a lecture section.

Since these two constraints complement each other depending on the audit status, we'll express it with one constraint.

$$\forall s \in \textbf{Student}.\forall c \in \textbf{Course}.$$
$$\quad s \textbf{ enrolled_in } c \supset$$
$$\quad\quad s \textbf{ signed_up_for } su \;\&$$
$$\quad\quad su \textbf{ is_for_course } c \;\&$$
$$\quad\quad \neg su.\textbf{fAudit} \supset$$
$$\quad\quad\quad \exists q \in \textbf{Quiz}.(su \textbf{ is_for_quiz } q \;\&\; q \textbf{ is_a_quiz_sec_of } c)$$

Let's look at the next one:

3. No students not enrolled in a course may sign up on any sections.

Trying to state this can get you rather confused. Let's consider a complement of this constraint first. That is, there is a student not enrolled in a course, but signed up on a section. That is:

$$\exists s \in \textbf{Student}.\exists c \in \textbf{Course}.$$
$$\quad((\neg s \textbf{ enrolled_in } c) \;\&$$
$$\quad\exists su \in \textbf{Sign_up}.su \textbf{ is_for_course } c)$$

Negating the whole thing, we get:

$$\neg(\exists s \in \textbf{Student}.\exists c \in \textbf{Course}.$$
$$\quad((\neg s \textbf{ enrolled_in } c) \;\&$$
$$\quad\exists su \in \textbf{Sign_up}.su \textbf{ is_for_course } c))$$

Phew!