4 April 2003

The instructor's comments have been added in red.

Mini Project

The debate over which college to go to is always a big one. People put their applicantions out and anticipate a letter of acceptance. Some people get that letter and some people do not. This brings out the relation *AcceptedTo*, which returns a Boolean value, true or false.

Students: the sets of all students

Colleges: the set of all colleges

$$AcceptedTo \subseteq Students \times Colleges$$

It is important to use a relation rather than a function because one student can be accepted to more than one college. Although to make it more complicated, some of the students are dating. This brings about the relation:

$$IsDating \subseteq Students \times Students$$

Then there has to be the relation *WillGoTo*. This is a relation because ~~there is no output~~ one may or may not go to a college.

$$WillGoTo \cancel{=} \subseteq Students \times Colleges$$

The students set up a few rules to go by so that everyone is spaced out and hangs out with different people. This will help them party at different colleges and hang out with a bigger group overall.

1. Everybody goes to college.
2. If two people are dating, they want to go to the same college.
3. No one can go to a college that they weren't accepted to.
4. Kevin and Tony do not go the same college.

5. No more than two people go to the same college.

In First-Order Logic, these rules should look somewhat like this:

1. $\forall x \exists y(S(x) \land C(y) \rightarrow \mathit{WillGoTo}(x,y))$

   (x is a student and y is a college

   [For a technical reason, this should be written as $\forall x \exists y(S(x) \rightarrow (C(y) \land \mathit{WillGoTo}(x,y)))$]

2. $\forall x \forall y(\mathit{Dating}(x, y) \rightarrow \exists z(\mathit{WillGoTo}(x, z) \land \mathit{WillGoTo}(y, z)))$

   (x and y are different students and y is any college)

3. $\forall x \forall y(\neg(\mathit{AcceptedTo}(x, y)) \rightarrow \neg(\mathit{WillGoTo}(x, y)))$

   (x is a student and y is a college)

4. $\exists x(\mathit{WillGoTo}(\text{Kevin}, x) \rightarrow \neg(\mathit{WillGoTo}(\text{Tony}, x)))$

   (x is a college)

5. $\forall x \forall y \forall z \forall q(((\mathit{WillGoTo}(x, q) \land \mathit{WillGoTo}(y, q) \land \mathit{WillGoTo}(z, q)) \rightarrow (x \neq y \lor y \neq z \lor z \neq x)) \rightarrow \neg(\mathit{WillGoTo}(z, q)))$

   (x, y, and z are all different students and q is a college)

This is the chart showing who got accepted where:

AcceptedTo		*Colleges*			
		TCNJ	Rider	Rowan	Rutgers
	Alan	F	T	T	T
	Tony	T	T	F	F
Students	Kevin	T	T	T	T
	Jon	F	T	T	F
	Emily	F	F	T	T
	Katie	F	T	F	F

According to the chart, the list notation of the relation *AcceptedTo* should look like this:

AcceptedTo = {(Alan, Rider), (Alan, Rowan), (Alan, Rutgers), (Tony, TCNJ), (Tony, Rider), (Kevin, TCNJ), (Kevin, Rider), (Kevin, Rowan), (Kevin, Rutgers), (Jon, Rider), (Jon, Rowan), (Emily, Rowan), (Emily, Rider), (Katie, Rider)}

The structure of this dilemma is called *Decisions*. This holds the two sets, *Students* and *Colleges*, the three relations: *AcceptedTo*, *Dating*, and *WillGoTo*.

Structure: *Decisions* = (*Students*, *Colleges*, *AcceptedTo*, *IsDating*, *WillGoTo*)

Sets: *Students* = {Katie, Tony, Kevin, Jon, Emily, Alan}

Colleges = {TCNJ, Rowan, Rider, Rutgers}

Relation: *IsDating* = {(Katie, Alan), (John, Emily), (Alan, Katie), (Emily, Jon)}

Can you tell who is going where?

Because Alan and Katie are dating, they will go to the same college. That college has to be Rider. Jon and Emily are also dating, so they are both have to go to Rowan. Kevin is a special case because he got accepted everywhere. Tony is also left. Rule 4 states that they cannot go to the same college. Rule 5 also says that no more than two people can go to the same college. Looking at the Acceptance Chart, you can see that Tony is going to TCNJ and Kevin is going to Rutgers.