Predicates and Predicate Logic (cont.)

Translate sentences to logical expressions

Example 1: If (x + y ≥ 300) then (x ≥ 150 or y ≥ 150)

We define the following predicates:

Translation:

For the next two examples, the universe of discourse (domain) is all students at UW-Madison.
We define the following predicates:

- S240(x) : x is a student in CS 240
- Calc(x) : x has studied calculus
- CS(x) : x is a CS major

Example 2: Every student in this class has studied calculus.

Rewrite: For every student in this class, they have studied calculus.

Rewrite:

Translation:

Why not:

Why not:

Example 3: Some students in this class are not CS majors.

Rewrite: There is a student in this class who is not a CS major.

Rewrite:

Translation:

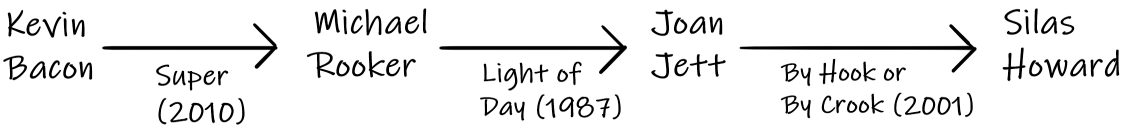
Why not:

Multiple quantifiers and domains

Example: The *Bacon number* of an actor is the number of degrees of separation they have from Kevin Bacon. Kevin Bacon has a Bacon number of 0. Actors who have co-starred with Kevin Bacon have a Bacon number of 1. Actors who have co-starred with actors who have co-starred with Kevin Bacon have a Bacon number of 2, and so on.

Use propositional logic to define what it means to have a Bacon number of 2. Use the following domains and predicates:

- Actors = domain of all actors
- Movies = domain of all movies
- Bacon2(x) : x has a Bacon number of 2
- Costars(a, b, m) : a and b both appeared (co-starred) in movie m $a \xrightarrow[m]{} b$



Bacon number of 2 means

Bacon2(x) ≡

Translate to predicate logic: Every integer has an additive inverse.

Consider

Take-away