Discussion of Pred Logic Quiz

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Many of you don't know the **basics** of logical form translation. Please see me, see the tutor, get this fixed. The problem is not going away. Please remember passing this class is a requirement for the major. It is time to get serious.

After going over the comments below, please have a look at these slides, which have been posted for a while.

Below I discuss each of the questions in detail, and go over some of the crazy bad answers some of you tried. Here are some general issues that weren't limited to one question:

1. Ill-formed translations. You are trying to translate the richness of English into a very limited, very impoverished language: logic. You have no prayer if you don't even know what counts as a well-formed expression of logic. Expressions like these:

   $a.$ $\text{walk}\,\&\,(X, Y)$
   $b.$ $\forall[\text{walk}(x)]$
   $c.$ $\exists x\,[\,\text{walk}(x)\ \text{man}(x)\,]$
   $d.$ $\text{talk}(x) \sim\ \&\,\text{walk}(x)$

   very quickly lead me to the conclusion that this person deserves no partial credit. Get the basics. Expression (a) has a predicate with no arguments conjoined with a some arguments with no predicates. Every predicate has arguments; all arguments need a predicate. Expression (b) has a quantifier $\forall$ with no variable. Makes no sense. Expression (c) is worse still. The two formulae walk(x) and man(x) have no **connective** joining them. You need to explicitly connect all sentences in logic with a connective like $\&$ or $\vee$ or $\rightarrow$. Expression (d) has $\sim$ followed by $\&$; $\&$ can only occur between two formula, and what;s on the left is not a formula. This however is okay

$$\text{talk}(x)\,\&\,\sim \text{walk}(x),$$

because adding $\sim$ to a formula (sentence) just makes another formula.

2. Predicates with ridiculous arities. Of all the errors, you can make, this is one that most strongly suggests you are not going to achieve one of the most important learning outcomes of this course, understanding the logical contributions individual words make to the meaning of sentences.

   Please see the slides above for discussions of the principles of assigning arities. They really align with basic linguistic analysis.

   For example, a transitive verb always translates as predicate with two arguments. That's why it's so disappointing to see some of you translating sentences like *Alicia ate brussel sprouts or okra* as

   $$\text{eat}(\mathbf{a},\, \mathbf{bs},\, \mathbf{o})$$

   The phrase *brussel sprouts or okra* is a single noun phrase filling one argument position of the verb *eat*. It describes what's being eaten. It's far less linguistically clueless to translate this as:

   $$\text{eat}(\mathbf{a},\, \mathbf{bs} \vee \mathbf{o})$$

   That too is wrong, but at least it shows you know what the linguistic units are and you're trying to capture the basic semantic relationships (the okra and brussel sprouts are getting eaten). To fix this wrong translation, you just have to realize that $\vee$ can only connect sentences, so this becomes:

   $$\text{eat}(\mathbf{a},\, \mathbf{bs}) \vee \text{eat}(\mathbf{a},\, \mathbf{o})$$

3. Random uses of $\exists x$. Many of you seem to be under the impression that if you begin a translation with $\exists x$, that will make it look more authoritative, or perhaps even cooler. But quite the opposite is true in many cases. Translating *Fido barked* as

   $$\exists x\, [\text{bark}(\mathbf{f})\,]$$

   does not make you look good: $\exists x$ is appropriate only when it is followed by a formula that says something about x. In most of our translations it is motivated by a noun phrase that begins with a certain kind of determiner (*a/n*, *some*); the determiner *no* motivates $\sim \exists x$. A determiner comes at the beginning of a Noun Phrase and translates as a quantifier (∀ or ∃), and the noun phrase then provides some descriptions of x; so *some dog* translates $\exists x\,\mathrm{dog}(x)$. Thus we should never have $\exists x$ unless it is followed by something about x.

Some of you have been doing the same with $\forall x$. Same comments apply; $\forall x$ translates determiners like *every* and *each* and *all* that come at the beginning of noun phrases, so $\forall x$ only makes sense when it is followed by a formula containing x.

4. Here is a **big** thing that went wrong for some of you. You tried to translate **is**. **Never translate any form of be**; *be* is not a predicate; it's not a transitive verb; it's just there to carry tense information. Here are relevant examples. Notice we treat **definite NPs** like *the table* and *the truck* as if they were proper names and translate them with a single letter constant **t**. Notice none of the forms of *be* is any of the following examples contribute anything to the translation.

Fido is a dog	dog(**f**)
Fido was happy	happy(**f**)
Fido is being a good dog	dog(**f**) & good(**f**)
Fido will be under the table	under(**f**, **t**)
Fido was hit by the truck	hit(**t**, **f**)

1. Alicia ate neither brussel sprouts nor okra. [You may translate *brussel sprouts* and *asparagus* as if they were proper names.]

Many, many people did badly on this. Let's list the reasons

- You didn't understand the hint. This suggests that you are a senior linguistics major who doesn't know the difference between a **proper noun** and a **common noun**. That's distressing and you have all my sympathy. **John**, **IBM**, and **Boston** are proper nouns; **dog** is a common noun. Proper nouns denote **specific** people, places, and organizations in the world. They generally don't take articles in English. We have been translating them as single letter constants like **b**, **j**, and **m**. Notice we stay away from the letters we use as variables: x, y, and z, and happily, in the sentences I choose for you, I stay away from proper names likes **Xerxes**, **Yolanda**, and **Zoltan**, to help you keep the constants and the variables distinct.

Treating *brussel sprouts* as if it were a proper name means translating it as **b**. That's it. *Alicia ate brussel sprouts* becomes:

$$\text{eat}(\mathbf{a},\ \mathbf{b}).$$

You could also translate sprouts as **bs**. It ain't rocket science.

Instead, many of you did something like this:

$$\exists x\,[\,\text{brussel-sprouts}(x)\,\&\,\text{eat}(\mathbf{a},\ x)\,]$$

This is exactly what it means to treat *brussel sprouts* as if it were a common noun. It is exactly the **opposite** of what it means to treat it as if it were a proper noun. Notice the translation of **brussel sprouts** occurs in an expression like this:

$$\text{brussel-sprouts}(x)$$

That means it is a **predicate**. Predicates occur outside parentheses in our logical language and the expressions inside the parentheses are its **arguments**. The verb *eat* is also translated as a predicate in this last translation:

$$\text{eat}(\mathbf{a},\ x)$$

Here. *eat* is a predicate with two arguments, **a** and x.

Every common noun should translate as a predicate. Every proper noun should translate as an argument.

- Another reason why so many of you did poorly on this sentence is that you don't know that Neither … nor … is equivalent to Not (Either … or …).

Alicia ate neither brussel sprouts nor okra.

$\Longleftrightarrow$

It is not the case that Alicia ate either brussel sprouts or okra

$\Longleftrightarrow$

It is not the case that either Alicia ate brussel sprouts or Alicia ate okra

$\Longleftrightarrow$

$$\sim (\text{eat}(\mathbf{a},\ \mathbf{b}) \vee \text{eat}(\mathbf{a},\ \mathbf{o}))$$

2. Breanna talked with Letitia. [Treat *talk-with* as a single predicate.]

   Again, lots of errors on what was essentially a free giveaway question. Why? Because you don't know how to tranlsate proper names like *Breanna* and *Letitia* and because you don't understand the hints. Some of you don't even understand what it means to treat something as predicate. The correct answer:

   a. talk-with($\mathbf{b}$, $\mathbf{l}$)

   Some of you used this translation, because you had the intuition that *talking with* is always reciprocal.

   b. talk-with($\mathbf{b}$, $\mathbf{l}$) & talk-with($\mathbf{l}$, $\mathbf{b}$)

   This is okay; nothing truth-conditionally wrong with it. But it's unnecessary. It is an entailment of (a) that

   c. talk-with($\mathbf{l}$, $\mathbf{b}$)

   But we don't need to try to put all entailments in our translations.

3. Breanna and Letitia talked. [Reading: they talked with each other.]

   Here the point was that if they talked to each other, that's the reciprocal reading of *and* that we get with verbs like *meet*, *marry*, and *collide*, so taking into account what *and* contributes this should be translated:

   talk-with($\mathbf{b}$, $\mathbf{l}$) & talk-with($\mathbf{l}$, $\mathbf{b}$)

4. James wrote to either Julian or Jack last Tuesday. [Please don't translate every name as "j".]

   Lots of issues again. I don't know why. You need to paraphrase this as the conjunction of two sentences and then translate that, just as we did with statement logic.

   The correct paraphrase:

   > Either James wrote to Julian last Tuesday or James wrote to Jack last Tuesday.

   Because *last Tuesday* is a **temporal adjunct** it can be safely ignored, so we have.

   write-to($\mathbf{Jm}$, $\mathbf{Ju}$) $\vee$ write-to($\mathbf{Jm}$, $\mathbf{Ja}$)

5. Pete is a card-carrying libertarian. [Treat *card-carrying* as a single predicate; don't treat *card-carrying libertarian* as a single predicate.]

   Again, many of you had no idea what the hint meant, which does not bode well. We sometimes translate two words as a single predicate, as when we translate *write to* as **write-to**:

   $$\text{write-to}(\mathbf{Jm},\ \mathbf{Ju})$$

   The hint was to do the same with *card-carrying*; translate it as a single predicate, as in:

   $$\text{card-carrying}(\mathbf{p})$$

   Once you realize this is what the hint means, you need to know that *card-carrying* is an adjective. This leads to the following translation:

   $$\text{card-carrying}(\mathbf{p})\ \&\ \text{Liberian}(\mathbf{p})$$

   Just kidding. The correct translation is:

   $$\text{card-carrying}(\mathbf{p})\ \&\ \text{libertarian}(\mathbf{p})$$

6. Pete wrote a small book of poems.[*a* = *some*]

   In this case, many of you left out the preposition *of* or assumed the same x could be the book and the poems.

   $$\exists x\,[\,\text{book}(x)\ \&\ \text{small}(x)\ \&\ \text{of}(x, \text{poems})\ \&\ \text{write}(\mathbf{p},\ x)\,]$$

   Compare this translation to the structurally similar sentence in the next example (*Spike sued some taxi driver from Ukiah*) in which the preposition *from* is treated the same way.

7. Spike sued some taxi driver from Ukiah. [You may treat *taxi-driver* as a predicate and *Ukiah* and *Spike* as proper names.]

   $$\exists x\,[\,\text{taxi-driver}(x)\ \&\ \text{from}(x, \mathbf{Ukiah})\ \&\ \text{sue}(\mathbf{s},\ x)\,]$$

   Generally when a preposition modifies a noun it will be translated as 2-place relation between the head noun variable (x in these cases) and the translation of the object of teh preposition (poems and Ukiah in these cases).

8. No baseball player likes every umpire. [Treat *baseball-player* as a predicate.]

   Again, a lot of people did not understand the hint. That's alarming. Please make sure you understand what it means to treat something like a predicate or treat something like a proper name. If you don't, you will not pass the midterm.

   The idea of translating this kind of sentence is to first identify the NPs.

   > [No baseball player] likes [every umpire].

   As a short cut, try moving just the first NP out

   > [No baseball player]$_x$ $\quad x$ likes [every umpire].

   Now translate the sentence with x, which is just like the previous two examples:

$$\forall y[\text{umpire}(y) \rightarrow \text{like}(x,\, y)\,]$$

   Now translate the NP *No baseball player*

$$\sim \exists x\,[\,\text{baseball-player}(x)$$

   Now put the the two translations together using the right connective for an $\exists$ type quantifier (&):

$$\sim \exists x\,[\,\text{baseball-player}(x)\,\&\,\forall y[\text{umpire}(y) \rightarrow \text{like}(x,\, y)]\,]$$