# Review materials (many based on Midterm 2016)

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## 1 Introduction

Translation basics (you shouldnt get these things wrong):

1.1. Proper names translate as constants. NEVER as predicates.

| | | |
|---|---|---|
| Right | a. | John walks. |
| | b. | walk($j$) |
| Wrong | a. | John walks. |
| | b. | John($w$) |
| | b'. | $\exists x$John($w$) & walk($x$) |

1.2. Intransitive verbs translate as 1-place relations.

a. John walks.
b. walk($j$)

1.3. The determiner *a* introduces an existential quantification and uses the connective $\&$:

a. A man walks.
b. $\exists x$[man($x$) & walk($x$)]

Similarly for *Some* (followed by either a singular or plural Noun).

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1.4. The determiner *every* introduces a universal quantification and uses the connective $\rightarrow$:

a. Every man walks.
b. $\forall x[\text{man}(x) \rightarrow \text{walk}(x)]$

Similarly for *all*, *each*, *all the*.

1.5. The determiner *no* is the negation of *a*. The translation of *No P Qs* is the negation of the translation of *Some P Qs*:

a. No man walks.
b. $\sim \exists x[\text{man}(x) \,\&\, \text{walk}(x)]$

1.6. A noun always introduces a predicate, usually a 1-place predicate (but see below)

a. A man walks.
b. $\exists x[\text{man}(x) \,\&\, \text{walk}(x)]$

1.7. The predicate translating the head noun of a quantified NP always takes as (one of) its argument(s) the quantified variable ($x$ in the examples below):

a. A man walks.
b. $\exists x[\text{man}(x) \,\&\, \text{walk}(x)]$
c. Every man walks.
d. $\forall x[\text{man}(x) \rightarrow \text{walk}(x)]$
e. $[_{\text{NP}}$ Every $[_{\text{N}}$ president $]$ of GM $]$ is pretty.
f. $\forall x[\text{president}(x, \text{GM}) \rightarrow \text{pretty}(x)]$
g. $[_{\text{NP}}$ Every $[_{\text{N}}$ city $]$ in France $]$ is pretty.
h. $\forall x[(\text{city}(x) \,\&\, \text{in}(x, \text{f})) \rightarrow \text{pretty}(x)]$
g. $[_{\text{NP}}$ Every successful $[_{\text{N}}$ C.E.O $]$ in France $]$ is pretty.
h. $\forall x[(\text{C.E.O}(x) \,\&\, \text{successful}(x) \,\&\, \text{in}(x, \text{f})) \rightarrow \text{pretty}(x)]$

1.8. An adjective always introduces a predicate, usually a 1-place predicate

a. Fred is $[_{\text{Adj}}$ bald $]$.
b. $\text{bald}(f)$
a. Fred saw a $[_{\text{Adj}}$ bald $]$ man.
b. $\exists x[\text{man}(x) \,\&\, \text{bald}(x) \,\&\, \text{see}(f, x)]$

1.9. There are relational nouns and relational adjectives. Watch for them.

a. Lyons is south of Paris.
b. south$(l, p)$
a. Fred is angry at Suzette.
b. angry-at$(f, s)$
a. Paris is the capital of France.
b. capital$(p, f)$

1.10. Most noun-noun compounds and some adjective noun pairs need to be translated as hyphenated predicates, not as conjoined predicates

| | | |
|---|---|---|
| Right | a. | Fred lost a pipe wrench. |
| | b. | $\exists x$[pipe-wrench$(x)$ & lose$(f, x)$] |
| Wrong | a. | Fred lost a pipe wrench. |
| | b. | $\exists x$[pipe$(x)$ & wrench$(x)$ & lose$(f, x)$] |
| Right | a. | Fred attended a large high school. |
| | b. | $\exists x$[large$(x)$ & high-school$(x)$ & attend$(f, x)$] |
| Wrong | a. | Fred attended a large high school. |
| | b. | $\exists x$[large$(x)$ & high$(x)$ & school$(x)$ & attend$(f, x)$] |

1.11. Not every adjective works the same way (*French* vs. *high*).

a. Fred attended a $[_{\text{Adj}}$ French $]$ $[_{\text{Adj}}$ high $]$ school.
b. $\exists x$[French$(x)$ & high-school$(x)$ & attend$(f, x)$]

1.12. Prepositions usually introduce a 2-place relation.

a. A pipe wrench is under the sink. (definite so OK to translate with constant.
b. $\exists x$[pipe-wrench$(x)$ & under$(x, s)$]

1.13. Prepositions usually introduce a 2-place relation (exception *south of*).

a. Every city in France is pretty.
b. $\forall x$[(city$(x)$ & in$(x, f)$) $\rightarrow$ pretty$(x)$]

## 2 Entailments [15 pts]

For each pair of sentences, say whether the first entails the second. If any of the pairs are logically equivalent, you should say so. Whenever you claim some sentence S1 does not entail another sentence S2, you need to describe some circumstances in which S1 is true and S2 is false.

As an example, consider the pair of sentences:

(a) Fido is a mammal.
(b) Fido is a dog

The following is a complete correct answer.

| | |
|---|---|
| Fido is a mammal $\Rightarrow$ Fido is a dog | no |

Suppose Fido is an elephant. Then we have:

| Sentence | Truth value |
|---|---|
| Fido is a mammal | true |
| Fido is a dog | false |

Therefore, *Fido is a mammal* does not entail *Fido is a dog*.

2.1. (a) Fido is a mammal.
(b) Fido is a land mammal.

2.2. (a) Fido is wet and Fido is hungry.
(b) Fido is hungry.

2.3. (a) Fido is wet or Fido is hungry.
(b) Fido is hungry.

2.4. (a) Fido is hungry.
(b) Fido is wet or Fido is hungry.

2.5. (a) John didn't eat a piece of pie.
(b) John didn't eat a piece of cherry pie.

2.6. (a) Only John ate four apples.

(b) John ate four apples

(a) John ate four apples.

(b) Only John ate four apples

2.7. (a) Celia is a Presbyterian soprano.

(b) Some Presbyterian is a soprano.

2.8. (a) Some Presbyterian is a soprano.

(b) Celia is a Presbyterian soprano.

2.9. (a) John sold Mary a Camaro.

(b) Mary bought a Camaro from John.

2.10. (a) Every Italian is a singer.

(b) Every red-headed Italian is a singer.

2.11. (a) Every Italian is a red-headed singer.

(b) Every Italian is a singer.

2.12. (a) Every Italian sings passionately.

(b) Every Italian sings.

2.13. (a) No Italian sings passionately.

(b) No Italian sings.

2.14. (a) A man I know speaks French.

(b) I know a man.

# 3 Logic [20 pts]

We have seen a number of sentences using the word *or*

| $p$ | $q$ | $p \vee q$ |
|---|---|---|
| T | T | T |
| T | F | T |
| F | T | T |
| F | F | F |

Consider the following four logical expressions (a)-(d). Which are logically equivalent to $p \vee q$?

$$\begin{array}{ll} (a) & \sim(\sim p \,\&\, \sim q) \\ (b) & \sim p \rightarrow q \\ (c) & \sim q \rightarrow p \\ (d) & p \rightarrow p \vee \sim q \end{array}$$

Answer the following questions:

3.1. Which of these expressions is logically exquivalent to $p \vee q$? Prove your answer by showing truth tables for all of the above expressions.

3.2. Point out any of the four expressions (a) - (d) that are tautologies or contradictions and explain why using the truth tables.

# 4 Translation [25 pts]

Translate the following sentences into predicate logic of the sort introduced in chapters 2 & 3 of our text. For any ambiguous sentences, give all the readings, and paraphrase them, saying which logical translation goes with which reading. Except where indicated otherwise, translate definite NPs and proper names using single letter constants.

4.1. Alice is a disgruntled libertarian.

4.2. Alice likes a disgruntled libertarian.

4.3. Alice and Betty criticized Charles.

4.4. John disliked everyone. (Assume A disliked B is just $\sim$ like$(A, B)$)

4.5. No red-haired Norwegian was disliked.

4.6. The begonia is close to the tulip.

4.7. Charles was befriended by a large black dog.

4.8. Lucien and Louis are enemies.

4.9. Not everyone I know speaks French.

# 5 Modality [25 pts]

For the following modal sentences, write down **quantified** modal truth conditions for **all** the readings. Please note: There **are** ambiguous examples.

For example:

(a) A bachelor must be unmarried.
(b) $p =$ a bachelor is unmarried.
$\forall w[p$ is true in $w]$

Note the following error strongly suggests you aren't thinking very hard about this:

(a) A bachelor must be unmarried.
(b) $p =$ a bachelor must be unmarried.
$\forall w[p$ is true in $w]$

Notice this possible worlds arent playing any role in the explanation of what *must* means, since since you're just made *must* part of the unanalyzed statement $p$.

Translate modal expressions like *can*, *could*, *may*, *might*, *must*, *should*, and *allow*, consistently. For example, if you use $\exists$ for epistemic readings of *may*, use it for deontic readings as well, and if you use it in one example with *may* use it in all.

5.1. John may not read the letter.

5.2. Harry is allowed to be in Boston.

5.3. Harry is not permitted to be in Boston.

5.4. All participants are required to sign an entry form.

5.5. You are permitted to eat one cookie.

5.6. You are forbidden to eat a cookie.

5.7. John may not have read the letter.

5.8. John must have read the letter.

5.9. John must not have read the letter.

5.10. John could have read the letter.

5.11. John could have read the letter.

5.12. John could not have read the letter.

5.13. John might have read the letter.

5.14. John might not have read the letter.