Midterm model answers 2016 (May 1, 2016)

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1 Introduction

2 Entailments, etcetera

2.1. (a) Fred is an intelligent politician.

(b) Fred is intelligent.

Acceptable answer 1:

> This is an entailment.

Acceptable answer 2:

> This is not an entailment. Suppose Fred is intelligent as a politician but a hopeless idiot at anything else. Then (a) is true and (b) is false.

2.2. (a) Susan is either a doctor or a lawyer.

(b) Susan is a doctor.

> Not an entailment. Suppose Susan is a lawyer. Then (a) is true and (b) is false.

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2.3. (a) Bibi will either complain to the chancellor or write a letter to the editor.

(b) Bibi will not complain to the chancellor and write a letter to the editor.

This is an implicature, which can easily be cancelled. Bibi will either complain to the chancellor or write a letter to the editor. In fact, she will do both.

2.4. (a) Bibi is a doctor.

(b) Bibi is either a doctor or a lawyer.

This is an entailment. If the first sentence is true, then of course the second is.

2.5. (a) Sheila is a republican who enjoys lacrosse.

(b) Some republican enjoys lacrosee.

This is an entailment.

2.6. (a) The truck collided with the Subaru.

(b) The Subaru collided with the truck.

Not an entailment. Suppose the Subaru is parked and the truck crashes into it at high speed. Then (a) is true and (b) is false. It would be possible to argue that this a cancellable implicature.

2.7. (a) The centerfielder is the shortstop's brother.

(b) The shortstop is male.

Not an entailment. Suppose the shortstop is the centerfielder's sister and the centerfielder is male. Then (a) is true and (b) false.

2.8. (a) The centerfielder and the shortstop collided.

(b) The shortstop collided with the center fielder.

Unlike the truck and Subaru example above, the center fielder and shortstop both have to be moving if (a) is true. Then (b) must also be true. So this is an entailment.

2.9. (a) Not every idiot is a politician

(b) Some idiot is not a politician.

These are logically equivalent.

2.10. (a) Every automatic weapon was confiscated.

(b) Every weapon was confiscated.

No entailment. Suppose all the automatic weapons are confiscated and bows and arrows are not. Then (a) is true and (b) is false. Some of you thought (a) implicated (b). But there is no general conversational reason to think (b) is true when (a) is uttered. In fact, since (b) entails (a) [see next example], there is a pretty decent argument that by taking the trouble to specify (a), the speaker implicates that (b) is false (Q-implicature to the negation of (b)).

2.11. (a) Every weapon was confiscated.

(b) Every automatic weapon was confiscated.

This is an entailment.

2.12. (a) Tommie allegedly ate a sardine.

(b) Tommie ate a sardine.

Not an entailment. Suppose that the D. A. arrests Tommie for public sardine eating (unaware that there is no law against this). And suppose further that the charges are completely unfounded. Tommie eats only red meat. Then (a) is true and (b) is false.

2.13. (a) No pizzas were eaten.

(b) No frozen pizzas were eaten.

This is an entailment. Since a negative is involved, it's worth demonstrating this with a further test. Suppose (b) is false. Then some frozen pizzas were eaten, and therefore (a) is false. So the falsity of (b) entails the falsity of (a), and that's another way of saying (a) entails (b).

2.14. (a) Lulu murdered Rollo.

(b) Lulu intentionally killed Rollo.

This is an entailment. Some of you thought this was logical equivalence and this was accepted as an alternative answer. But it's debatable, because of cases like assisted suicide and killing someone during a a war.

2.15. (a) The room is warm.

(b) The room is cold.

These are contraries. No entailment relation, no implicature relation. Nothing entails or implicates a contrary.

2.16. (a) The room is warm.

(b) The room is not hot.

This is a cancellable Q-implicature. The room is warm; in fact, it's hot.

2.17. (a) John's bicycle is broken.

(b) John's bicycle is not broken.

These are contraries. In fact, they would be contradictories if not for the fact that neither has to be true if John has no bicycle. No entailment or implicature relation. And to those of you who said these are logically equivalent, would that I had more points to deduct!

2.18. (a) John's bicycle is broken.

(b) John has a bicycle.

You're right. This was not on the midterm. But consider it anyway. Certainly (a) entails (b), but so does the negation of (a):

John's bicycle is not broken.

So if both p and $\sim p$ entail q, then p presupposes q. So *John's bicycle is broken* presupposes *John has a bicycle*.

3 Logic [20 pts]

Consider the truth table for $\sim p \to q$

p	q	$\sim p$	$\sim p \to q$
T	T	F	T
T	F	F	T
F	T	T	T
F	F	T	F

Consider the following logical expressions. Which are logically equivalent to $\sim p \to q$?

(a) $\sim (q \to p)$
(b) $\sim q \to p$
(c) $p \vee \sim q$
(d) $p \vee q$
(e) $\sim (\sim p \wedge \sim q)$
(f) $p \to (q \to p)$
(g) $(p \to q) \to p$
(h) $\sim (p \to (q \to p))$

Answer the following questions:

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

3.2. Point out any of these expressions that are tautologies or contradictions and explain why using the truth tables.

Here are the truth tables, with all the relevant columns. Those of you who got this wrong invariably omitted filling out columns on which the correct truth-values depend.

(a)

p	q	$q \to p$	$\sim (q \to p)$
T	T	T	F
T	F	T	F
F	T	F	T
F	F	T	F

(b)

p	q	$\sim q$	$\sim q \to p$
T	T	F	T
T	F	T	T
F	T	F	T
F	F	T	F

(c)

p	q	$\sim q$	$p \lor \sim q$
T	T	F	T
T	F	T	T
F	T	F	F
F	F	T	T

(d)

p	q	$p \lor q$
T	T	T
T	F	T
F	T	T
F	F	F

(e)

p	q	$\sim p$	$\sim q$	$\sim p \land \sim q$	$\sim (\sim p \land \sim q)$
T	T	F	F	F	T
T	F	F	T	F	T
F	T	T	F	F	T
F	F	T	T	T	F

(f)

p	q	$q \to p$	$p \to (q \to p)$
T	T	T	T
T	F	T	T
F	T	F	T
F	F	T	T

(g)

p	q	$p \to q$	$(p \to q) \to p$
T	T	T	T
T	F	F	T
F	T	T	F
F	F	T	F

(h)

p	q	$q \to p$	$p \to (q \to p)$	$\sim (p \to (q \to p))$
T	T	T	T	F
T	F	T	T	F
F	T	F	T	F
F	F	T	T	F

Discussion:

Formulas (b), (d) and (e) are equivalent to $\sim p \to q$. Formula (f) is a tautology and formula (h) is a contradiction.

4 Translation [30 pts]

4.1. Breanna and Letitia are enemies.

$$\text{enemy(b, l)} \wedge \text{enemy(l, b)}$$

4.2. IBM is a non-governmental organization.

Three reasonable answers, because the exact meaning of *non-governmental organization* is not entirely predictable from the words.

$$\sim \text{governmental-organization}(\textsc{ibm})$$

$$\text{non-governmental-organization}(\textsc{ibm})$$

$$\sim \text{governmental}(\textsc{ibm}) \wedge \text{organization}(\textsc{ibm})$$

4.3. Pete wrote a small book of poems.

$$\exists x,\ y\,[\text{book-of}(x, \text{y})\ \&\ \text{poem}(y)\ \&\ \text{write}(p,\ x)]$$

4.4. Neither syntax nor semantics is fun. (You may translate both *syntax* and *semantics* as if they were proper names, but give them distinct translations, please)

$$\sim [\text{fun(syn)} \vee \text{fun(sem)}]$$

Note the following is equivalent.

$$\sim \text{fun(syn)}\& \sim \text{fun(sem)}$$

But the first translation is more natural. Why? Because it's easy to see how the meaning of the whole comes from the meaning of the parts. The translation of *either syntax or semantics is fun* is

$$\text{fun(syn)} \vee \text{fun(sem)}$$

and the natural translation of *neither syntax nor semantics is fun* is the negation of this so:

$$\text{not} + \text{either} \ldots \text{or} \ldots \ = \text{neither} \ldots \text{nor} \ldots$$

4.5. Leanne gave every professor a red apple. (Assume it wasn't the same apple)

$$\forall x[\text{professor}(x) \rightarrow \exists y[\text{apple}(y) \ \& \ \text{red}(y) \ \& \ \text{give}(\text{l},\ y,\ x)]\,]$$

The reading **not** requested is the one on which all professors got the same apple:

$$\exists y[\text{apple}(y) \ \& \ \text{red}(y) \ \& \ \forall x[\text{professor}(x) \rightarrow \ \text{give}(\text{l},\ y,\ x)]\,]$$

Here is the step by step derivation of the requested reading, based on identifying the following Noun Phrases *every professor* and *a red apple*. Notice that if you reverse steps (f) and (g) you get the non-requested reading.

a.		Leanne gave $[_{\text{NP}}$ every professor $]_x$ $[_{\text{NP}}$ a red apple $]_y$
b.	$[_{\text{NP}}$ every professor $]_x$	Leanne gave x $[_{\text{NP}}$ a red apple $]_y$
c.	$[_{\text{NP}}$ every professor $]_x$ $[_{\text{NP}}$ a red apple $]_y$	Leanne gave x y
d.	$[_{\text{NP}}$ every professor $]_x$ $[_{\text{NP}}$ a red apple $]_y$	give(l, x, y)
e.	$\forall x$ professor(x) $\exists y$ apple(y) & red(y)	give(l, x, y)
f.	$\forall x$ professor(x)	$\exists y$ [apple(y) & red(y) & give(l, x, y)]
g.		$\forall x$ [professor(x) $\rightarrow$ $\exists y$ [apple(y) & red(y) & give(l, x, y)]]

4.6. A red apple was given to every professor. (Assume it wasn't the same apple). This is (more or less) the passive of

Someone gave every professor a red apple.

There is a difference between in meaning between the active and passive versions, however. The active paraphrase seems to say that one particular someone made sure professors weren't apple-less. The passive version leaves it open whether all the apples were given by the same person. We capture this by using a translation just like the previous one, except that *Leanne* will be replaced with an existentially quantified variable ($\exists\, z$), and that new existential will have **narrow scope**.

$$\forall x[\text{professor}(x) \rightarrow \exists y[\text{apple}(y)\ \&\ \text{red}(y)\ \&\ \ \exists z\ \text{give}(z,\, y,\, x)]\,]$$

The active sentence above has a reading on which the existential **wide scope**:

$$\exists z\ \text{person}(z)\ \&\ \forall x[\text{professor}(x) \rightarrow \exists y[\text{apple}(y)\ \&\ \text{red}(y)\ \&\ \text{give}(z,\, y,\, x)]\,]$$

4.7. No students with red hair were chosen. (I'm assuming that the exact meaning of *red* isn't predictable in the phrase *red hair* and treating *red-hair* as a predicate):

$$\sim \exists x\, y\, z\ [\text{student}(x)\ \&\ \text{red-hair}(z)\ \&\ \text{with}(x, z)\ \&\ \text{choose}(y,\, x)\,]$$

4.8. The library is adjacent to the rec center.

$$\text{adjacent-to}(\text{l, rc})$$

4.9. The library and the rec center are adjacent.

$$\text{adjacent-to}(\text{l, rc})\ \&\ \text{adjacent-to}(\text{rc, l})$$

4.10. Fun is fun. I'm assuming *fun* the predicate and *fun* the argument have diferent trranslations. When you do something like this — treat two instances of the same expression as having different meanings — you **must** comment on it.

$$\text{fun(f)}$$

Notice the following would be logically incoherent:

$$\text{fun(fun)}$$

A predicate can't be an argument. In particular, it can't be an argument of itself, because, well, that would be very upsetting.

4.11. Either John or Mary sang to Barak and Michelle. (Ma = Mary, Mi = Michelle). Parentheses are needed in translating this.

$$(\text{sing}(\text{J}, \text{B}) \,\&\, \text{sing}(\text{J}, \text{Mi})) \;\vee\; (\text{sing}(\text{Ma}, \text{B}) \,\&\, \text{sing}(\text{Ma}, \text{Mi}))$$

Note the following alternative does not seem to be a possible reading

$$(\text{sing}(\text{J}, \text{B}) \;\vee\; \text{sing}(\text{Ma}, \text{B})) \,\&\, (\text{sing}(\text{J}, \text{Mi}) \;\vee\; \text{sing}(\text{Ma}, \text{Mi}))$$

This one allows John to sing to Barak and Mary to sing to Michelle, and that doesn't seem to make the given sentence true. We say the *or* conjoining the subjects obligatorily takes wide scope over the *and* conjoining the objects.

4.12. Every student was proud of the president

$$\forall x\ [\text{student}(x) \rightarrow \text{proud-of}(x,\ \text{p})\,]$$

5 Interesting surprise problem [20 pts]

Translate the following sentences:

(1) a. Mary embraced Sue.

$$\text{embrace}(\text{m},\ \text{s})$$

b. Mary and Sue embraced.

$$\text{embrace}(\text{m},\ \text{s}) \,\&\, \text{embrace}(\text{s},\ \text{m})$$

The translation of (1b) entails the translation of (1a), since any formula of the form

$$p \,\&\, q$$

entails q. This seems to correctly describe a fact about the English sentences in (1a) and (1b); (1b) in fact entails (1a): (1b) describes reciprocal embracing, and (1a) describes Mary embracing Sue, while remaining neutral as to whther Sue embraced back.

I assume the following meaning postulate:

$$\forall x,\ y\,[\text{embrace}(x,\ y) \rightarrow \text{has-arms}(x)\,]$$

This requires that whatever fills the first argument position of *embrace* have arms. This kind of meaning postulate — which spells out **what kind of thing** one must

Figure 1: Embracing

(a) (b)

Figure 2: Lampposts with and without

be to fill a particular argument position of a predicate — deals with what are called **selection restrictions**. Given these selection restrictions on the first argument of **embrace** and the translation of (1b) above, both Mary and Sue must have arms, because both occur in the first argument position of *embrace*; (1b) is natural since by default we assume both Mary and Sue have arms. In contrast, (2b) is odd,

(2) a. The drunk embraced the lamppost.
    b. ? The drunk and the lamppost embraced.

because its translation will be:

$$\text{embrace}(\text{d, l}) \,\&\, \text{embrace}(\text{l, d})$$

And, by the meaning postulate, the second conjunct will entail that the lamppost has arms, surely not a default assumption about a lamppost. Considering the different kinds of lampposts pictured in Figure 2 might help (2b) a little, but the sentence is still strange because *embrace* seems to require animacy, as well as arms. That might be captured by modifying the selection restrictions in the meaning postulate as follows

$$\forall x,\, y\,[\text{embrace}(x,\, y) \rightarrow \text{has-arms}(x) \,\&\, \text{animate}(x)\,]$$

In the following pair, (3b) is odd for the same reason (2b) is odd; it entails the lamppost has arms and is animate.

(3) a. Sue embraced Mary.
    b. The lamppost embraced the drunk.

This is because in the translation, the lamppost occupies the first argument position, which has those selection restrictions:

$$\text{embrace}(\text{d, l})$$