TPT37 – FCI
(Natural and artificial Intelligence)

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Evaluation – June 2018

Examples of answers

Q1. Consider the following grammar:
S → 01S01
S → 0S1
S → 0101

Which binary strings among the following belong to the corresponding language?

- ❑ 0101101101
- ❑ 1100101100
- ☒ 0100101101
- ☒ 0010101011

Q2. A top-down parser that uses a context-free grammar applies grammar rules

- ☒ from left to right
- ❑ from right to left

Q3. Chart-parsing methods such as Earley's or CYK algorithm use a table to store

- ☒ recognized phrases
- ❑ rules as they are applied
- ❑ recognized non-terminals

Q4. Consider the sentence:

She cut the cake with a knife.

Find at least two syntactic interpretations (indicate structures with parentheses).
Which structure is more obvious to a human reader?
Would an intelligent program accept the less obvious structure? Why or how?

There are two obvious syntactic structures:

She (cut (the cake) with a knife)

She (cut (the cake with a knife))

The first one, in which *with the knife* is complement of the verb, is more likely to occur to a contemporary human mind as the semantics is readily constructed.

The alternative structure requires that the phrase *the cake with a knife* be given an interpretation first: for instance, there are several cakes on the table, but only one with a knife near to it. A meaning construction procedure would require such a context to accept this second version of the sentence.

Q5. Provide a lexical entry for the verb 'to sell'. It should contain a reasonable feature structure to control for the fact that both the seller and the buyer are human.

Example of answer in the spirit of TP2 (procedural semantics):

v([subj: dp([sem: human]), compl2: dp([sem:human])]) --> [sell].

Q6. Consider the sentence (about, say, a schizophrenic person):

She heard voices during the exam.

How many aspectual interpretations can you find for this sentence?

Explain how each interpretation can be generated, using the following switches: *viewpoint, duration, slice, inchoativity, predication, determination.*

Explain why the following sentences are less likely to be ambiguous.

His phone broke during the exam.

She got disturbed by the noise from the neighbouring lecture during the exam.

'hearing voice' may

1. **last throughout the exam**
2. **occur at some moment during the exam**
3. **occur repeatedly during the exam**

In 1., 'hearing voice' is a ground *g* that matches the ground 'during the exam'.

In 2., 'hearing voice' gets predicated, becomes a figure *f* that matches a slice of 'during the exam'.

In 3., 'hearing voice' gets predicated, becomes a figure *f* that gets repeated and matches the ground 'during the exam'.

In *His phone broke during the exam*, the breaking episode is an *f* that must be matched with a slice (at some moment during the exam).

By contrast, the *noise from the neighbouring lecture* is likely to last as long as the exam and would not match a slice of 'during the exam' if predicated.

Q7. A phrase like "student hero" can mean "student who is a hero" or "hero of students."
Can you provide a formal explanation for this ambiguity?

We suppose that the meaning of words is constructed as predicates. In a context in which you can be the hero of someone, 'hero' can be represented as a two-place predicate:

hero(X, Y) ←→ student(Z)

The principle of <u>semantic linking</u> states that those predicates must share a variable. Hence the ambiguity.

Q8. The phrase "No parking on both sides" is apparently ambiguous, but it is not after all. Can you represent the two meanings logically? How would a program reject one of the two meanings?

The ambiguity is syntactic: no(parking on both sides) *vs.* ((no parking) on both sides). Example of logical translations:

¬park(Driver, Car, side1 + side2)

¬park(Driver, Car, side1) ∧ ¬park(Driver, Car, side2)

The first meaning could be rejected at the <u>procedural</u> level, when the 'park' predicate get executed.

Q9. Find a context in which "*The roof is dark*" is argumentatively relevant. Why is it relevant in this context? Imagine an utterance that might follow "*The roof is dark.*" How would the CAN generate that utterance?

…/…

An argumentative utterance is relevant if it raises a problem or is an attempt to solve a problem.

Ex1: In this region, it must be hot in the house during summer (problem).

Ex2: It absorbs solar heat during winter (solution concerning heating expenses).

Follow-up after Ex1: It's not a problem, because in summer, we get the shadow of the trees.

Follow-up after Ex2: Yes, but it must be hardly bearable in summer.

The CAN procedure searches for contradiction / attempts to solve some pre-existing contradiction through abduction. Provided with adequate knowledge, it may find the 'shadow' argument through abduction, or find the heat problem through forward chaining.