

Practice Exam

You have 120 minutes to do this exam. Please number every sheet of paper that you submit, and note the total number of sheets on the first page. You may not use any additional materials beyond those we distribute together with this exam. **Please do not use pencils!**

You can achieve a total of XXX points in this exam. The grade is determined based on a total number of 100 points, so there are XX bonus points. In order to pass, you must get at least 50 points.

We accept answers in English and German; feel free to use whichever language you feel more comfortable with.

Good luck!

1 Short Questions

- (a) FrameNet and PropBank are lexical-semantic repositories providing semantic role information. What are the basic differences?
- (b) How many arguments has a standard transitive verb expression an event like “hit” (a) in standard FOL, (b) in Davidson's event semantics, (c) in Neo-Davidsonian semantics. Give simple representations of “Mary hit Bill” (take Mary and Bill to be of type e).
- (c) What is the relation between Description Logic and first-order predicate logic?
- (d) Type theory is an extension of first-order logic. Why do we need the additional expressivity? Give one example.

2 Plural Semantics

The following sentence has three readings in total. On scope ambiguity and one plural-specific ambiguity are involved.

(1) *Two lecturers prepared an exam*

- (a) Explain the three different readings.
- (b) The wealth of readings is due to the fact that “prepare” belongs to the class of mixed predicate. How many readings would Sentence (1) have, if “prepare” were a (purely) collective or a (purely) distributive predicate?
- (c) Give a short characterisation of the three classes of predicates.

3 Description Logic

- (a) Construct a TBox describing students. Use the following roles and concepts: Student, FirstYearStudent, SuccessfulStudent, Person, University, Exam, registered, takePart, pass. The TBox should encode the following facts:
 1. Students are persons registered at a university
 2. Successful students pass every exam.
 3. First-year students have not (yet) take part in an exam.
- (b) Can a first year student be a successful student? Motivate your claim.
- (c) Translate the description logic axioms from part (a) into first-order logic.

4 Type theory

Consider sentence (1) and its syntactic structure (2):

(1) *An unknown person robbed a bank.*

- (2) [S [NP [Det An][N' [Adj unknown] [N person]]] [VP [v robbed] [NP [Det a] [N bank]]]]
- (d) Give the appropriate types for the five words occurring in this sentence.
- (e) Translate “person,” “robbed,” “bank” to *person'*, *rob'*, *bank'*, respectively, and the indefinite article and “unknown” to appropriate lambda expressions, where the translation of the latter should use the constant *know** of type $\langle e, \langle e, t \rangle \rangle$.
- (f) Derive the semantic representation for the sentence, using basic composition rules and beta reduction. If you are not able to find a reasonable lambda term for “unknown,” you may use *unknown'* as translation for this part of the problem.
- (g) Specify the type and try to give a type-theoretic representation that expresses the semantic function of the adjectival prefix “un-”, as in “unknown,” “unclear” (for the attributive use of the adjective).
 Note: Do not use event semantics, but just standard type-theoretic semantics, as we introduced it in the first part of the course.

5 Type theory and modal logic

Give a type-theoretic representation of the adjective „unbelievable“. The representation should use the underlying constant *believe** of type $\langle t, \langle e, t \rangle \rangle$ and a modal operator.

6 Cooper storage

Consider the following sentence and its syntactic structure.

- (3) *Every student believes that a professor works.*
- (4) [S [NP Every student] [VP [v believes] [S' that [S [NP a professor] [VP works]]]]]

The sentence is scopally ambiguous: In total, it has three readings.

- (a) Compute one semantic representation for this sentence using the Nested Cooper Storage technique in which “a professor” takes scope over “believe.” Assume that *believe* translates into *believe'* of type $\langle t, \langle e, t \rangle \rangle$; the other expressions should be represented as usual.
- (b) Question (a) asks for one reading of the sentence. Please indicate how the other two readings can be derived by sketching at which level you apply which rule (storage, retrieval, or application).

7 Underspecification

- (a) Extend the semantics construction rules for dominance graphs from the lecture by rules for $S \rightarrow V S'$ and $S' \rightarrow \text{that } S$.
- (b) Compute a dominance graph for sentence (3). You don't have to do this step by step - it is sufficient to give the final graph and indicate which interface node in the graph corresponds to which node in the syntax tree by using indices as we did in the lecture.

8 Elementary DRT

Consider the following text T1 :

Mary knows a professor. He recommends a book. She reads it.

- (a) Derive a DRS K1 for the text T1 using the DRS construction algorithm from the lecture. You don't have to spell out every single step of the derivation, but do show some of them.

- (b) Determine the truth conditions of K1. Simplify the formulation of the truth conditions wherever possible.
- (c) Although the text T1 introduces several discourse referents that are available for anaphoric reference, the pronouns can't refer to all antecedents due to their genders. Specify this restriction informally. Then show how it can be incorporated into the DRS representations and construction rules.
- (d) Optional: English is different from German in that nouns in German have a grammatical gender (which can differ from the natural gender), and a pronoun must agree with the grammatical gender of the antecedent. Discuss the implications of this fact for DRS representations and construction rules, and try to give rules that take this situation into account.

Note: Problems 9 and 10 have next Tuesday's lecture as a prerequisite.

9 Complex Conditions in DRT

Consider the following text T2 :

Mary knows a professor. If he writes a book, she doesn't read it.

- (a) Derive a DRS K2 for the text T2 using the DRS construction algorithm. You don't have to spell out every single step of the derivation, but do show some of them.
- (b) Determine the truth conditions of K2, simplify wherever possible.
- (c) Try to express the truth conditions (as requirements towards the model structure) in natural language as simply as possible.
- (d) Translate K2 into a formula of first-order predicate logic.

10 Presuppositions

Natural language expressions come with (at least) two layers of meaning information, the assertion and the presupposition component. Summarize briefly the major differences between assertions and presuppositions.