KRR Assignment 2B: Winograd Challenge Case Study — Short Essay

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General Information

This piece of work (Assignment 2B) counts for 10% of the total module grade.

You should do this work in groups of 3 (or possibly 2 in some cases). Group assignment is done via Minerva. You will initially have a period where you can enrol in groups of your own choosing. After that enrolment period, students who are not in a group will be randomly assigned either to new groups or existing groups that have less than 3 members. Note that to form a group of your choice, you will need to ensure that all group members join the group in quick succession, otherwise other students may join. Also, if you form a group of only 2 then it is likely that a third student will later join or be added randomly.

The Winograd Schema Challenge Background

In his pioneering investigation of language understanding, the AI researcher and computational linguist Terry Winograd had noticed that the interpretation of natural language sentences often depends on complex background knowledge. Based on one of Winograd's examples, Hector Levesque (with subsequent collaboration of Ernest Davis, Leora Morgenstern, Charles Ortiz and others) devised a set of language interpretation problem examples, which they proposed as a challenge problem for AI systems. (Details for the particular form of the Winograd problems are covered in on of the KRR module lectures.) In answering this question you will be taking a small step towards addressing the *Winograd Schema Challenge*.

In preparation for this part of the assignment you should revise the material on the Winograd Challenge in the module notes and also explore the following web sites:

- http://www.cs.nyu.edu/davise/papers/WinogradSchemas/WS.html
  This is Ernie Davis' web page all about the *Winograd Schema Challenge* with links to schema sets and other relevant information.
- https://cs.nyu.edu/faculty/davise/papers/WinogradSchemas/WSCollection.html
  This is Ernie Davis' original collection of 150 Winograd schemas.
  The numbering of this set will be used to identify particular schemas.
- https://cs.nyu.edu/faculty/davise/papers/WinogradSchemas/WSCollection.xml
  This is an XML version of the original Winograd schemas, which is less densely formatted than the previous version and may be a bit easier to read.

Assignment 2B: Task

Your task for this part of the assignment is:

Write a short essay of approximately 2 pages ($\sim$ 1000 words) that discusses, in relation to *one* particular Winograd Schema, the possibilities and difficulties involved in resolving that schema using methods of Knowledge Representation and Reasoning.

Further details are on the next page.

Selection of Winograd Schema

In order that students cover a wide range of different Winograd Schema examples, each group will have a list of 9 schemas (or possibly 6 if there are only 2 in the group) from which they can choose one that they will study in detail and write the essay about. The expectation is that each member of the group would consider 3 of these schemas. Then the group would discuss which one seems the most suitable/interesting to write about.

The selection of schemas to choose from should be generated by the following code:

```
def winograd_choices(*users):
    users = list(users)
    users.sort()
    n = 0
    for c in "".join( users ):
        n = n + ord(c)
    schemas = list(range(1,150))
    choices = []
    for _ in range(len(users)*3):
        cut = sum([ord(u[-1]) for u in users])% len(schemas)
        schemas = schemas[cut:] + schemas[:cut]
        n *= sum([ord(u[-1]) for u in users])
        i = n%len(schemas)
        choices.append(schemas[i])
        del schemas[i]
    return choices

# Example use (replace with usernames of your group)
print(winograd_choices("csc5bb","sc25abc", "ml99omg"))
```

Structure and Content of your 'Winograd Schema' Mini-Essay

Submission Information Make sure that you give the names and usernames (i.e. UoL login names, something like `sc99abc`) of all students in the group.

It is suggested that you divide your essay into the following sections:

Introduction. Give a very brief description of the Winograd Schema Challenge and presentation of the particular schema example that you are considering in your essay. Give the number of the schema you are investigating.

Informal Analysis. Discuss your chosen schema informally. Try to explain what facts and reasoning principles would enable an intelligent agent to disambiguate the sentence by attaching the correct reference to the pronoun.

Formalisation using KRR Methods. Use the techniques of symbolic knowledge representation that you have learnt so far to give a formal specification of some of the facts axioms or inference steps that you consider to be key to resolving the reference in the case of your chosen Winograd schema. You may use standard first-order logic, Prolog code, or some other logic that you consider appropriate (e.g. temporal logic, tense logic, situation calculus or default logic). If you wish you could use different logical formalisms to represent different aspects of the reasoning, but make sure that the meaning of each formula you give is clear.

Limitations. Discuss the limitations of the formal representation that you have outlined. In particular, consider whether your representation would be sufficient to support solution of the schema problem by a purely automatic theorem prover. In most cases I would expect the answer to be *no*, so you you will be explaining what is missing from your representation.

Essay Length Limit

The main text of your short essay should fit onto 2 pages of A4 with a minimum font size of 11pt. You may use one further page to include a short bibliography and possibly an appendix listing some additional formulae that you refer to in the main text. It is suggested that you do not try to cram too much into your essay as this may result in lowering the mark you get for the clarity and coherence of your essay.

Marking Scheme

The essay will be graded according criteria:

Criterion	Marks Available
Overall clarity, coherence and presentation	10
Informal explanation of how the schema can be resolved	10
Proposed axioms and inference mechanisms	10
Discussion of difficulties and limitations	10

Your mark out of 40 for this part of the assignment will be scaled by 1/4, so it will contribute to a 10% portion of your overall module grade.

How to Submit

The submission will be via Gradescope. Full instructions regarding how and what to submit will be posted on Minerva.