Ontology Testing
(exercise discussion)

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Discussion

• Those of your working without method guidance:
  – What methods did you come up with?
• Are those methods similar to what the other group got?
  – Any additional ways to test?
• What kind of problems did you find in the ontology?
Method 1 – Unit tests

• Verifying that the ontology supports retrieval of information corresponding to the CQs
• Write one unit test corresponding to each CQ of the ontology (module)
  – Unit test? – SPARQL query
• What kind of errors?
  – Mainly missing elements
  – Violation of modeling best practices

Method 1 – Unit tests cont.

1. Retrieve the CQs
2. For each CQ reformulate it as a SPARQL query
3. For each unit test, i.e. each SPARQL query, create a new "test case"-module importing the module to be tested, and add facts (= test data) to it.
4. For each SPARQL query decide what a successful test should return
5. Run the SPARQL queries over "test case"-modules
6. Compare the actual results (from step 5) to the expected(from step 4), and decide if the test was successful or not
7. For any unsuccessful tests, analyze the reason for the failure
Method 2 – Performing inferences

• Verifying that the ontology supports the reasoning tasks required
• Create one test case for each inference to be made (according to the requirements)
  – Test case? – Set of “input” facts that should produce the desired output of inference
• What kind of errors?
  – Unfulfilled reasoning requirements
  – Unexpected side-effects
  – Inconsistencies

Method 2 – Performing inferences cont.

1. Collect explicit reasoning requirements, determine if there are any implicit reasoning requirements
2. For each, list input and expected output
3. Create one new “test case”-module for each reasoning requirement, import the module, and add facts corresponding to “input”
4. List the expected inferences that should be made
5. Run an OWL reasoner over the “test case”-modules
6. Compare the actual results (from step 5) with the expected ones (from step 4), and decide if the test of each reasoning requirement was successful or not. Success = all expected inferences, no harmful side-effects
7. For any unsuccessful tests, analyze the reason for the failure
Method 3 – Performing “stress tests”

- Verify that the ontology enforces the contextual statements and is robust against unexpected or erroneous data
- Create one test case for each contextual statement and “boundary value” to test
  - Test case? – Data that should produce some errors, e.g. inconsistency, in the ontology
- What kind of errors?
  - Unfulfilled or missing contextual statements, i.e. missing axioms
  - Implicit constraints that should be made explicit
  - Unexpected side-effects

Method 3 – Performing “stress tests” cont.

1. Collect explicit reasoning requirements, contextual statements and other constraints, and determine if there are any implicit requirements, e.g. additional constraints that can be derived from the context
2. For each, determine if there is a range of values that constrain the acceptable input or output that should be allowed by the ontology. For each constraint, determine cases outside of that range, and any other kinds of erroneous input that could be tested.
3. Create a new "test case"-module for each of the intended tests.
4. Add each of the cases to a "test case"-module, and run the reasoner.
5. Check the result against the expected result determined in step 2, and decide if the test was successful or not.
6. For any unsuccessful tests, analyze the reason for the failure.
Other ways of testing?

- Inspection
  - Checking coverage
    - terminology
    - axioms
  - Checking against best practices, e.g. ODPs

- “Peer review”

- …

Errors in the ontology

- Band and Person should be disjoint classes, based on common sense, but they are not.
- This “error” should be found by identifying an implicit contextual statement i.e. a persons cannot be a band, and by defining stressing unit tests that would cause persons to be inferred being bands and/or vice-versa.
Errors in the ontology

• Roles of musicians are modeled as properties; hence CQ number 3 is not covered.

• This error can be found by defining a SPARQL unit test representing the CQ based on the ontology.

Errors in the ontology

• Genre for a track should be only one. The ontology misses an axiom for restricting Track class on genre property to have exactly 1 value. This causes a track to possibly have more than one genre, which is against one of the explicit contextual statements.

• This error can be captured by defining a stressing unit test that includes more than one genre for a track.
Errors in the ontology

- One track realizes only one song. The ontology defines an existential restriction for class Track on property recordingOf, causing a track to be potentially the realization of more than one song.
- This error can be detected by stressing the ontology through a unit test that defines more than one song realized by a same track.

Errors in the ontology

- Modeling recording of an album requires time indexing as from CQ number 7. The ontology misses such an n-ary relation.
- This error can be found by defining a SPARQL unit test representing the CQ based on the ontology
Errors in the ontology

- The class (n-ary) AlbumRecordingParticipation is defined for modeling the participation of a band and a number of persons at the recording of an album. The axiomatization set for this class allows to instantiate a situation where a band, and a number of person participate in the recording of a number of album. Although this is not a clear mistake, there might be an implicit contextual statement that requires to have only one album referred to by a situation of album recording participation.

- This “error” can be detected by asking clarification to the customer about this particular constraint, possibly define a new contextual statement, and stress the ontology by defining a unit test that include more than one album for a situation of album recording participation.