Competency questions for ontologies

COMP62342

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(with thanks to Robert Stevens)

Previously on COMP62342

- Last week, what is a knowledge representation and what is an ontology;

- Gaining operational knowledge of using OWL and Protégé

- This week:
  - Acquiring knowledge to put into an ontology
  - Formalising that knowledge
  - The semantics of OWL

What are CQ?

- Michael Grüninger and Mark Fox (1995)
- What must an ontology be "competent" to do (answer)?
  - The ontology should have the axioms sufficient to answer competence questions
  - What vegetarian pizzas are there that don't have olives?
  - Implies discriminations of different toppings, vegetable/fish/meat toppings and closure of toppings

The role of CQ in ontology authoring

- Questions that help capture:
  - Scope
  - Content
  - A form of evaluation

  What pizzas have both capers and anchovy, but no meat?

  Indicates some basic content and scope

  Implies ability to close off toppings lists

  Implies categorisation of toppings

  Is by no means exhaustive – CQ don't list all toppings

  Can transform CQ into queries against an ontology

Some example CQ for pizza

How many pizzas are available?	Find all vegetarian pizzas	Can you have a pizza with any combination of toppings?
Do pizzas come in different sizes?	How many pizzas in the menu contain meat?	Can I remove toppings from a pizza?
Are there any children's pizzas?	Find pizzas with a single meat ingredient	Find all the pizzas with less than 3 toppings
Are different bases available?	Does this pizza contain halal meat?	If I have 3 ingredients, how many kinds of pizza I would make?
What kind of bases are possible?	Find all the nut free pizzas	Find all pizzas which are sharing 3 or more ingredients
Show me all pizza base options	Which pizzas do not have nuts?	Are we including folded pizzas (calzone) in our domain?
Is it thin or thick bread?	How many pizzas have either ham or chicken topping?	Should we include the oven type in the pizza definition? (e.g. wood fired vs. electric oven)
Is it "deep pan" or "Chicago" style? (deep pan sucks!)	Find all pizzas that have prawns but not anchovy	Explore relationships between common pizza choices to hypothesise about the origins of pizza toppings
Is it stuffed crust and what is it stuffed with?	What is the most popular (used) topping?	How much it will cost me to order all pizzas in the menu?
Which are gluten free bases?	What is the third least popular topping?	How much does Margherita Pizza weight?
Which pizzas are spicy?	Which toppings are allowed for customisation purposes?	How many pizzas did I eat last week?
Which sort of cheese do we have?	Reason backwards and suggest toppings that commonly go with each other (e.g. anchovies and capers)	I want to know whether a pizza is healthy
What sauces are available?	Are toppings organic?	Can I have a menu without pizzas please?
Find pizzas with peppers and olives	Show me the offers of the day	Which is the latest combination of toppings?

CQ for family history

- Must be able to represent kin relationships –
  - Parentage;
  - Grandparents;
  - Greatgrandparents;
  - Ancestors;
  - Aunts, uncles and cousins to the second degree.
- Must represent marriage
- Must represent in-law relationships – parents, siblings, etc
- Must represent birth, death and marriage years

CQ and testing

- Obvious relationship to testing
- My ontology must be *competent* to do this question
- CQ "What pizzas have anchovy?"

Class: AnchovyPizza
　　　EquivalentTo: Pizza and hasTopping some Anchovy

- We need a list of the pizzas with anchovy to make it work as a test
- CQ look a lot like acceptance tests
- The Query tab in Protégé can be used here

CQ for Furniture

- This afternoon you'll generate some CQ for an ontology of Furniture

- Look at the sources and think what you'd want an ontology driven Intelligent furniture catalogue be competent to do

- What questions would it then need to ask of the ontology in order to function?

- Which of these questions do you think you could phrase in terms of query against the ontology?

- Which would be answered using additional information?