

G53KRR past exam questions and ALC description logic.

In previous years, I used description logic defined in the textbook to set exercises and exam questions. Since now I use ALC, I decided to go through past exam papers and show how the answers would change for ALC. Note that not all of the questions below can be answered using ALC!

- G53KRR 2008 question 5. Given the atomic concepts *Female*, *Male*, roles *Child*, *Sibling* and constant *alice*, define in the description logic above the following concepts:
 1. “Mother of Alice” (someone female whose child is Alice) **Not expressible in ALC**
 2. “Parent” (someone who has a child)
 3. “Uncle” (someone male who has a sibling who has a child)
Using the same atomic concepts translate the following sentences in description logic:
 4. Every grandparent is a parent
 5. Alice is a grandmother
- G53KRR 2009 question 4. Express the following concepts and sentences in description logic using constants *john*, *g51prg*, roles *Module* and *Supervision* and atomic concepts *Academic*, *Lecturer*, *Compulsory*:

C1 concept of an academic who has some project students

C2 concept of an academic who teaches at least two modules **Not expressible in ALC: can only express at least one**

C3 concept of an academic who teaches only compulsory modules

C4 concept of someone who teaches G51PRG **Not expressible in ALC**

S1 a lecturer is an academic who has at least 8 project students and teaches at least 2 modules **Not expressible in ALC: can express has some students and teaches some modules**

S2 John teaches at least 3 modules and they are all compulsory **Not expressible in ALC: can only express at least one**
- G53KRR 2010 question 3. Express the following concepts in \mathcal{DL} using the atomic concepts *Animal*, and *Fish*, and the roles *Tail*, *Leg*, and *Eat*.

C1 An animal that has a tail

C2 An animal that has a tail and four legs **Not expressible in ALC: can only express has a leg**

C3 An animal that eats only fish

C4 An animal that eats only things that themselves eat only fish

Express the following sentences in description logic using the atomic concepts *Cat*, *Fish*, and *Animal*, the roles *Leg*, and *Eat*, and the constant *tiddles*:

S1 Tiddles is a cat who eats only fish

S2 Cats are animals that have four legs **Not expressible in ALC: can only express has a leg**
- G53KRR 2011 question 3.
 1. Express the following concepts in description logic using atomic concepts *School* and *Female*, roles *Pupil* and *Employee*, and a constant *anne*:
 - (a) A school which has at least 30 pupils. **Not expressible in ALC**

- (b) A school which has at least 30 pupils and 5 employees. **Not expressible in ALC**
 - (c) A school where all the pupils are girls.
 - (d) A school where one of the pupils is Anne. **Not expressible in ALC**
2. Express the following sentences in description logic using the atomic concepts *School*, *Female*, *GirlsSchool*, the roles *Pupil* and *Employee*:
- (a) A girls school is defined as a school where all pupils are girls.
 - (b) In girls schools all employees are female.
- G53KRR 2012 question 6. Given roles *Sister* and *Brother*, define the following concepts:
 1. Someone who has 7 sisters **Not expressible in ALC**
 2. Someone who has 7 sisters and 7 brothers **Not expressible in ALC**
 3. Someone all of whose sisters have 7 brothers **Not expressible in ALC**

Consider the following interpretation (D, I) : $D = \{d_1, d_2, d_3\}$, $I(R) = \{\langle d_1, d_2 \rangle, \langle d_1, d_3 \rangle\}$, $I(a) = d_1$ (a is a constant), $I(B) = \{d_2, d_3\}$ (B is an atomic concept). Which of the following sentences are true in this interpretation and why? (the exam had a totally different language, so here I give different questions):

1. $\forall R.B(a)$
2. $\exists R.B(a)$
3. $\exists R.B \sqsubseteq \forall R.B$