Principles of Knowledge Representation and Reasoning

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Exercise Sheet 11

Due: July 15, 2008

Exercise 11.1 (Continuous Endpoint Class, 5 marks)

(a) State four elements of $\mathcal{C}$ which are no base relations of Allen's interval calculus. Prove that they really are contained in $\mathcal{C}$. (Do not use the examples from the lecture slides.)

(b) Show that $\mathcal{C}$ is closed under intersection and converse.

(c) Show that $\mathcal{C}$ is *not* closed under union.
You may use without proof that $\mathcal{C}$ is a proper subset of Allen's interval calculus $\mathcal{A}$.

(d) Prove that $\mathcal{C}$ is *not* closed under complement.
Hint: Use parts (b) and (c).

Exercise 11.2 (RCC-5, 5 marks)

In the lecture we introduced Allen's interval calculus for *temporal* reasoning. Another interesting application of qualitative reasoning is *spatial* reasoning which adresses qualitative relationships between regions in space. A common spatial calculus is the RCC-8[1], which has 8 base relations. Here, we consider the slightly simpler RCC-5 with the following 5 base relations (the difference to RCC-8 is that interior and border points are not distinguished):

$X \mathrm{EQ}\, Y$	X is equal to Y.
$X \mathrm{DC}\, Y$	X and Y do not share any point (disconnected).
$X \mathrm{PO}\, Y$	X and Y share points but none of the regions is completely contained in the other (partial overlap).
$X \mathrm{PP}\, Y$	X is a proper subregion of Y (proper part).
$X \mathrm{PP}^{-1}\, Y$	Y is a proper subregion of X.

State the composition table for RCC-5 (no proofs are necessary).

[1] http://en.wikipedia.org/wiki/Region_Connection_Calculus