Constraint Programming

2017/2018 – Mini-Test #2

Wednesday, 19 December, 18:00 h in 204-Ed.II

Duration: 1.5 h (open book)

1. Interval Arithmetic

Consider the univariate polynomial function expressed in the standard form as: $f(x) = x^3 - x^2 + x$

1.1. Express this function in the Horner form: $a + x(b + x(c + dx))$

1.2. Choose an interval (with width > 0) for which the natural interval evaluation of the standard form computes an enclosure smaller than the obtained by the Horner form. Justify

1.3. Compute the smallest enclosure you can for the range of the function in $x \in [0,1]$. Justify.

2. Interval Newton

Consider the polynomial of the previous question: $f(x) = x^3 - x^2 + x$

2.1. Define the interval Newton function for the polynomial.

2.2. Prove with the interval Newton method that the polynomial has no roots in [1/2, 3/4].

2.3. Prove with the interval Newton method that the polynomial has a root in [-1/2, 1/3].

3. Constraint Propagation

Consider the constraints below and a box B = [-3,3]×[-3,3]

c1: $x^3 - 3x^2 + 3x - y \leq 1$

c2: $x^2 + y^2 \leq 9$

3.1. Is the system box-consistent in box B?

3.2. Is the system hull-consistent in box B?

3.3. Find narrowing functions for the constraints, by decomposing them into primitive constraints, and check whether the system is hull-consistent wrt these narrowing functions in B.