# Constraint Programming

## 2019/2020 – Mini-Test #2

Wednesday, 11 December, 16:30 h in 128-Ed.II

Duration: 1.5 h (open book)

### 1. Interval Arithmetic

Consider the univariate polynomial function expressed in the standard form as:

$$f(x) = x^2 - 4x + 3$$

1.1. Express the function in the factored form.
1.2. Compute the mean value extension of *f* over the interval [$a$,$b$] centered at the midpoint c.
1.3. Find, if possible, an interval (with width = 1) for which the natural interval evaluation of the mean value extension computes an enclosure smaller than the obtained by the factored form.
1.4. Prove the inclusion monotonicity property of the interval arithmetic square operator.

### 2. Interval Newton

Consider the function: $f(x) = (x-1)^2 - e^{x-3}$

2.1. Define the interval Newton function for the polynomial.
2.2. Evaluate the interval Newton function in [0.4, 0.8] and in [0.8,1.2].
2.3. From the above evaluations what can be concluded with respect to the existence of roots within those intervals.

### 3. Constraint Propagation

Consider the constraints below and a box $B$ = [2,3]×[3,5]

c1: $(x-4)^2 - y \leq -1$

c2: $x^2 - 4x + y \leq 0$

3.1. Is the system hull-consistent in box $B$?
3.2. Is the system box-consistent in box $B$?
3.3. Can you reduce box $B$ by applying HC4-revise on both constraints? Justify.
3.4. Apply HC4-revise to constraint c1 with an initial box $B'$ = [2,3]×[0,2].
3.5. What is the box obtained by applying BC3-revise on both constraints with the initial box $B'$?