

Real solving

We start by reading the file containing the main functions. This set of programs is not a very efficient, neither robust one. It was only made to illustrate notion treated in the lectures.

```
> read("/Users/ruatta/AGCD/isolation.maple");
0 (1)
```

Root counting

We give here some instance of the use of the function to count the real roots of univariate polynomial lying in a interval.

```
> f := expand((x-1)*(x-4/7)*(x-24/5));
Sf := StHaSeq(f, x);
f := x^3 - 223/35 x^2 + 284/35 x - 96/35
Sf := [x^3 - 223/35 x^2 + 284/35 x - 96/35, 3 x^2 - 446/35 x + 284/35, -33092/11025 + 39818/11025 x,
160123716/396368281] (2)
```

Counting the number of roots of f in [-1,0]

```
> NbRealRoots(Sf, x, -1, 0);
0 (3)
```

The same but in [0,1]

```
> NbRealRoots(Sf, x, 0, 1);
```

Clearly, f(1)=0 and this computation is not safe.

Bad luck, at least one of the bound of an interval is a root of the polynomial

```
-1 (4)
```

The number of roots in [0,1.2]

```
> NbRealRoots(Sf, x, 0, 1.2);
2 (5)
```

It looks good. We look now in [0,10]

```
> NbRealRoots(Sf, x, 0, 10);
3 (6)
```

We change the polynomial :

```
> g := x^4 - 2;
g := x^4 - 2 (7)
```

```
> Sg := StHaSeq(g, x);
Sg := [x^4 - 2, 4 x^3, 2] (8)
```

```
> NbRealRoots(Sg, x, 0, 2);
1 (9)
```

```
> NbRealRoots (Sg, x, -2, 2);
```

2

(10)

Roots isolation

```
> IsolateRealRoots (Sf, x, 0, 4);
```

Again a very clear message thanks to the assertion made un IsolateRealRoots.

Bad luck, at least one of the bound of an interval is a root of the polynomial

Error, (in IsolateRealRoots) assertion failed, Bounds of intervals must not be root

```
> IsolateRealRoots (Sf, x, 0, 1.2);
```

$[[0, 0.6000000000], [0.6000000000, 1.2]]$

(11)

```
> IsolateRealRoots (Sg, x, -15, 2);
```

$\left[\left[-\frac{9}{4}, -\frac{1}{8} \right], \left[-\frac{1}{8}, 2 \right] \right]$

(12)

```
>
```