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 treaten in the lectures.

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

$$0 \quad (1)$$

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);
```

$$f := x^3 - \frac{223}{35}x^2 + \frac{284}{35}x - \frac{96}{35}$$

$$Sf := \left[x^3 - \frac{223}{35}x^2 + \frac{284}{35}x - \frac{96}{35}, 3x^2 - \frac{446}{35}x + \frac{284}{35}, -\frac{33092}{11025} + \frac{39818}{11025}x, \frac{160123716}{396368281}\right] \quad (2)$$

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

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

$$0 \quad (3)$$

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
```

$$-1 \quad (4)$$

The number of roots in [0,1.2]

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

$$2 \quad (5)$$

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

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

$$3 \quad (6)$$

We change the polynomial :

```
> g := x^4 - 2;
```

$$g := x^4 - 2 \quad (7)$$

```
> Sg := StHaSeq(g,x);
```

$$Sg := \left[x^4 - 2, 4x^3, 2\right] \quad (8)$$

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

$$1 \quad (9)$$

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

$$2 \tag{10}$$

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);
```

$$[[0, 0.6000000000], [0.6000000000, 1.2]] \tag{11}$$

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

$$\left[\left[-\frac{9}{4}, -\frac{1}{8}\right], \left[-\frac{1}{8}, 2\right]\right] \tag{12}$$

```
>
```