

## Lab 7

### Least squares approximation

Use Matlab functions *polyfit* and *polyval*.

1. The following table lists the temperatures of a room recorded during the time interval  $[1 : 00; 7 : 00]$ . Find the best linear least squares function  $f(x) = ax + b$  that approximates the table. Use your result to predict the temperature of the room at  $8 : 00$ . In the same figure, plot the points (Time, Temperature) and the least squares function.

Time	1:00	2:00	3:00	4:00	5:00	6:00	7:00
Temperature	13	15	20	14	15	13	10

2. The vapor pressure  $P$  of the water (in bars) as a function of temperature  $T$  (in  $^{\circ}C$ ) is:

$T$	0	10	20	30	40	60	80	100
$P$	0.0061	0.0123	0.0234	0.0424	0.0738	0.1992	0.4736	1.0133

- (a) Obtain the best linear least squares polynomial and use it to approximate the pressure  $P$  at  $T = 45^{\circ}$ .
  - (b) Obtain other two least squares approximations for the given data, for 2 different degrees of the polynomials. Find their values for  $T = 45^{\circ}$ .
  - (c) Compute in all three cases the approximation errors, knowing that the exact value is  $P(45) = 0.095848$ .
  - (d) Plot the interpolation points, the 3 least squares approximants and the interpolation polynomial, in the same figure.
3. Consider 10 random points in the plane  $[0, 3] \times [0, 5]$  using Matlab function *ginput*. Plot the points and the least squares polynomial of 2nd degree that best fits these points.