MATA123 Computational Linear Algebra and Geometry
Homework assignment — spring 2012

The homework assignment must be done **in groups of two persons or alone**. Copying from someone else is **strictly prohibited** including copying from the Internet. The assigment must be **delivered in time**, and the instructions given below must be followed. Late or incomplete assigments will not be accepted, so please be sure to read the instructions carefully!

Homework consists of four exercises which all must be completed.

In all the exercises below C is your (either one of you) date of birth (for example if your date of birth is 25.4. then $C = 25$). The codes must be included in the final report, and you should also explain in comments like `%Etsitään indeksit pisteille joiden etäisyys <1` what happens in the code.

1. Draw a picture of the function $f(x, y) = C\sin(6x)e^{-(x^2+y^2)/y}$ when $(x, y) \in [0, \pi) \times [1, 5]$. Write a file creating two images using `mesh` and `imagesc`. Arrange them side by side using `subplot`, save the image, and attach it as well as the code to your report.

2. Create a function `[X,Y,G]=ex2(n,m)` where n is number of points to x and m number of points to y direction. The returned `X,Y,G` should be such that they can be used to draw a picture (using `mesh`) in $(x, y) \in [0, \pi) \times [1, 5]$ of $g(x, y)$:

$$g(x,y) = \begin{cases} f(x,y), & \text{if } f(x,y) \geq 0 \\ 0, & \text{otherwise,} \end{cases}$$

   where $f(x, y)$ is as in Exercise 1. Give a title 'Positive part' and labels 'x', 'y' 'g(x,y)' to the image, and attach the picture and the function to your report.

3. Create vectors

```
x=0:10;
y=C*[106 128 133 168 183 192 216 241 269 289 293];
```

   Find the best approximating line in the least squares sense to this data. Give four different ways to solve the resulting problem $\min_b ||Ab - y||$ using MATLAB. Plot the points and the least squares line in a same figure and attach to your report.

4. Generate 3000 uniformly distributed points in $(-1, 1)\times(-1, 1)$. Then pick up those points that are in a unit disk $B(0, 1)$. Attach a picture of the original points, the points in the disk.
   Instructions: One way is to create vectors of uniformly distributed points that contain the x and y coordinates separately. To find points in the unit disk, create a vector r that contains the distances of all the points (x, y) from the origin. Then find indexes for $r < 1$ and use these indexes to plot the points.

Delivery

The assignment is delivered by email to the address

`mikko.j.parviainen@jyu.fi`

The work must be delivered **latest by Monday May 14th 2012**. The subject line must contain the text

```
MATA123 assignment
```

Remember to add your names to the report.

Acceptance

The assignments that are delivered in time will be either accepted or rejected. In some cases, minor corrections may be asked after the delivery.