MIE-MPI, Mathematics for Informatics - Homework no. 1

Instructions:

- You should try to solve all the exercises. Even if you do not do all the exercises, you can get all the points.
- Sign every paper of your solution on the top of the page along with the number of the homework.
- Presentation is taken into account; correct results themselves are not enough. The reasoning on how the result was found should be clearly visible.
- Comment your calculations in a reasonable way: the reader should understand what you do and *why*. The solution should be "possible to read", not "needed to decrypt".
- Do not answer unasked questions. It is important to know what is needed to solve the problem and what is not needed.
- If you use a result from another source than the lectures and tutorials, cite your source properly (do not forget to cite used software if applicable).
- The homework is a preparation for the next written test.
- The homework is collected at the tutorial (Thursday 24/10/2019). If you cannot come, you can use the mailbox at the Department of Applied Mathematics, 14th floor of building A. In the latter case, send me an email at `francesco.dolce@fjfi.cvut.cz` before the deadline.

Exercice 1. Find all critical points, saddle points and all points of minima or maxima of functions

(a) $f(x,y) = (x-1)^2 + y^2 - 17$,

(b) $f(x,y) = (2x - y + 1)^2$,

(c) $f(x,y) = x^3 + y^3 - 3xy$,

(d) $f(x,y) = x^2 + y^2 - 4\ln x - 10\ln y$.

Exercice 2. Let $f(x,y) = x^2 - 2y^2 - 6yx + 3$. Find minima and maxima of f subject to $x + y = 7$.

Exercice 3. Calculate

$$\iint_D (x^3 y + y^2 x^2 + 1)\,\mathrm{d}x\,\mathrm{d}y$$

where D is equal to:

a) $[0, 2] \times [0, 1]$;

b) the triangle with vertices $(0, 1), (1, 1)$ and $(0, 3)$;

c) the bounded subset of $\mathbb{R}^2$ which is delimited by the x-axis, the line having equation $y = 2x - 1$ and the line having equation $y = -(x - 2)^2 + 8$.