

Evaluation Project 1, TMA4215 Autumn 2015

Out of a maximum of 10 points, the table below shows the score for each group. On the next page, you will find some general comments on the most common errors.

Group nr.	Student numbers				Points
1	738010	741957	731915		9.0
2	732343	731867	741959	741966	9.5
3	763475	715013	725093	730608	9.0
4	724650	705729	764227	724056	9.5
5	750344	750323	742146		10.0
6	723807	749294	757590		9.0
7	763483	763429	729532	763616	10.0
8	752110				6.0
9	732318	729611			9.0
10	739550	739556			9.5
11	750394	750338	750342	752074	9.5
12	348337				9.5
13	748398	750382	750280		9.0
14	764772				9.0
15	764922	741731			9.5
16	747991	747992	748007		9.0
17	741645	750320	750496	759161	9.5
18	764395	764774	764183	764105	8.0
19	750403	750366	740095		10.0
20	764144				9.0
21	750352	750345			8.5
22	758339	758348			10.0
23	750346	741665	750551	750400	9.5
24	748003	750572			9.5
25	741379				9.0
26	701017				6.0
27	732074				8.0
28	730797	764958	764595	764885	10.0
29	764080	502085			7.5
30	764310				9.0
31	724267				9.5
32	737997				9.0
33	741437				8.0

Most common errors

- Problem 1e: When showing that a function g is a contraction on $[a, b]$, the inequality

$$|g(x) - g(y)| \leq L|x - y|, \quad 0 < L < 1,$$

should hold for all $x, y \in [a, b]$. It is *not* sufficient to show that it holds only for the endpoints a and b . Moreover, some of you have forgotten to show that $g(x) \in [a, b]$ for all $x \in [a, b]$, which is a necessary assumption for the Contraction Mapping Theorem.

- Problem 1e: When applying the contraction mapping theorem on g_3 for the interval $[1, 2]$, you need to show that $g_3(x) \in [1, 2]$ for all $x \in [1, 2]$. Most of you have correctly commented that $g_3(1) = \sqrt{5} \notin [1, 2]$. However, to overcome this problem, one can try to extend the interval so that the assumptions of the Contraction Mapping Theorem apply. Using $[1, \sqrt{5}]$ works.
- For the Newton solver, almost all of you have implemented a wrong stopping criteria for the iteration loop. It was specified that the stopping criteria should be $\max_i |f_i(x)| \leq \epsilon$. If the MATLAB-variable \mathbf{f} is a vector with the function values of f at the current iteration x_k , then the correct way to check for convergence would be: $\max(\text{abs}(\mathbf{f})) \leq \text{tol}$.
- Some of you have forgotten to print a warning message if the iterations did not succeed. This can be done in a variety of ways, e.g., one can check the flag `iFlag` and print a warning message if this says "not success" (the most common way is to set `iFlag = true` if success and `iFlag = false` if not).
- Many of you use symbolic variables and functions to define \mathbf{f} and its Jacobian J_f . The intention was that you simply should explicitly calculate \mathbf{f} and J_f in `testProblem.m`, e.g., like this:

```
function [f, J] = testproblem(x)
f = [x(1)^2 - 2*x(1) - x(2) + 0.5; x(1)^2 + 4*x(2)^2 - 4];
J = [2*x(1) - 2, -1; 2*x(1), 8*x(2)];
end
```

Using symbolic variables is bad practice because it can really slow down your program and because this functionality is not available in all other programming languages. For this project, you have not been punished if you have used symbolic variables, but we strongly suggest you to not use it in the following of this course, especially not in the next project.

- Problem 3: A great portion of you were not able to set up the system of equations correctly. Some of you have sign errors and rounding errors. If we let the flow in pipe 4 be from left to right, then the first four equations are

$$\begin{aligned}q_1 - q_2 - q_3 &= 0, \\q_3 - q_4 - q_6 &= 0, \\q_5 + q_6 - q_7 &= 0, \\q_2 + q_4 - q_5 &= 0.\end{aligned}$$

Then the smaller two loops gives the equations

$$\begin{aligned}\Delta P_2 - \Delta P_4 - \Delta P_3 &= 0, \\ \Delta P_4 + \Delta P_5 - \Delta P_6 &= 0.\end{aligned}$$

The larger loop including pipe 2,3,5 and 6 are linearly dependent on these two, so we omit that one. Finally, the gauge pressure, P_0 , is equal to the sum of pressure drops through one possible path, s.t.

$$\Delta P_1 + \Delta P_3 + \Delta P_6 + \Delta P_7 - P_0 = 0.$$

One can also choose a different path and get another equation, but still one should get the same solution. It should be easy to verify that your obtained solution at least is reasonable.