SPSC Homework Guidelines

Daniel Arnitz, Paul Meissner

{daniel.arnitz, paul.meissner} @tugraz.at

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1 Introduction

This document is intended for all students doing homeworks at the SPSC Lab. It also contains an overview of the most common mistakes for some of our courses.

1.1 How should I use this document?

First of all read the general Section 2, which applies to all our courses. If you are taking a specific problem class at the SPSC lab, you might also want to read the most common mistakes section for that course.

1.2 What are the consequences if I do not follow these guidelines?

Within this document, you will find two types of items, which are marked either with exclamation marks ("!") or circles ("o").

> ! These items are mandatory. Violating these rules has consequences, which are typically point penalties.

> o These items are guidelines. Guidelines should help you to prepare your homeworks and to avoid common and unnecessary mistakes. This means you will not loose points if you violate one of those, however we strongly advise you to read and consider them. A common style also makes it easier for us to correct your homeworks.

1.3 Will this document be updated?

Yes, we will update and improve this document in the course of time. So please check for the most recent version, which is provided at our website www.spsc.tugraz.at

2 General Style Guide and Rules

2.1 Plagiarism, Cheating and Deadlines

! List all your references (except the course script / notes), especially in case of direct quotes. A note "source: Oppenheim, Schafer; Discrete-time Signal Processing" or the like is fully sufficient. *Please note that we will not accept any kind of plagiarism or cheating!*

! A deadline given as "*No later than* 2009/11/26" implies that 2009/11/27 00:00 is *too late.* The consequences for late submissions depend on the course.

2.2 Questions

o If you do not understand a question or think there is a mistake in the homework assignment: *just ask*! In principle, the best way to do so is a newsgroup posting (preferred way, if your course has one), or an email to the lecturer.

o If you find a mistake in this document, the authors will be thankful for your response.

2.3 SPSC homework and thesis template for LaTeX

o If you use LaTeX, you can use our template for homeworks and diploma theses. You can find it on our homepage (www.spsc.tugraz.at) in the teaching section. If you want to use it, please ask one of the authors of this document for username and password.

2.4 Style of homeworks

! Make sure your equations are correct and meaningful. For example, note that the convolution equation

$$y(n) = x[n] * h[n] = \sum_{i=0}^{N-1} h[n] * x[n-k]$$

is both erroneous and inconsistent in notation (see also Section 2.7). Pay attention to your notation, incorrect equations will lead to point penalties.

o Although PC-generated homeworks (LaTeX, Word, . . .) are preferred, *neat* hand-written homeworks are also okay.

o Avoid to cross out things. Use a pencil or something else that can be erased. If you use a ball-pen and make a mistake, cross it (~~like this~~) but do not scrawl the entire area.

o If multiple cross-outs cover more than a quarter of the page, please dump the sheet.

o If you work with a word processor to create your homework, use a formula editor to create formulas. Equations like `copt=Rxx^-1*p=E(x[n]x[n]^T)^-1*E(d[n]x[n])` are difficult to read and error-prone.

2.5 Protocols

! The protocol is an important part of your work. As such, it has to contain all your results, your conclusions and observations. If you are asked to compare something (e.g., a simulation result with different parameter settings), do not only write "there are differences", but also draw your conclusions *why* there are differences. Add *relevant* plots that show your results and support your conclusions.

! One protocol per group is sufficient. All group members however should contribute and understand the details of your homework.

! Make sure your derivations are traceable. Omitting steps that are essential in the derivation will lead to point penalties. In case your derivations become completely irreproducible, these penalties can become significant.

! Label your plots (name, values and units). For Matlab/Octave, use the commands `legend`, `xlabel`, `ylabel` (`zlabel`) and `title`. Also label every hand-written plot. Unlabeled plots will lead to point penalties.

o Try to answer questions explicitly and as short as possible. Making an answer longer does not in general increase its quality.

o Always double-check your results if possible (e.g., compare to theoretical values). If there is a huge difference between theory and your observations, try to find errors in your scripts / observations *before* you try to explain the difference.

o Store intermediate results to prevent accumulation of rounding errors. Stick to analytic derivations as long as possible.

o Make sure the contents of your plots can be identified. Do not combine $\sin(x)$ and $10^6 \cdot \sin(x)$ in one plot. Do not create a subplot for each single one of 20 coefficients ($\Rightarrow 0.5 \times 4$ cm per subplot). Have a look at Figure 1.

o Do not add code listings to your protocol except where this is absolutely necessary or explicitly requested by the homework problem sheet or the lecturer.

o Do not explain your functions in detail unless they are really complex. Add a header and useful comments to your Matlab code instead (see also Section 2.6).

2.6 Matlab

! Create functions with the specified interfaces (e.g., `xcf(x,y,M)`) if you are asked to do so. Do not edit provided .m-files unless you are asked to do so. Non-compliant functions will not pass automatic checks, which in turn will cost you points.

! Submit *all* Matlab files you created. We have to be able to run your code without getting error messages.

o Always check the parameters (variance, mean value, . . .) of your input signals!

o Comment your code properly. State what you are doing and why, but do not comment every line like
`y=x+1; % here I'm adding 1 to x in order to get y`

o Add a header to your functions. At least functionality and input/output parameters of your functions should be explained when `help` is called.
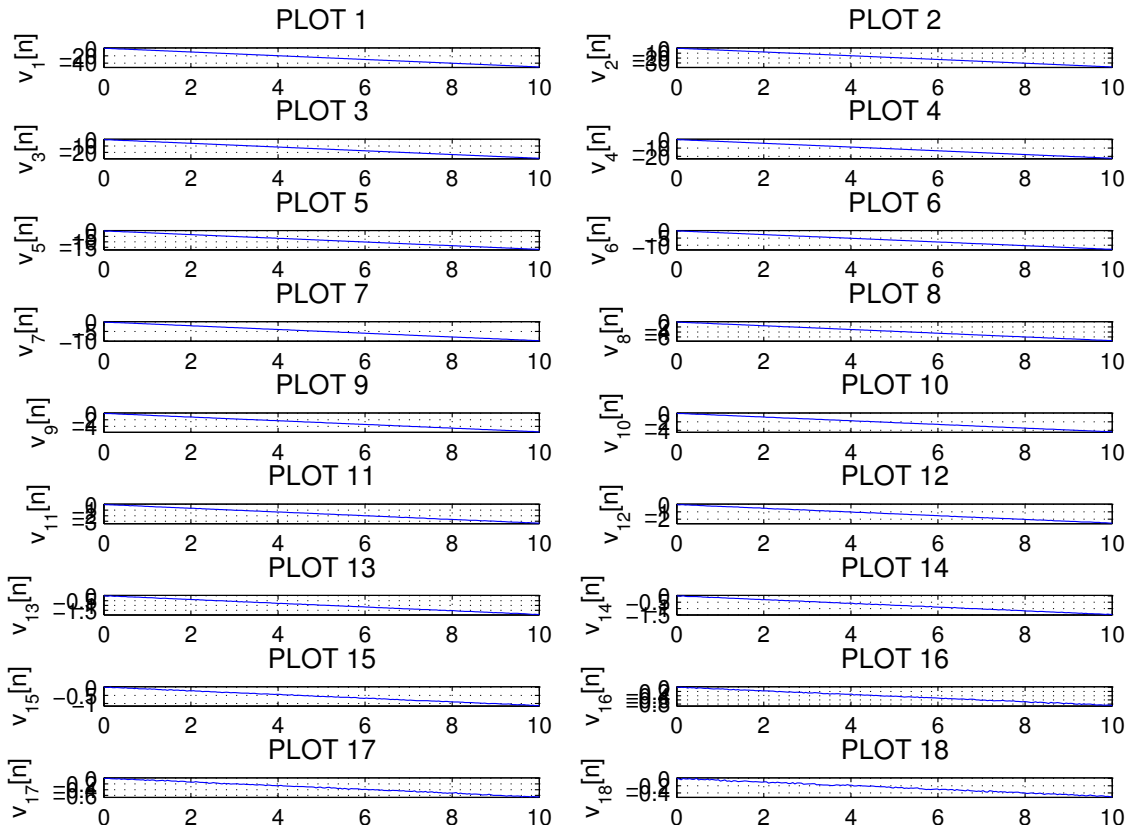
(a) Too many subplots
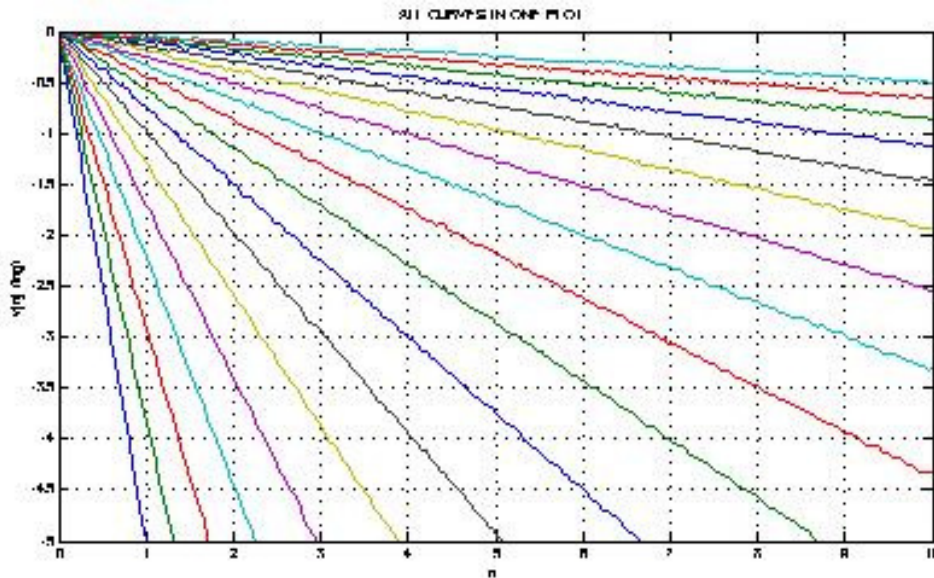
(b) Low quality

Figure 1: How plots should not look like. . .

o Start your script files with `close all; clear; clc;` Note that `clear all`, among other things, will also delete debug break points.

o Make sure your functions work for row *and* column vectors (i.e., add something like `x = x(:);` for each input vector at the beginning of your function to make `x` a column vector regardless of its prior orientation).

o If you use `filter` instead of `conv` to implement a linear FIR filter in Matlab you don't have to bother with the output vector length.

o You can use Matlab's `saveas` command to save your pictures as graphics. Use vector graphics if possible.

2.7 Mathematical Pitfalls

! Please distinguish between functions $g[n]$, scalars g and vectors $\underline{g}$. For example
$$E\{x[n]g[n]^T x[n]\} = E\{x[n]^2 g[n]\} \neq E\{\underline{x}[n]\underline{g}^T\underline{x}[n]\}$$

! Use $a[n] * b[n]$ only for convolution. A multiplication should look like $a[n] \cdot b[n]$ or $a[n]b[n]$. The term $\underline{a}[n] \times \underline{b}[n]$ is a cross product between two time-variant vectors while $N \times M$ is the size of a matrix.

o $y[n] = \underline{g}[n]^T\underline{x}[n]$ means the system $G\{\cdot\}$ is time-variant, with a transfer function $G(z, n)$. Write $y[n] = \underline{g}^T\underline{x}[n]$ if it's not.

o Please use square brackets for discrete functions and round brackets for continuous ones. For example, $y(t)$ is continuous while $y[n]$ is discrete.

3 Most Common Mistakes: Adaptive Systems

! Always check the parameters of your input signals...

! Be careful: $r_{xy}[k] = r_{yx}^*[-k] \neq r_{yx}[k]$ (* is the complex conjugate). Only the auto-correlation function for real signals is symmetric

$$r_{xx}[k] = r_{xx}[-k] \text{ if and only if } x[n] \in \mathbb{R}$$

This is of course also true for estimators

$$\hat{r}_{xy}[k] = \frac{1}{N} \sum_{n=0}^{N-1} x[n]y[n-k] \quad \neq \quad \hat{r}_{yx}[k] = \frac{1}{N} \sum_{n=0}^{N-1} y[n]x[n-k]$$

! Use the definition given in the lecture course for auto- and crosscorrelation function. If you do not, keep in mind that some derivations and subsequent definitions depend on the notation of auto- and crosscorrelation function and have to be modified accordingly.