

ISS 2017/18 intro

Honza Černocký, ÚPGM FIT VUT

Agenda

- organization
- Targets
- A bit of motivation
- program of the course
- Evaluation
- Sources
- Note on begin physically at FIT

Organization

Web

- <http://www.fit.vutbr.cz/study/courses/ISS/>
- <http://www.fit.vutbr.cz/study/courses/ISS/public>

Organization

- 2 lecture groups 1 x week, 3h, 2 breaks.
- Tuesday – Czech, Friday - ENGLISH.
- **Numerical exercise** 1 x 14 days, 2h. 3 groups weekly are ENGLISH. Registration in WIS, hopefully OK. Self-study, tests.
- Ex computer labs for self-study, **project** on their basis.

Organisace II.

- Numericals on Thu 28.9. cancelled (and then more cases during the semester), come to any other group within the 14-day block
- Forum on Google groups,
<http://www.fit.vutbr.cz/study/courses/ISS/public/forum.html>
 - For registration, the anti-robot answer is „Šebestova pomůcka“.
 - Please use Search before asking question.
- Recognition of points from exercise and project - 2 years back, email me, I will assign points in January.

Who will teach ?

- Lectures - Honza Černocký - myself
- Numerical exercises: assistants and PhD students of DCGM



Franta Grézl



Láďa Mošner



Katka
Žmolíková



Murali Karthick
Baskar (EN)



Karel Beneš



Miro Skácel



Olda Kodym



Anna Silnova
(EN)

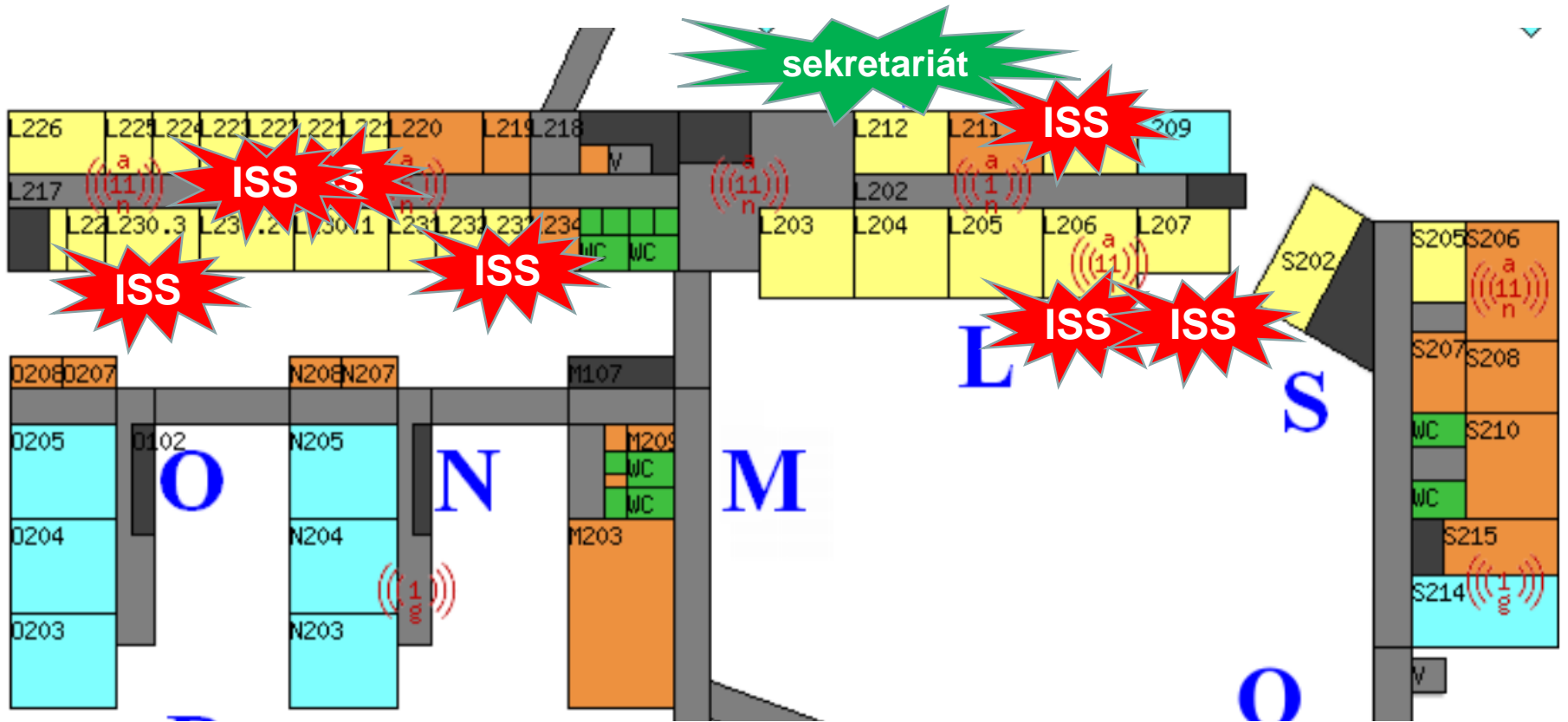
Contacts

- <http://www.fit.vutbr.cz/~cernocky>
- <http://www.fit.vutbr.cz/~grezl>
- <http://www.fit.vutbr.cz/~imosner>
- <http://www.fit.vutbr.cz/~ibenenes>
- <http://www.fit.vutbr.cz/~izmolikova>
- <http://www.fit.vutbr.cz/~baskar>
- <http://www.fit.vutbr.cz/~iskacel>
- <http://www.fit.vutbr.cz/~ikodym>
- <http://www.fit.vutbr.cz/~isilnova>

Contacting us

- By email
 - Please use subject „ISS“
- Personally
 - Anytime before/during/after lecture or exercise.
 - If other time, please make appointment by email.
 - Honzu can be caught using DCGM secretaries – Sylva Otáhalová and Jana Slámová, next to the staircase in „L“ building
- **In case of generally interesting question, use the forum !**

Finding us at DCGM



Goals of ISS

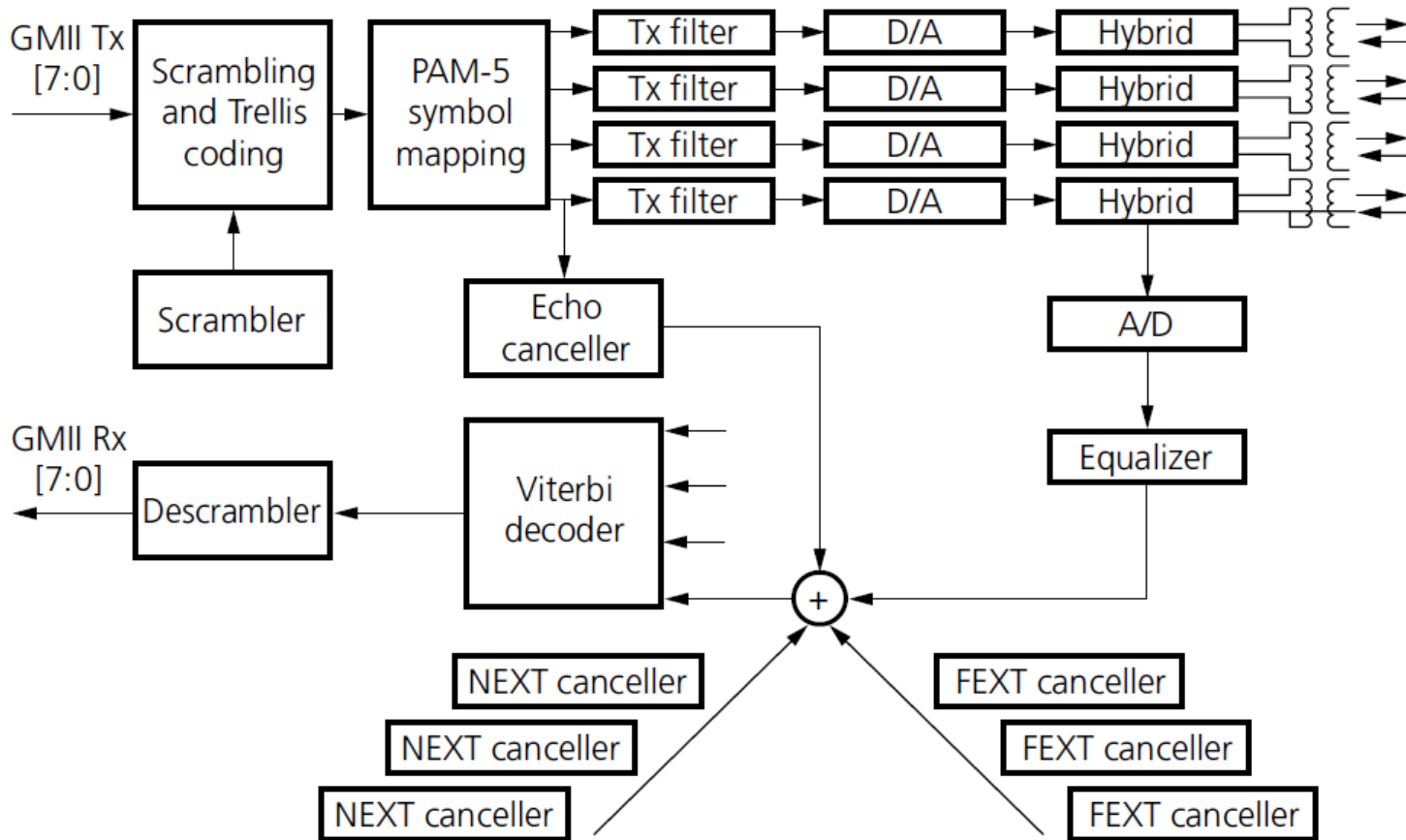
To learn and understand basic theory of signals and linear systems with continuous and discrete time. To introduce to random signals. The emphasis of the course is on spectral analysis and linear filtering - two basic building blocks of modern communication systems.

Praktically

- Filtering – “how to change it”.
- Spectral analysis - „how to look inside“
- Random signals – „nothing around us is 100% sure“

Motivation I – Gigabyte Ethernet

FIGURE 16. Architecture of a 1000BASE-T Transceiver



Source: 3COM

Motivation III – make \$



Karel Janeček ... is co-owner (23.6 %) and president of board of RSJ, ...

MP3

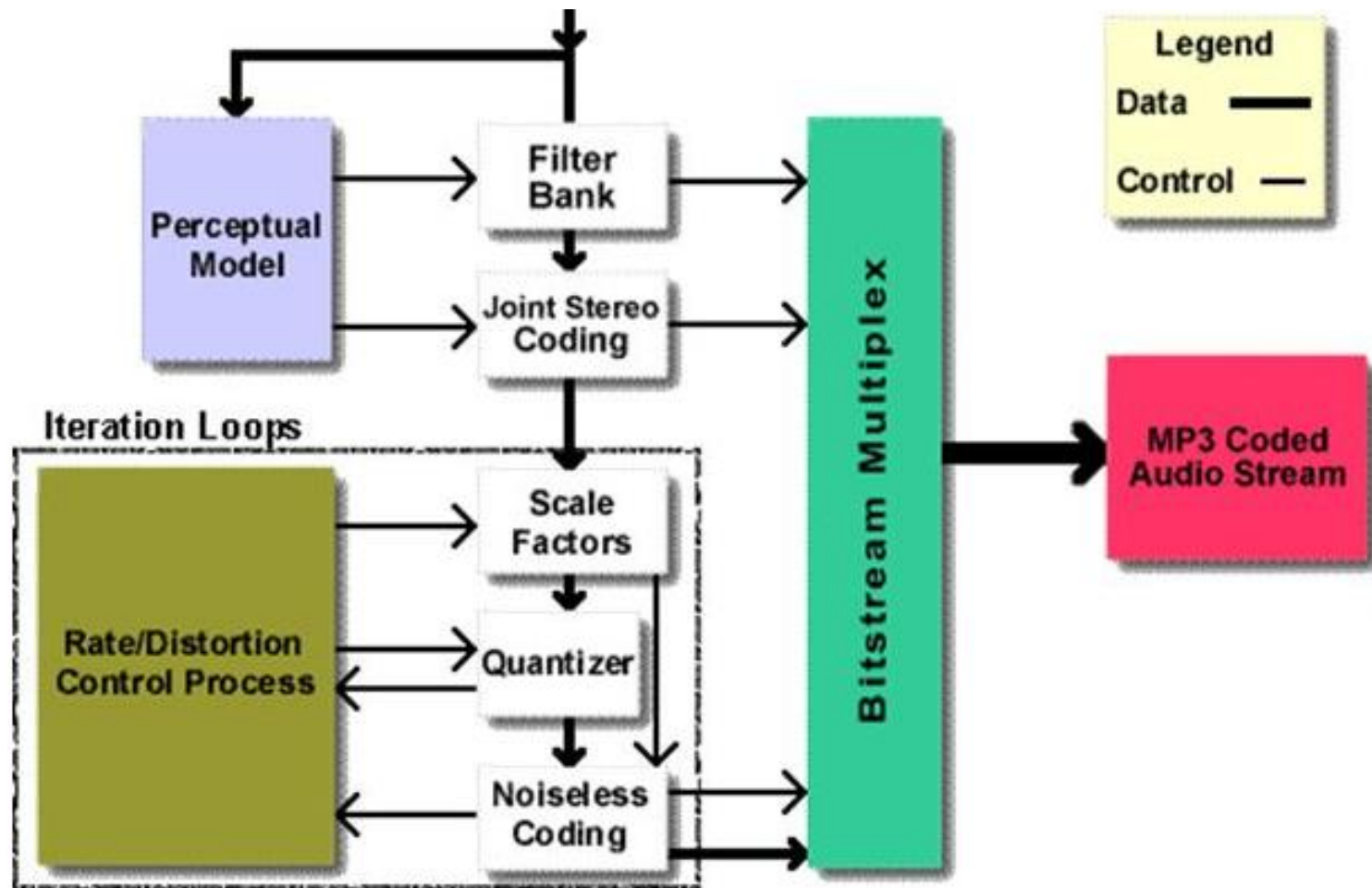
sound quality	bandwidth	mode	bitrate	reduction ratio
telephone sound	2.5 kHz	mono	8 kbps	96:1
better than short wave	4.5 kHz	mono	16 kbps	48:1
better than AM radio	7.5 kHz	mono	32 kbps	24:1
similar to FM radio	11 kHz	stereo	56...64 kbps	26...24:1
near-CD	15 kHz	stereo	96 kbps	16:1
CD	>15 kHz	stereo	112..128kbps	14..12:1

Ukázka:

```
-rw-r--r-- 1 cernocky speech      62274 Feb 19 15:33 sinf.mp3
-rw-r--r-- 1 cernocky speech    674776 Feb 19 15:43 sinf.wav
```

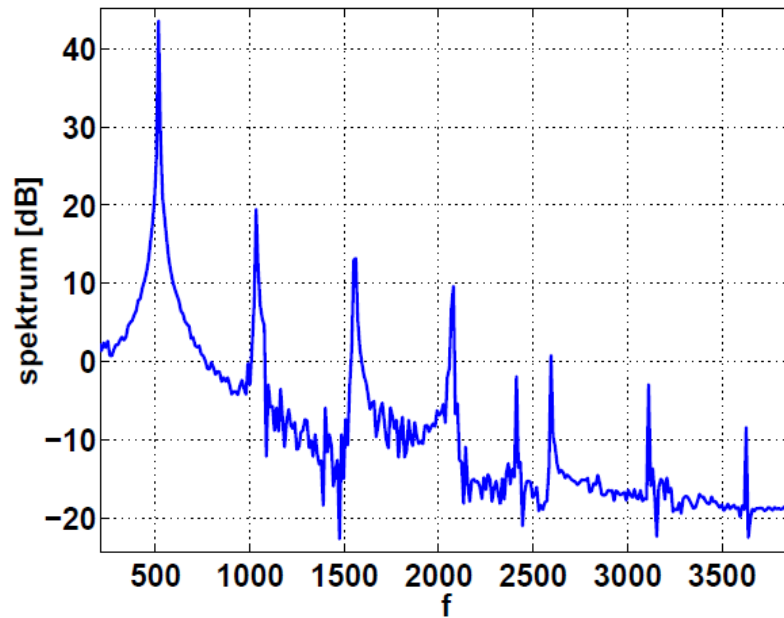
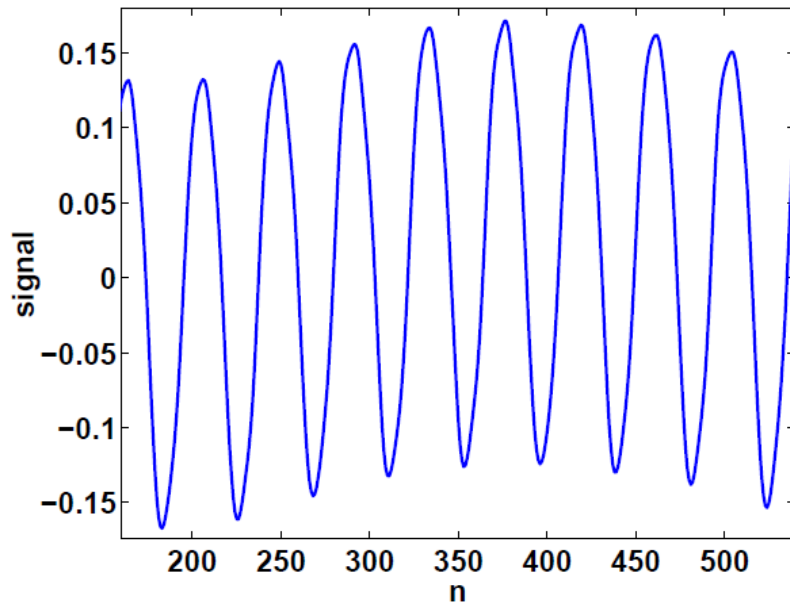
„Physical demonstration“

... and implementation



Try it out fast – sopranino recorder ...

```
s = wavread('SIG/out.wav'); x = s(7100:9147);  
X = fft(x);  
f = (0:1023)/2048 * 44100 / 2;  
plot (f, 20*log10(abs(X(1:1024))));
```



Hraji na frekvenci 517 Hz. Co to je za tón ?

$a_1=440\text{Hz}$, posun mezi tóny je $q = \sqrt[12]{2}$, $440 \times q^3 = 523 \dots$ takže je to c2 a jsem pěkně nízko... a je tam toho mnohem více než jen 517 Hz!!.

Program

1. Intro and basics of used maths
2. Digital filters - fundamentals and practical usage
3. Frequency analysis using DFT - fundamentals and practical usage
4. Image processing (2D signals) - fundamentals and practical usage
5. Random signals - fundamentals and practical usage
6. Intro to theory II, energy, power.

Program II.

7. Frequency analysis of continuous time signals
8. Continuous time systems
9. From continuous to discrete - sampling, quantization
10. Discrete signal sin more detail
11. Digital filtering in more detail
12. Random signals in more detail
13. Applications and advanced topics of signal processing

Numerical exercises

1. Complex numbers, cosines and complex exponentials and operations therewith
2. Basics, filtering, frequency analysis
3. Continuous time signals: energy, power, Fourier series, Fourier transform
4. Continuous time systems and a bit of sampling
5. operations with discrete signals, convolutions, DTFT, DFT
6. digital filtering and random signals

Numericals – organization

- **No PCs, paper and pencil !**
- **Complete assignments and solutions on the Web, go through them in advance**
- Program
 - 1h discussion and complicated things – prepare questions.
 - 5 min test for 2 points
 - Discussion continued – about the test, other exercises, etc.

Projekt – study part (ex computer labs)

1. Intro to Matlab
2. Projection to bases and Fourier series
3. Frequency analysis, filtering, working with sound.
4. Image processing
5. Random signals
6. Sampling and quantization

Matlab is paid ☹️

Computer labs should run also in Octave, but not tested, help needed.

Project

- Based on questions from computer exercises.
- Submitted as a short protocol (answers, graphs, ...)
- Use anything you like – Matlab, Octave, Python Notebook, ...

Project II

- Bonus exercise
 - Something harder for clever students.
 - No points, but bottle of French wine for best/most innovative solution
- Custom project possible
 - Can be linked to BP, work for company, project practice ...
 - Must be linked to ISS
 - Contact Honza.



Evaluation

- Tests in numerical exercises each 2b, total max **12b**.
- Half-semester exam, **NOTHING** allowed, full text, max **25b**.
- project – max **12b**.
 - Bonus exercise: no points, but la bouteille du rouge
- Final exam – max **51b**, **NOTHING** allowed, list of equations will be available. Full text.
 - Lower limit for passing 17 points.

Litteratura

- <http://www.fit.vutbr.cz/study/courses/ISS/public/>
- Oppenheim A.V., Wilski A.S.: Signals and systems, Prentice Hall, 1997.
- Jan, J., Kozumplík, J.: Systémy, procesy a signály. Skriptum VUT v Brně, VUTIUM, 2000.
- Šebesta V.: Systémy, procesy a signály I., Skriptum VUT v Brně, VUTIUM, 1997

Text for ISS being created right now, help needed.

Internet sources

- Wikipedie
- Youtube demos
- Online lectures from good universities (MIT, Stanford)

Video

- Oth CZ and EN lectures streamed and recorded
 - Standard video servers
 - <http://www.superlectures.com/fit-iss/>
(attention to sequencing!)

Good advice

Videoa by měla sloužit pouze jako **pomůcka** pro ty, kteří na přednášce nemohou být a jako pomůcka při učení. Pro hodně studentů se záznamy Bohů žel staly jediným zdrojem informací ke kursu, který shlédnou "tahem" 2 dny před zkouškou (můj speed-up coeff hje prý okolo 1.5x), a po zkoušce se jim opět okamžitě vypaří z hlavy. Nejen v ISS. **Toto je patologické použití záznamů a varuji Vás před ním ...**

Zobecnění dobré rady

Myslíte si, že

- Když umíte HTML/PHP, umíte vše z informačních technologií?
- „Těžké“ kursy na FITu (matematika, teoretická informatika, signály, ...) Vám v životě na nic nebudou a stačí, když je projdete s odřenýma ušima ?
- FIT dáte i když budete pracovat během studia na 100% úvazek ?

My, učitelé a výzkumníci na FITu, si to nemyslíme !

- Poctivé studium z Vás neudělá boháče během studia, ale drasticky zvyšuje Vaši cenu na trhu práce.
- Algoritmy Googlu, Facebooku, Amazonu a dalších velkých hráčů nestojí na HTML a PHP, ale na solidních teoretických základech.
- Na FITu funguje několik špičkových výzkumných skupin a pracujeme na evropských a amerických projektech, to opravdu „nedáváme“ s tím, co umíme ze střední školy !

**Chodit
do školy
se vyplatí !**

Summary

- (paper) notebooks, pencils !
- What goes through your hands will not be forgotten:
 - Write !
 - Draw !
 - Construct!
 - Program!
 - Visualize !
 - Try things out !
- Attend !
- Communicate
 - Speak to me and tutors!
 - Forum
 - (Mail)