T-61.5010 Information Visualization Examination

21st May, 2014

To pass the course you must also pass the term project (assignment). Results of this examination are valid for one year after the examination date. To get full points you must complete all of the problems 1-5. All of the problems have an equal weight. There are 50 points in this exam in total.

Answer in English. Please write clearly and leave a wide left or right margin. No extra material (calculator, lecture notes etc.) is allowed. Please write your answers preferably using a ballpoint pen, not a pencil.

PLEASE ANSWER EACH QUESTION ON A DIFFERENT SHEET!

The results will be posted to the course homepage in Noppa. No other announcement will be made.

There are 4 (four) pages in this examination. You can keep this paper.

1 Multiple choice questions

The following questions each have different proposed answers. Only one of them is correct. **For each question, you have to give your answer along with your confidence ("High" or "Low").** Grading for each of these multiple choice questions is then:

- +2 if answer is right and confidence is high
- +1 if answer is right and confidence is low
- 0 if answer is missing
- -1 if answer is wrong and confidence is low
- -2 if answer is wrong and confidence is high

Write on your answer sheet the correct answer (A, B, C, D, ...), along with the confidence you have (High, Low) for that question; e.g. "A, Low" is a proper way of answering a question. **Missing confidence for a question will be treated as "Low". Total score for this question is between 0 and 10.**

Question 1.

The hieroglyphs are a set of

A) sensory symbols;
B) arbitrary symbols;
C) sensory and arbitrary symbols;
D) None of the answers above is correct.

Question 2.

According to the CIE system of colour standards, in the chromaticity diagram

A) any set of three non-aligned coloured lights specifies a triangle. Only points on the edges of the triangle can be represented as a mixture of the given lights;
B) none of the realisable colours fall within the spectrum locus (the set of chromaticity coordinates representing single wavelength colours);
C) All the answers above are correct;
D) None of the answers above is correct.

Question 3.

In the theory of pre-attentive features, the conjunction search of two pre-attentive attributes

A) is always pre-attentive;
B) can be pre-attentive;
C) is never pre-attentive;
D) does not exist;
E) None of the above answers is correct.

Question 4.

Which affirmation is correct?

A) MDS (Multi-dimensional Scaling) preserves all distances;
B) CCA (Curvilinear Component Analysis) does not preserve small distances;
C) For MDS, the Stress is always increasing with the projection dimension;
D) MDS requires the coordinates of the original data to project (distances are not enough);
E) None of the above answers is correct.

Question 5.

The first principal component for PCA (Principal Component Analysis), Fig. 1, is given by

A) line *a*;
B) line *b*;
C) lines *c* and *d*;
D) line *d*;
E) PCA cannot be computed for this type of data;
F) None of the answers above is correct.

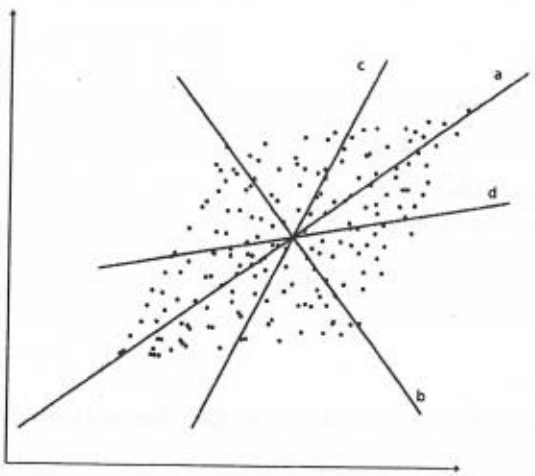

Figure 1: Which of the four lines is the first principal component?

2 Depth Cue Theory

Discuss and explain the Depth Cue theory, on the basis of the piece of art below.

Figure 2: Canaletto, *London: The Thames from Somerset House Terrace towards the City*, 1750-1751.

3 Concept definitions

Define and explain in a maximum of 4 lines per concept all of the following terms:

- Color
- Redundant data-ink
- Principal Component Analysis
- Lie-factor
- Geons

Instructions for concept definitions: Write in full sentences. The *maximum four lines* should be interpreted as *it can be fitted in four lines using a readable-size handwriting.* Concept definitions should give a precise meaning of a term (where available), or mention the most important aspects of a broad concept (if a precise definition is not available).

4 Essay 1

Explain the principle of Self-Organizing Maps and how they can be used for Nonlinear Dimensionality Reduction.
Maximum 2 pages, explain all the technical terms that are used in your essay.

5 Essay 2

Define Tufte's four fundamental graphical designs (i.e., Data-maps, Time-series, Space-time narratives and Relational graphics) and discuss their use using excellent examples from literature.
Maximum 2 pages, explain all the technical terms that are used in your essay.

Instructions for the essays: Write in full sentences and structure your answer in paragraphs. The essays should be understandable to your fellow student who has asked you to tell him/her about the topics (he/she has the necessary prerequisite information to take this course but has not taken it).

NOTE: Both essays are compulsory!