

i Cover page

1 Question 1 – General aspects of visualization

Which of the 8 statements are *true*? Which of them are *false*?

Correct answer gives **1** point for the statement, while wrong answer gives **-1** point.

If you answer *unsure*, you will get **0** points for that statement.

You need not motivate your answer.

You cannot get less than **0** points on the whole question.

a) Visualization offers a way to see the unseen.

True

☐

False

☐

Unsure

☐

b) Scientific visualization can handle both discrete and continuous data.

True

☐

False

☐

Unsure

☐

c) Human visual perception and cognition is irrelevant for scientific visualization.

True

☐

False

☐

Unsure

☐

d) The purpose of visualization of scientific data is solely to make pretty pictures.

True

☐

False

☐

Unsure

☐

e) Visualization is dependent on computer graphics techniques.

True

☐

False

☐

Unsure

☐

f) Visualization is often interactive.

True

☐

False

☐

Unsure

☐

g) Visualization is a reduction of data dimensionality to the 2D screen.

True

☐

False

☐

Unsure

☐

h) Evaluation of visualizations is based on qualitative methods.

True

☐

False

☐

Unsure










☐


Totalpoäng: 8

2 Question 2 - Evaluate ChatGPT for scientific visualization

Ersätt med din uppgiftstext...

Skriv in ditt svar här

Teckenf... ▾ | **B** *I* U \times_2 \times^2 | $\frac{1}{x}$ |   |    |   | Ω   Σ |



Ord: 0/500

Totalpoäng: 8

3 Question 3 – High-dimensional Data

Which of the 8 statements are *true*? Which of them are *false*?

Correct answer gives **1** point for the statement, while wrong answer gives **-1** point.

If you answer *unsure*, you will get **0** points for that statement.

You need not motivate your answer.

You cannot get less than **0** points on the whole question.

a) Glyphs can effectively represent as many as twelve parameters while maintaining readability.

True

☐

False

☐

Unsure

☐

b) Parallel coordinates are a visualization technique used to explore multivariate data by representing each data point as a polyline (or curve) connecting parallel axes.

True

☐

False

☐

Unsure

☐

c) When using t-SNE, the distances between points in the low-dimensional space do not directly correspond to exact distances in the high-dimensional space. The goal of t-SNE is to preserve similarities, not distances, so the visualization should be interpreted with this in mind.

True

☐

False

☐

Unsure

☐

d) UMAP is always a better alternative than t-SNE for visualizing high-dimensional data.

True

☐

False

☐

Unsure

☐

e) Principal Component Analysis and t-Distributed Stochastic Neighbor Embedding are both dimensionality reduction techniques.

True

☐

False

☐

Unsure

☐

f) t-SNE is primarily used for visualization in 2D or 3D, especially when the goal is to reveal clusters and patterns in the data, while PCA is often used for reducing dimensionality (to any dimension lower than the original) when the goal is to retain the most important features and reduce noise.

True

☐

False

☐

Unsure

☐

g) One important feature of t-SNE, compared to visualizing data with PCA, is that we always obtain the same visualization using t-SNE in each run, while PCA does not.

True

☐

False

☐

Unsure

☐

h) If data, such as feature vectors are large, it can make sense to first compress the data with PCA and then run t-SNE for visualizing the data, as long as just noise is removed.

True

☐

False

☐

Unsure










☐


Totalpoäng: 8

4 Question 4 – Contouring and Marching Squares

Ersätt med din uppgiftstext...

Skriv in ditt svar här

Teckenf... ▾ | **B** *I* U \times_2 x^2 | I_x |   |    |   | Ω  |  | Σ |



Ord: 0/500

Totalpoäng: 8

5 Question 5 – Visualization algorithms

Which of the 8 statements are *true*? Which of them are *false*?

Correct answer gives **1** point for the statement, while wrong answer gives **-1** point.

If you answer *unsure*, you will get **0** points for that statement.

You need not motivate your answer.

You cannot get less than **0** points on the whole question.

a) Stereoscopic rendering requires double update rate for the visualization to avoid flickering.

True

☐

False

☐

Unsure

☐

b) Hedgehogs is a technique for vector-field visualizations.

True

☐

False

☐

Unsure

☐

c) Iso-surfaces can be constructed using the Marching Cubes algorithm.

True

☐

False

☐

Unsure

☐

d) Interpolation techniques cannot be used to make iso-surfaces smoother.

True

☐

False

☐

Unsure

☐

e) The output for streamline renderings does not generally depend on the seed-points chosen.

True

☐

False

☐

Unsure

☐

f) Opacity combined with streamtube rendering is common for better visibility.

True

☐

False

☐

Unsure

☐

g) The rainbow colour map is a general good choice for visualizing data.

True

☐

False

☐

Unsure

☐

h) Illumination is sufficient as depth cue for 3D renderings.

True

☐

False

☐

Unsure

☐

Totalpoäng: 8

Document 1

Attached



Exam in Scientific Visualization
1TD389 & 1MD140
Tuesday January 9, 2024, at 08:00 – 13:00

During the course you have handed in group computer exercises giving a grade pass or fail.

At today's written exam corresponding to 3 hp, neither tools nor collaborations are allowed. This individual exam is on your knowledge after having followed and studied the course and will result in your grade 3 – 4 – 5 for the complete course of 5 hp or 7,5 hp (depending on which course you are registered for).

Our intention is that it should be quite easy to pass the exam, that is, *IF you have worked on and reflected on the assignments.*

The exam is divided into 5 questions on central topics during the course with each question having 8 points resulting in a maximum of 40 points for the written exam. Grades are given in the following way:

- ≥ 36 for grade 5
- ≥ 28 for grade 4
- ≥ 18 for grade 3

Good luck!

*/ Ingela Nyström
Anders Hast*

Question 2

Attached



Question 2 – Evaluate ChatGPT for scientific visualization

It has become widely spread to use ChatGPT for learning purposes.

Let's see how good (or bad?) ChatGPT is on our subject scientific visualization.

Question: Please, describe the visualization pipeline commonly used for scientific data.

Answer: The visualization pipeline for scientific data is tailored to handle complex and multidimensional datasets encountered in research with purpose to help scientists gain insights. The steps often include:

1. **Data Acquisition:**
Scientific data is obtained from various sources, such as simulations, experiments, sensors, telescopes, or laboratory equipment. The data may include numerical values, spatial information, time-series data, and other relevant attributes.
2. **Data Preprocessing:**
Raw data often requires preprocessing to clean, filter, and handle missing values. This step may involve data normalization, scaling, or transformations to prepare the data.
3. **Data Exploration and Analysis:**
Before creating visualizations, scientists often perform statistical analysis, clustering, or other methods to understand the characteristics and patterns in the data.
4. **Feature Extraction:**
It is common to extract specific features or variables, for example, identifying relevant parameters, isolating regions of interest, or extracting patterns and trends.
5. **Data Representation:**
Mapping the data to visual properties is crucial. Examples are representing numerical values through color gradients, using different shapes or sizes for data points, or employing contour plots to depict variations in data.
6. **Spatial and Temporal Mapping:**
Techniques to represent 3D spatial data, time-series data, or even multidimensional data through techniques like parallel coordinates or hyperspace mapping.
7. **Volume Rendering:**
For datasets involving 3D structures or volumetric data (e.g., medical imaging, fluid dynamics simulations), volume rendering techniques may be applied to visualize internal structures and variations.
8. **Integration with Simulation/Modeling:**
In some cases, the visualization pipeline is integrated with simulation or modeling tools. This allows researchers to visualize and analyze simulation results in real-time or post-processing.
9. **Presentation and Publication:**
Once scientists have gained insights from the visualizations, they may present their findings in research papers, presentations, or interactive platforms. Effective communication of complex scientific information is a key aspect of the pipeline.

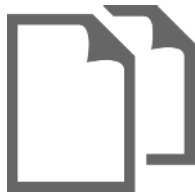
The visualization pipeline for scientific data is highly specialized and may involve domain-specific techniques and tools depending on the nature of the data and the scientific field.

Your task is to assess the correctness of the answer above and whether there are any weaknesses in the answer.

Maximum one A4 page, that is, no more than 500 words.

Question 4

Attached



Question 4 – Contouring and Marching Squares

What is the ambiguity problem in Marching Squares?

Describe two different ways of solving the problem.

Which solution is better than the other?

Why is it so?

Maximum one A4 page, that is, no more than 500 words.