TU Delft Delft University of Technology

Faculty of Architecture & the Built Environment

3D modelling of the built environment (GEO1004) — 5 ECTS

Location: A+BE Room R
Date & time: 18 May 2026, 13:45
Responsible teacher: Ken Arroyo Ohori

1. The subject matter is in full accordance with the study guide.
2. This midterm exam is not part of the final mark for the course.
3. All questions have equal weight in this exam.
4. Answer directly on these pages. If there is not enough space, use the extra sheet at the end.
5. This is an open book/computer exam, so you are free to check the course materials (videos/handouts/assignments), both printed or on your computer, as well as any other static materials you can find on the internet (eg technical books, documentation, articles). However, you are **not allowed to use LLMs** (such as ChatGPT, Gemini, Claude, or any other AI language model) during the exam, and **the use of your phone is forbidden**.
6. This midterm exam has 6 questions, and 8 pages.
7. Fill out your name and student ID.
8. You have 1 hour to do this exam.

Name: _____

Student ID: _____

Lesson 1.1

In your own implementation of Homework 1, **(a)** describe the data structures that you used (½ point) and **(b)** explain how you used them (½ point).

Lesson 1.2

(a) In your own words, why is it easier to use a half-edge data structure than a full-edge data structure? (½ point) **(b)** Illustrate with an example (½ point).

Lesson 2.2

Your employer asks you to calculate the volume of each building in a certain area. Each building is available as a *b-rep* stored in an OBJ file. **(a)** Describe the methodology you will use, knowing that the volume of a tetrahedron can be calculated with the formula in Equation 4.1 of the 3D book[1] (½ point). **(b)** Describe 2 pitfalls you might encounter (¼ point each).

[1] Should be in pages 37–39, depending on your version.

Lesson 3.1

In the voxelisation method presented in class (intersection targets), explain what is the relationship between the dimension of the targets and the dimension of the objects we want to voxelise.

Lesson 3.2

(a) Draw two CompositeSurfaces having the same topology: one should be valid according to ISO19107 and the other one should not be (½ point). **(b)** Explain briefly why the first is valid and why the second is not (½ point).

Lesson 4.1

You are given an AHN point cloud of Delft. Describe one useful thing that we could get from it using the distinction between interior and exterior MAT.

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