

# GEO1003 - Shared Notes

Master Geomatics Students

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# Introduction

This is the introduction to the notes.

## Example

### Introduction

The goal of this chapter is just to demonstrate how things should be organized. It will be removed from the notes in the end.

## Markdown Basics

### Resources and Helpers

A nice cheat sheet about Markdown can be found at this link: <https://www.markdownguide.org/cheat-sheet/>.

On VS Code, there are some nice extensions that can help you write Markdown files:

- Markdown All in One to provide useful shortcuts and commands
- markdownlint to properly format your Markdown files

Feel free to ask me if you have questions about Markdown.

### Comments

```
This <!--This is a comment.--> is  
<!--  
Comments are not rendered.  
They can take multiple lines  
-->  
a  
sentence.
```

This is a sentence.

### Headers

```
<!-- Comment the fist headers to avoid messing up the outline of this file -->  
<!--  
# Level 1  
  
## Level 2  
  
### Level 3  
-->
```

#### Level 4

##### Level 5

##### Level 6

## Level 4

Level 5   Level 6

## Bold and Italic

- Normal text
- **\*\*Bold text\*\***
- *\_Italic text\_*
- ***\*\*\_Bold and italic text\_\*\****
  - Normal text
  - **Bold text**
  - *Italic text*
  - ***Bold and italic text***

## Lists

### Unordered list:

- Unordered list item 1
- Unordered list item 2
  - Nested unordered list item

### Ordered list:

1. Ordered list item 1
2. Ordered list item 2
  1. Nested ordered list item

### Unordered list:

- Unordered list item 1
- Unordered list item 2
  - Nested unordered list item

### Ordered list:

1. Ordered list item 1
2. Ordered list item 2
  1. Nested ordered list item

## Links

[Example link] (<https://www.example.com>)

Example link

## Images

![Example image](../../images/example.jpg){ width="250" }



Figure 1: Example image

## Blockquotes

> This is a blockquote.

This is a blockquote.

## Code

Inline code: ``print("Hello, World!")``

Code block:

```
```python
def hello_world():
    print("Hello, World!")
```
```

Inline code: `print("Hello, World!")`

Code block:

```
def hello_world():
    print("Hello, World!")
```

## Tables

*Table: A simple table*

|          |          |
|----------|----------|
| Header 1 | Header 2 |
| Cell 1   | Cell 2   |
| Cell 3   | Cell 4   |

Table 1: A simple table

| Header 1 | Header 2 |
|----------|----------|
| Cell 1   | Cell 2   |
| Cell 3   | Cell 4   |

## Empty Section

An other section that is empty.

## Exams Overview

### How does GNSS work? (~20%)

#### Definitions

- Ephemeris
- Time-To-First Fix (TTFF) / Cold, warm hot
- Receiver clock bias
- Code-based differential
- C/A-Code (PRN)
- Pseudorange measurements
- Differential GNSS
- Carrier phase
- GPS spoof
- GPS jamming

#### Example questions

- What is the role of GNSS in timing information (think critical economic infrastructure)?
- How does the GNSS space segment effectively enable navigation?
- Why is it important to synchronise the GPS clock with ground-based clocks?
- Where are the ground-based clocks located?
- What is the cause of the receiver 'clock bias', and how is it resolved through the code-based positioning solution?

- How does code-based Differential GNSS ‘solve’, among other error sources, the travel-time delay of the signals through the ionosphere?
- What is the difference between GPS jamming and GPS spoofing?
- How do GPS jamming devices work?
- Is ... description of ... correct? Rephrase if not.

## GNSS performance (~20%)

### Definitions

- Dilution of precision (DOP)
- Horizontal dilution of precision (HDOP)
- Vertical dilution of precision (VDOP)
- Geometric dilution of precision (GDOP)
- Accuracy
- Precision
- Availability
- Continuity
- Integrity
- Real Time Kinematic (RTK)
- Network RTK
- Precise Point Positioning (PPP)
- PPP-RTK
- DGNSS
- Error sources
- 06-GPS

### Example questions

- How can the Time-to-First-Fix (TTFF) be significantly improved in GNSS-enabled, Wi-Fi/4G-connected, smartphones compared to stand-alone code-based, GPS receivers?
- What influences the fluctuation in DOP values?
- What are the reasons behind the higher values of VDOP throughout the day compared to HDOP?
- Which real-time positioning corrections have to be provided to obtain higher accuracy? Why are these corrections not just incorporated into the standard GNSS Services?
- Which fundamental issues cause the difference in horizontal and vertical accuracy of (e.g.) 20 cm versus 40 cm?
- How can the performance of each of the following parameters be improved: a) accuracy, b) precision, c) availability, and d) integrity?
- For positioning, does it matter where you are: a) at the North Pole, b) in the centre of a city in the Netherlands, c) somewhere at the Equator?
- What kind of corrections does 06-GPS offer, how are these corrections obtained, and how do they reach centimeter accuracy?
- Is ... description of ... correct? Rephrase if not.

## GNSS in the built environment (outdoor, indoor and in between) (~20%)

### Definitions

- Shadow matching
- Urban canyon
- Multipath

### Example questions

- Why is Wrong-Side-of-the-Street accuracy preferable for GPS precision over a general indication like '10 meters anticipated accuracy'?
- What features of Assisted GPS (A-GPS) enable achieving a time-to-first-fix (TTFF) of 1 second?
- What is shadow matching?
- Is ... description of ... correct? Rephrase if not.

## CRS (~10%)

### Definitions

- Geocentric CS
- Topocentric CS
- Ellipsoid
- Epoch
- Map projection
- Terrestrial Reference System
- Terrestrial Reference Frame
- Datum
- Coordinate system
- Coordinate reference system
- Transformation
- Conversion
- International Terrestrial Reference Frames (ITRF)
- Normaal Amsterdams Peil (NAP)
- Rijksdriehoeksmeting (RD)

### Example questions

- What could go wrong when users exchanging geoinformation in RD coordinates do not use the official RDNAPTRANS™ procedure between ETRS89 and RD?
- What are the needed operations for a transformation from ETRS89 to the Rijksdriehoeksstelsel?
- For what purposes is a more accurate geoid useful?
- What are the factors you would consider when choosing between different CRSs?
- What are the current issues concerning CRS?
- Is ... description of ... correct? Rephrase if not.

## Wi-Fi-monitoring / Fingerprinting (~20%)

### Definitions

- Wi-Fi-Monitoring
- Wi-Fi-Fingerprinting
- Location
- Position
- Yield
- Consistency
- Overhead
- Power consumption
- Latency
- Roll-out and operating costs
- Time of Arrival (ToA)
- Time Difference of Arrival (TDoA)
- Received Signal Strength (RSS)
- Angle of Arrival (AOA)
- Trilateration
- Path-Loss
- Fine Timing Measurement (FTM)
- Radio Frequency Identification (RFID)
- Inertial Navigation Systems (INS)
- Visual Based Indoor Localisation
- Isovists

### Example questions

- What is Wi-Fi Monitoring and Fingerprinting?
- What is Wi-Fi Triangulation?
- How would you redesign the layout and/or the way of working of a Wi-Fi-based solution inside the Faculty of Architecture and the Built Environment, such that you optimize the localisation/positioning of Wi-Fi performance?
- What is an opt-in and an opt-out?
- Is ... description of ... correct? Rephrase if not.

## Location awareness and privacy (~10%)

### Definitions

- IndoorGML
- I-Space
- sI-Space
- sO-Space
- O-space



**Example questions**

- What does the significance of decimal places mean in Lat/Long coordinates?
- Why is it useful to have detailed information about the surroundings?
- Can you navigate using only information of the route (not the surroundings)?
- How can IndoorGML help with indoor navigation?
- Is it legal for a hospital to get a real-time overview map of all visitors and employees?
- What is an opt-in and an opt-out?
- Is ... description of ... correct? Rephrase if not.