LO53 final test Name:_____

Duration: 2 hours**,** calculator and A4 R/V personal notes **only**

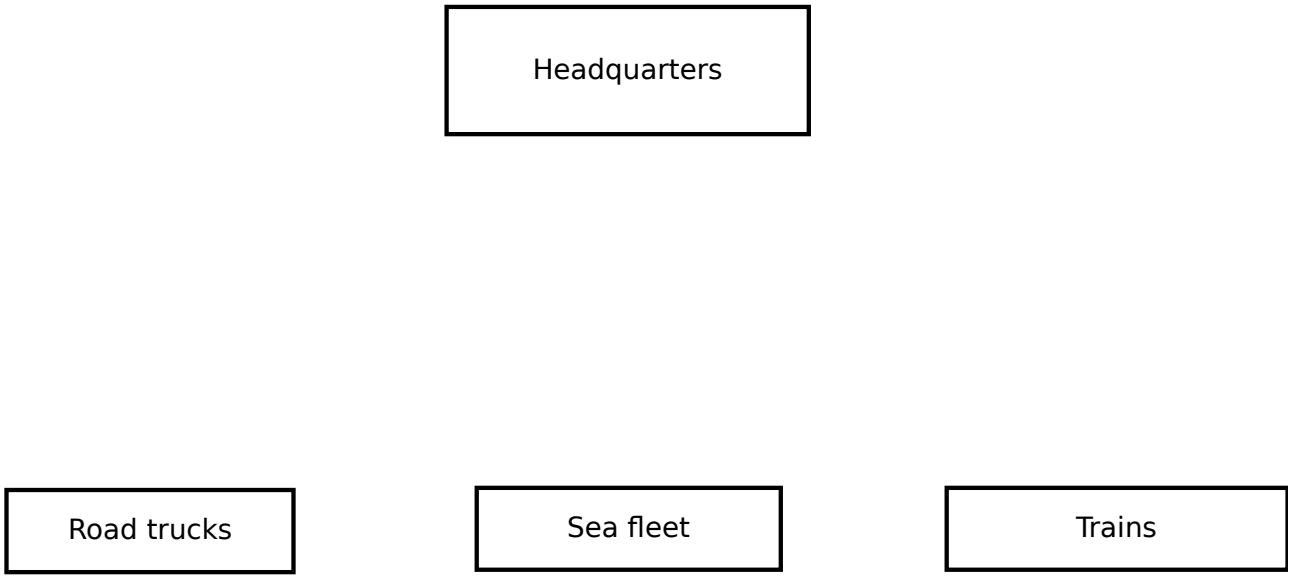
GNSS

Knowledge questions (3 pts)

1. Why do we qualify GNSS as « global »?
2. What is the difference between precision and accuracy?
3. In GPS, what is the rôle of the control segment?
4. What is the difference between triangulation and multilateration?
5. Which of the following systems is not a GNSS:
   - GPS
   - GLONASS
   - EGNOS
   - GALILEO
6. What is a GNSS augmentation system?

Exercise 1 (3 pts)

You are project manager for a global logistics company. Your boss has asked you to propose a system to follow all the transports in real time. Propose an architecture with its specifics (network, software, etc.) and their primary roles on the picture below :



Exercise 2 (3 pts)

Provide an algorithm to compute multilateration with the GPS iterative method.
Inputs are: $\mathbf{P_0}$, the initial location estimate, **S**, a N*3 matrix with satellites x, y, z coordinates (1 satellite on each line), **D** a N elements vector with distances from the satellites towards the GPS chip to be located (1 value for each satellite, each **D** element corresponding to the same index line in **S**.
You can use usual matrix operations, the M^{-1} operator to inverse a matrix, and M^T to compute the transposite of matrix M.

Exercise 3 (3 pts)

Let A (0.0, 0.0), B (10.0, 2.0), $(\widehat{\vec{AB}, \vec{AM}}) = 30.0°$ and $(\widehat{\vec{BA}, \vec{BM}}) = -60.0°$
What type of location calculation will you use to find M coordinates?
Compute M coordinates.

SIG

Knowledge questions (3 pts)

1. Which of the following are valid WGS84 coordinates ?
   - 115.0°N, 4.0°W
   - 115.0°, -65.0°
   - 47.0°S, 225.0°E
   - 47.8°N, 6.98°E

2. In WGS84, what is the meaning of :

Latitude :	◯X-coordinate	◯Y-coordinate
Longitude :	◯X-coordinate	◯Y-coordinate

3. Among the following softwares, pick the ones that are related to GIS?
◯Openstreetmap
◯QGIS
◯Oracle
◯Merkaartor
◯Microsoft Bing
◯OpenStack
◯Cartomancer
◯GDAL

4. Speed of the Earth's rotation is lower at the equator than at 45°N?
◯true
◯false

5. What are the 3 main types of information found in OpenStreetMap data extraction?

6. What limitation has the SHP file type?

Exercise 1 (2 points)

1. Let a WGS84 location lon=6.8°W, lat=47.6°S. Give its coordinates in mercator projection (between 0 and 1, starting in the upper left corner).

2. We want the corresponding tile in a zoom = 14. What are the tile x and y coordinates?

Exercise 2 (2 pts)

Due to the recent Google Maps drastic licensing change, you need to propose a solution based on OpenStreetMap to compute a grid of landuse (i.e. what kind of infrastructure is built and used for which purpose). You already have an API providing you with OSM queries for getting one particular type of infrastructure at a time: `query_amenity(TYPE)`.

1. Propose a data structure for the grid
2. Propose an algorithm (do not put too many details in the calculations) to compute the landuse for all of the types in an array named `landuses_types`;

Survey (1 pt)

During the LO53 module, how would you evaluate the difficulty of the following parts of the program:

Radio Link
◯ simple ◯ medium ◯ very difficult ◯ impossible

Indoor Positioning Systems
◯ simple ◯ medium ◯ very difficult ◯ impossible

GNSS
◯ simple ◯ medium ◯ very difficult ◯ impossible

GIS
◯ simple ◯ medium ◯ very difficult ◯ impossible

For each part of the program, what would have helped you to succeed better?

Radio Link

Indoor Positioning Systems

GNSS

GIS