NTNU – Trondheim
Norwegian University of Science and Technology

Department of Geography

Examination paper for GEOG3523 - GIS Data Capture and Mapping

Academic contact during examination:	**Hans Ola Fredin**
Phone:	**402 27 859**

Examination date:	**3rd June, 2015**
Examination time:	**3 hours**
Credits:	**7.5**
Grades to be announced on:	**24th June, 2015**
Permitted examination support material:	**None**

Language:	**English**
Number of pages:	**4**
Number of pages enclosed:	**0**

The exam is made up of three parts and you should answer all of them. The parts are weighted as indicated in the parentheses.

Part 1, **Briefly explain these concepts (20%):**

a) **Spatial resolution**, **spectral resolution**, **radiometric resolution**

and **temporal resolution**. Hint: give examples with satellite image and aerial photograph

b) "Raster", "TIN" and "Point Cloud"

c) Cartographic generalization

d) Visual hieararchy

Part 2, Cartography (40%)

Provide an assessment of the map shown on page 3. Which important map elements are present and missing? If you think the map could be improved, suggest some ways on how. Ground your answers on why these changes would improve the map. *The map is shown in landscape view on the next page!*

KAZAKHSTAN

Legend:
- —·—··— International boundary
- —···— Oblast boundary
- ✪ National capital
- ◉ Oblast capital
- ○ Town
- —— Main road
- —— Secondary road
- ┼┼ Railroad
- ✈ Airport

RUSSIAN FEDERATION

CHINA

KYRGYZSTAN

TAJIKISTAN

UZBEKISTAN

TURKMENISTAN

CASPIAN SEA

ARAL SEA

URAL MOUNTAINS

WEST KAZAKHSTAN
NORTH KAZAKHSTAN
EAST KAZAKHSTAN
SOUTH KAZAKHSTAN
QOSTANAY
AQTÖBE
ATYRAÜ
MANGGHYSTAÜ
QYZYLORDA
ZHAMBYL
ALMATY
QARAGHANDY
PAVLODAR
ASTANA

KAZAKH UPLANDS
BETPAQ DALA
Ustyurt Plateau
Caspian Depression

Cities and towns:
Öskemen, Semey, Georgiyevka, Beskol, Zaysan, Urdzhar, Ayaguz, Beskol, Taldyqorghan, Akshiy, Almaty, Bishkek, Snü, Shu, Akbakay, Furmanovka, Zhanatas, Zhambyl, Tashkent, Shymkent, Samarqand, Qyzylorda, Zhezqazghan, Sarysu, Saryshagan, Dzhambul, Balqash, Qaraghandy, Astana, Kokshetaü, Kzyltü, Petropavl, Kurgan, Chelyabinsk, Omsk, Karasuk, Kachiry, Lebyazh'ye, Kurchatov, Pavlodar, Bestamak, Qostanay, Rudnyy, Zhailma, Arqalyk, Turgay, Jorghay, Qarabutaq, Khromtaü, Embi, Aqtöbe, Qyyl, Dzhambeyty, Oral, Kalmykovo, Furmanovo, Ganyushkino, Atyraü, Beyneu, Shalqar, Aktumsyk, Yrghyz, Baikonur Cosmodrome, Zhetybay, Aksu, Aqtaü, Fort Shevchenko, Samarqand, Ishim

Rivers:
Irtysh, Ertis, Tobol, Ishim, Nura, Sarysu, Syr Darya, Shu, Ili, Amu Darya (Oxus), Ural, Volga, Zhem, Zhayyq, Tarim, Toxkan, Tekes

Lakes:
Zaysan Köli, Alaköl, Balqash Köli, Tengiz Köli, Ysyk-Köl

Ustyurt Plateau, Poluostrov Buzachi, Ostrova Tyuleni, Ostrova Vozrozhdeniya, Kazakskiy Zaliv

Scale: 0 100 200 300 400 500 km
0 100 200 300 mi

Baku (Bakı)

Part 3, Short essay (40%)

You have been employed as a GIS engineer for a geological project evaluating the ground water (subsurface water) potential across the border of Sweden and Norway. The groundwater can typically be found in soils filling the larger valleys in Norway and Sweden, very little groundwater is found in intervening highland areas.

You collaborate with other GIS engineers and geologists, and are getting data from geologists in Sweden and Norway. These data consists of point observations (samples from water wells), where the following data are given from the geologists.

- Well capacity (liters of water/hour)
- Depth to the groundwater
- Thickness of the water-bearing horizon (aquifer thickness)
- Chemistry of the water (concentrations of the most important chemical elements, for example Iron, Manganese, Calcium, Potassium,…)

The wanted result is one or several maps showing the volumes of ground water, interpolated from the well data (point observations). Overlayed on this map, or shown in separate maps, should be representation of well capacity and the main water chemistry.

Please discuss how you would solve the problem and how the resulting map(s) should look like. The following aspects should be discussed;

1. Choice of database model and database design
   a. Multi-user or single user database
   b. Which feature classes are necessary
   c. Which raster datasets wil be derived
2. Which GIS-operations are necessary to produce the resulting dataset(s)?
3. Discuss potential problems with different projections and geodetic datums across the Swedish-Norwegian border
4. Cartographic considerations and how you can efficiently communicate these data. Also briefly discuss potential web-map publishing. Make a scetch demonstrating how your map(s) would look like.