



PROFESSIONAL (Geodetic) EXAMINATION
Friday, November 28, 2003
9:00AM

TIME ALLOWED: Four (4) hours
OF QUESTIONS: Seven (7)

INSTRUCTIONS

Note: This is a closed book examination. No aids are allowed.

1. There are seven (7) questions. Please ensure that you have a complete copy of the examination.
2. Note the number of marks for each question before compiling your answers and allocate your time accordingly.
3. Place your exam registration number at the top right-hand corner of **each page** of your answers. **DO NOT** write your name on or in the book(s).
4. Each answer must begin on a new page, however questions may be answered in any order.
5. Reference each response to its question number, including subsection.
6. Write only on the right hand side of the examination book. You may wish to use the left (unruled) side for calculations, etc., however anything written on the unruled side will not be considered during marking.
7. Do not write in pencil.
8. This examination must be returned to the invigilator with your answer book(s).

TOTAL MARKS: 100
PASS: 65%

Question 1**(20)**

1. One of your firm's clients has approved an estimate to establish some third order GPS control stations at a remote northern Ontario exploration site. The site area is approximately 15 km by 15 km. The area is in rugged undulating terrain with dense bush. The area is interspersed with rough logging roads and trails, and there are just barely enough locations to set GPS stations with a minimum amount of obstructions.

The client has requested an approximate 7.5 km grid spacing of the GPS points for a total of nine. The client has also requested that the project be georeferenced to the Canadian Spatial Reference System (NAD83 datum). The closest existing control stations are about 200 km away and are of fourth order accuracy.

The network (absolute) accuracy must not exceed 50 cm in three dimensions. The local (relative) accuracy must not exceed 10 cm in three dimensions.

- a) Discuss the monumentation you would use to ensure the stability and retrieval of the GPS stations and how you would portray the information in the final report. (2 marks)
- b) You are instructed to leave Toronto and commence the project with yourself and two other persons with 3 GPS dual frequency receivers and one backup unit. Reference stations are not to be left unattended. Considering the size of the project area, the ruggedness of the terrain, and the GPS station spacing, outline your network design and observation strategy including observation times. Also discuss quality control checks that you would use to ensure the reliability of the field observations. Provide a brief comment on the issue of trivial (non-independent) and non-trivial (independent) baselines in your network design strategy. (6 marks)
- c) At the end of each day, and at the end of the last day, what checks would you apply to ensure the quality and security of the data, before leaving the site and returning to Toronto. (3 marks)
- d) Assume that the post-processing software package that you are using, uses a chi-square test on the a posteriori variance factor. You have done all the vigilant checks and there are no blunders to be found in the data, but the test still fails. This is a common problem with GPS software. What is the problem and what steps would you take to ensure that the test passes and why? (2 marks)
- e) To georeference the project network, briefly outline the procedures you would take, including the post-processing of all data acquired, to ensure an integrated survey that meets the project requirements. (5 marks)
- f) Before you leave the site for Toronto, the geologist-in-charge has made an additional request, which will be a cost-plus item. He wants a monumented backsight station for one of the GPS stations. Your reconnaissance reveals that there is not a suitable location for GPS observations and you decide to observe a solar azimuth. Would you observe the solar azimuth by the altitude method or the hour angle method and why? (2 marks)

Question 2**(10)**

You are a Certificate of Registration member employed by an engineering firm contracted to provide topographic plans, design, and layout for road reconstruction. In the course of doing the field work you find and tie in cadastral monument.

- a) How would you illustrate the cadastral information on the plans?
- b) What would you tell your client if he insisted that the highway limits be shown on the plan?
- c) The engineers complete the road design and use the property line as offsets for the construction. Two years after project completion and release of holdback it is discovered that the road was constructed on private property. What are the liability and responsibility issues for the firm and professional?

Question 3**(15)**

In order to conduct a successful GPS campaign, a systematic approach must be taken.

Describe a typical project scenario from conception to the delivery of the final results, for a GPS control survey of twelve points, designed to meet second order survey standards.

What areas of the project cycle must be given special attention and why?

Question 4**(9)**

- a) Define the geoid. (2 marks)
- b) State the methods and approaches to determining the geoid. What are the absolute and/or relative accuracies associated with these methods? (4 marks)
- c) Outline the implications of the geoid on modern positioning techniques. (3 marks)

Question 5

(15)

- a) Define the legal/business term "contract". (2 marks)
- b) What are the key elements of a binding contract? (7 marks)
- c) There are a number of methods for billing and estimating a contract. Identify three methods and briefly discuss the merits of each. (Advantages / disadvantages) (6 marks)

Question 6

(20)

Describe the characteristics and properties of the NAD27, NAD83(adopted), NAD83(CSRS) and WGS84 datums. (5 marks each)

Question 7

(11)

The Association of Ontario Land Surveyors is referred to as a "self-governing body."

- a) What are the obligations of our self-governing body? (4 marks)
- b) How does the Surveyors Act ensure that the public is served and/or protected by our Association? (7 marks)