

**CANADIAN BOARD OF EXAMINERS FOR PROFESSIONAL SURVEYORS**

**C6 - GEODETIC POSITIONING**

October 2017

**ote: This examination consists of 5 questions on 2 pages.**

Marks

Q. No

Time: 3 hours

Value   Earned

1.	<p>The coordinates of marker <i>A</i> are given with respect to NAD83(CSRS):</p> <p align="center"><b>Marker A</b> : N45°57'02."3453      W71°43'21."3478  <b>Marker B</b> : N45° 55'53."4327      W71°43'41."5612</p> <p>a) Explain the acronym NAD83(CSRS). Explain the difference between NAD83 (original) and NAD83(CSRS) in terms of realization, type of measurements included, precision, transformation between both.</p> <p>b) Estimate roughly the azimuth from marker <i>A</i> to marker <i>B</i>. (<i>just giving a numerical result without commenting on how you got it will not be accepted</i>).</p> <p>c) Explain (<i>without any actual numerical calculation</i>) how you obtain UTM coordinates for Marker <i>A</i> and the grid bearing (in UTM) from <i>A</i> to <i>B</i>.</p> <p>d) The marker <i>C</i> is located 300.000 m to the south and 200.000 m to the east of marker <i>A</i>. Calculate latitude and longitude of marker <i>C</i>. You may assume that the given values are distances on the ellipsoid. (<i>Just giving a numerical result without commenting on how you got it will not be sufficient</i>).</p>	10  5  5  5	
2.	<p>You are responsible for a local survey in a rural area. The network consists of 50 points distributed homogeneously over an area of 10 km x 10 km. Your task is to determine the UTM coordinates of all 50 points with respect to NAD83 (CSRS). An accuracy of 2 cm is required. At your disposition are 5 dual frequency receivers capable of RTK.</p> <p>a) Explain what RTK stands for and how it works. What type of GPS observations are used? Which accuracy can be achieved? Why are dual frequency measurements mandatory?</p> <p>b) What is a PDOP and how is it obtained? What is its use?</p> <p>c) Explain your strategy for solving this task and meeting the required accuracy in terms of number of reference stations used, occupation plan with rovers, ties to NAD83 (CSRS), total duration in days.</p> <p>d) The result you got from your survey are 3D Cartesian coordinates of all points with respect to NAD83 (CSRS). Explain what UTM stands for and how you transform the 3D Cartesian coordinates to UTM.</p>	10  5  10  5	

3.	<p><i>Quotation from a publication by David B. Zilkoski (NOAA) : There are several different height systems used by the surveying and mapping community. Two of these height systems are relevant to the International Great Lakes Datum of 1985 (IGLD 85): <b>orthometric heights</b> and <b>dynamic heights</b>. <b>Geopotential numbers</b> relate these two systems to each other.</i></p> <p>a) Define geopotential numbers and give their SI-units.</p> <p>b) Which <b>type</b> of measurements do you need to determine geopotential numbers? Explain <b>with formulas</b> how they are obtained.</p> <p>c) How do you convert geopotential numbers to dynamic heights?</p> <p>d) Define orthometric heights. How are they obtained from geopotential numbers?</p>	3 10 3 4	
4.	<p>The <i>International Earth Rotation and Reference Systems Service (IERS)</i> publishes the following Earth orientation parameters : <b>i)</b> polar motion (x,y), <b>ii)</b> universal time (UT1 – UTC, UT1 – TAI), <b>iii)</b> Celestial pole offsets (<math>\Delta\psi</math>, <math>\Delta\varepsilon</math>).</p> <p>a) VLBI is a geodetic space technique that contributes to the determination of the Earth Rotation parameters. Explain how VLBI works. Which EOPs can be determined by VLBI <b>only</b> and not by GPS? Justify.</p> <p>b) Explain what polar motion accounts for.</p>	10 5	
5.	<p>What is the name of the official new vertical datum in Canada? How has it been realized and how is it maintained? What are the advantages of changing to this new approach? Do you see any disadvantages?</p>	10	
<b>Total Marks:</b>		100	