

CANADIAN BOARD OF EXAMINERS FOR PROFESSIONAL SURVEYORS

C6 - GEODETIC POSITIONING

March 2017

Although programmable calculators may be used, candidates must show all formulae used, the substitution of values into them, and any intermediate values to 2 more significant figures than warranted for the answer. Otherwise, full marks may not be awarded even though the answer is numerically correct.

Note: This examination consists of 4 questions on 2 pages.

Marks

Q. No

Time: 3 hours

Value Earned

1.	The coordinates of marker A and marker B are with respect to NAD83(CSRS):		
	Marker A	Marker B	
	x = 1407349.667 m	x = 1407524.424 m	
	y = -4241325.964 m	y = -4241604.959 m	
	z = 4535832.190 m	z = 4535523.373 m	
	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.	12	
	b) Give a rough estimation (resolution of 0.1°) of the latitude and longitude of the marker A . (<i>just giving a numerical result without commenting on how you got it will not be accepted</i>).	6	
	c) Calculate the component of the vector AB (from A to B) with respect to NAD83(CSRS). Explain in details (<i>with equations but without any actual numerical calculation</i>) how you obtain a rough estimation of the azimuth from A to B.	6	
	d) Explain (<i>without any actual numerical calculation</i>) how you obtain UTM coordinates for Marker A and the grid bearing (in UTM) from A to B.	6	
2.	a) What are the differences between <i>ICRS</i> and <i>ITRS</i> in terms of orientation of the axes? Enumerate and explain the different earth rotation parameters (EOP) as published by the International Earth Rotation Service and their link to the transformation between <i>ICRS</i> and <i>ITRS</i> .	10	
	b) 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 and not by GPS? Justify.	10	

3.	<p>In November 2013, Natural Resources Canada (NRCan) has released the Canadian Geodetic Vertical Datum of 2013 (CGVD2013), which is now the new standard for heights across Canada.</p> <p>a) Which older vertical datum is CGVD2013 replacing? What are the major differences between the older and the new vertical datum (realization, maintenance, use)? What are the advantages of this change? Do you see any disadvantages?</p> <p>b) Explain how heights with respect to the new CGVD2013 can be determined from GPS. How does the approach change compared to using the old vertical datum?</p> <p>c) Explain how heights with respect to the new CGVD2013 can be determined from conventional leveling. How does the approach change compared to using the old vertical datum?</p> <p>d) You have to convert the heights of 40 markers distributed over an area of 1 km by 1 km from the old datum to the CGVD2013. You need an accuracy of better than 1 cm. How do you proceed?</p>	15 5 5 5	
4.	<p>GPS is a navigation system and the basic task is to provide the facility to determine instantaneously a 3D-position, worldwide and 24 hours a day independent on weather conditions.</p> <p>a) Explain in details how a standalone <u>low-cost</u> GPS receiver calculates its position. On which observations does it rely? Which unknowns are determined? Which additional information is needed and how does the receiver get this information? Which accuracy can be achieved?</p> <p>b) What does PPP stand for? What are the differences in this approach compared to the basic solution you explained in 2a) in terms of receiver type, observations used, unknowns, additional information and accuracy?</p>	15 5	
Total Marks:		100	