CANADIAN BOARD OF EXAMINERS FOR PROFESSIONAL SURVEYORS

SCHEDULE I / ITEM 6 **March 2009**
CARTOGRAPHY AND MAP PROJECTIONS

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 by the answer. Otherwise, full marks may not be awarded even though the answer is numerically correct.

Note: This examination consists of 7 questions on 2 pages.

Time: 3 hours

Q. No		Marks Value	Marks Earned
1.	a. Name 8 of the main parameters required in any geodetic map projection. b. Clearly explain two practical examples of when you may need to know the projection type and the projection parameters of a map. c. The Canadian base maps are produced on a series of projections for each individual province. This is done in order to keep the scale factor distortion in each province to a very low level. A company wishes to use only one projection in order to avoid having discontinuities. Area is not important, but the shapes of features should not have any great distortion. Design a suitable projection, given the range of latitude as 41°N to 84°N and the range of longitude as 52°W to 141°W.	4 6 10	
2.	The magnetic declination given on a 1998 (January) Canadian 1:50,000 Topographic Map for an area on the west coast is 20°E decreasing (moving westward) 6′ per year. The geodetic bearing of a hydro line on this map has been determined to be S18°44′30″W. Clearly showing the steps taken to arrive at the result, what is the October 2007 magnetic bearing of the hydro line?	5	
3.	The scale factor (k) at any point (x, y) on a UTM projection can be determined using the following formula: $$k = k_0\left[1+\frac{(x-x_0)^2}{2R^2}\right]$$ where k_0 and x_0 are the scale factor and the false Easting coordinate at the central meridian, respectively, and R is the mean radius of the earth. In a large-scale cadastral mapping of a region (with 360 km East-West extent), a scaling accuracy ratio of 1/10,000 is required and a modified Transverse Mercator projection (similar to UTM) is to be used. The radius of the earth in the region can be taken as 6,371 km. a. Determine the number of zones (showing the computational steps followed) and the scale factor (to 6 decimal places) to be used at the central meridian so that the scaling accuracy ratio remains within 1/10,000. b. What is the distance between the two secant lines in a zone while still maintaining the scaling accuracy of 1/10,000 in the region? c. If a single zone is used for the whole mapping region, what would the worst scaling accuracy ratio for the zone be, assuming the scale factor determined in (a) is adopted for the central meridian?	8 6 4	

4.	Explain the following as used in cartography a. Map scribing. b. Four-Color Process digital printing. c. Address matching.	3 3 3	
5.	a. Summarize in a table form, for each of these visual variables (size, orientation, shape, color hue), if they can be used properly for qualitative and quantitative data. (Place visual variables as rows; quantitative and quantitative data as two columns; for various levels of acceptability, use P for poor, M for marginally effective and G for good.) b. Explain with suitable examples, the reasons for choosing the visual variables in (a) for the qualitative data. c. List those visual variables in (a) that will be most suitable for line symbolization of maps, giving an example of typical data or feature in each case.	4 6 3	
6.	Clearly explain the essential differences between the following terms as used in cartography. Your explanations must demonstrate your understanding of each of the terms. a. Cadastral plan and cadastral map. b. Map exaggeration and map aggregation. c. Orthophotomap and orthophoto.	4 4 4	
7.	a. What are the implications of Internet on modern cartography? Explain your answers with respect to cost, map-making, map use, map reproduction and map positional accuracy. b. Discuss 5 of the major limitations of Internet mapping. c. Two most commonly used graphics file formats on the Internet are GIF (Graphics Interchange Format) and JPEG (Joint Photographic Experts Group). Which of these formats will you prefer in Internet mapping? Explain why.	10 10 3	
	Total Marks:	100	