CANADIAN BOARD OF EXAMINERS FOR PROFESSIONAL SURVEYORS

E-5 ADVANCED PHOTOGRAMMETRY

March 2012

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 10 questions on 2 pages.

Time: 3 hours

Q. No		Marks Value	Earned
1.	a) What is meant by Quality Assurance (QA) and Quality Control (QC)?	3	
	b) What are the factors that should be considered in the QA for a photogrammetric mapping mission?	4	
	c) What are the QC measures for evaluating the outcome from a photogrammetric mapping mission?	3	
2.	a) What are the parameters defining the Interior Orientation of a given camera?	3	
	b) What are the alternative methodologies for estimating the Interior Orientation Parameters of a given camera? Which methodology would you prefer? Why?	5	
	c) How would you classify the following cameras in terms of being normal, wide, or super-wide angle cameras (explain your answers): • 9" × 9" format size with 30 cm focal length, • 9" × 9" format size with 15 cm focal length, and • 9" × 9" format size with 8 cm focal length.	3	
3.	a) What is the main limitation of a digital frame camera when compared with an analogue one?	2	
	b) What are the different alternatives for stereo-coverage using line cameras?	3	
	c) How would the stereo-coverage alternatives associated with line cameras affect the Ground Sampling Distance (GSD) in the acquired scenes?	3	
4.	a) Discuss the differences between 2D and 3D rotation matrices in terms of number of elements in the matrix, number of independent parameters required to describe the corresponding rotation matrix, and number of orthogonality conditions that should be satisfied.	3	
	b) What are the main differences between the collinearity equations and Direct Linear Transformation models?	4	
5.	a) What is the role of the Interior Orientation (IO) in the photogrammetric reconstruction procedure?	2	
	b) What is the role of the geo-referencing in the photogrammetric reconstruction procedure?	2	
	c) What are the quantities measured by a GPS/INS system onboard an imaging platform? What are the main requirements for relating these measurements to the exterior orientation of the exposure stations?	4	
	d) Is it possible to incorporate a GPS/INS system onboard the imaging platform to facilitate object space reconstruction from a single image? Why?	2	
6.	a) What is the objective of image matching?	2	
	b) What is the conceptual basis of the cross-correlation image matching?	3	
	c) What is meant by image resampling according to epipolar geometry? How would this process facilitate the image matching procedure?	3	

7.	a) What are the differences between direct and indirect transformation during image rectification? Tabulate the advantages and disadvantages of each method. b) What is meant by the double mapping problem when generating orthophotos from large scale imagery over urban areas? c) Explain the conceptual basis of the z-buffer method for true orthophoto generation	4 3 3	
8.	a) What are the main components of an airborne LiDAR mapping system? b) What are the main factors affecting the size of the laser footprint? c) What is the conceptual basis of point positioning using a LiDAR system? d) What are the main advantages of LiDAR when compared to a photogrammetric system? e) What are the main advantages of a photogrammetric system when compared to LiDAR? f) How would you compare the intensity image generated from a LiDAR system to an optical image?	2 3 3 3 3 2	
9.	a) What is meant by data registration? Why is it an important issue? b) What are the characteristics and possible applications of an orthophoto? c) What are the different strategies for ortho-rectification of imagery? Tabulate the advantages and disadvantages of each method?	3 3 4	
10.	a) What is the fundamental challenge in multi-sensor photogrammetric triangulation involving imagery captured by frame and line cameras onboard aerial and satellite imaging systems? Why? How would you mitigate such a challenge? b) What are the main differences between the following bundle adjustment procedures: i. Photogrammetric triangulation through indirect geo-referencing, ii. GPS-controlled photogrammetric triangulation, and iii. GPS/INS-controlled photogrammetric triangulation?	4 6	
	Total Marks:	100	