



Mid Year 2005 Final Examination

University of South Australia

Student ID:		Student Name:	
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DIVISION OF INFORMATION TECHNOLOGY, ENGINEERING & THE ENVIRONMENT
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SCHOOL OF NATURAL & BUILT ENVIRONMENTS

Subject Area:	GEOE	Catalogue Number:	2012
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EARTH OBSERVATION SCIENCE 1

Examination Day: ????	Examination Date: ????
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Examination Time: ????	Length of Exam: 2 hours + 10 minutes reading time
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Examination Venue:	Ridley Centre/Royal Banquet Room/Other _____
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Instructions to Candidates
<p>Attempt ALL questions.</p> <p>Marks (percentages) for each question are as indicated.</p> <p>This is an open book examination.</p> <p>Programmable calculators are permissible.</p>



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QUESTION 1

(25 marks)

Consider that you have a single digital aerial photograph that covers an area of interest for which you need to produce an image map. The terrain in question is largely flat with undulations not exceeding 25 metres. A DTM with an accuracy of ± 5 metres is available but this would be at an additional cost.

The photograph is from a typical wide angle survey camera (focal length of 153 mm and format of 230 mm by 230 mm), is from a height above average terrain of 7,650 metres and is therefore of scale 1:50,000. It has been scanned in a precise photogrammetric scanner with a pixel size of 15 microns.

- (i) If we exclude polynomial rectification as a option discuss the methods of rectification that could be used to generate the image for the map.
- (ii) To investigate whether it is necessary to purchase the DTM compute the probable magnitude of the error that would exist in the rectified image by either using or not using the more accurate DTM. (*Note – consider that the area of interest completely fills the image format*).
- (iii) Comment on the control requirements in all cases.
- (iv) Give a brief account of the required operational procedures.

QUESTION 2

(20 marks)

In the manual (i.e. not automatic) triangulation of a block of stereoscopic aerial photography by way of the "bundle method" we undertake the sequential procedures of interior orientation (IO) and then exterior orientation (EO).

For **each of these procedures** give a brief description of

- the aim of the procedure;
- the observational procedure and "pointings" required including the number, position and nature of the observed points; and
- the method(s) by which we evaluate the success of the procedure.

QUESTION 3

(20 marks)

Consider that your photogrammetric company has received a roll of exposed and processed aerial photography (i.e. hard copy film images) covering a project area consisting of 10 parallel flight lines of 25 exposures each. The photography could be considered to be typical wide angle imagery with an average scale of approximately 1:10,000. Ground control points have not been pre-targeted. [*Note to students – this information should be taken to mean that the imagery is of a largish block of medium/large scale photography with otherwise typical photogrammetric specifications*]

The imagery is to be used to generate a seamless digital orthophotograph of the project area using digital photogrammetric techniques.

Outline each of the steps involved in this process being sure to include details of any automated processes that we could make use of and comment on the quality assurance (QA) considerations where applicable.



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QUESTION 4

(20 marks)

An area of undulating terrain is to be mapped with photography of an average scale of 1:38,000. The area of interest is 30 kilometres long by 20 kilometres wide and has terrain variations from 215 metres to 395 metres with the average being 305 metres.

The camera to be used is a super-wide angle camera of focal length 88.45 mm and format of 230 mm by 230 mm and the forward and side overlap are to be 60% and 25% respectively.

- (i) Determine the flying height of the aircraft and the variation in scale due to relief (i.e. the maximum and minimum scales).
- (ii) Compute the ground coverage dimensions and area of a typical neat stereo-model.
- (iii) Based on the average photographic scale and applying a factor of safety of 5% of the coverage of a single photograph determine the number of photographs required to completely cover the area of interest stereoscopically.
- (iv) Provide an annotated sketch showing the flight lines and exposures as well as the extent of stereoscopic coverage.

QUESTION 5

(15 marks)

Discuss any **ONE** of the following topics

1. **Image matching** is used in digital photogrammetry for the processes of automatic DTM extraction from stereo-pairs of digital photographs AND automatic tie point extraction from multiple overlapping imagery.
2. **Polynomial rectification** is a useful technique for correction of image distortions for small scale aerial photography and satellite imagery but is very much dependant on the array of ground control points.
3. **Image coordinate refinement** is necessary for attaining the highest order of accuracy from photogrammetric measurement.