UNIVERSITY OF SOUTH AUSTRALIA

DIVISION OF INFORMATION TECHNOLOGY, ENGINEERING AND THE ENVIRONMENT

SCHOOL OF GEOINFORMATICS, PLANNING AND BUILDING

Geodetic Concepts: GEOE 2009

Semester 1, 2003

Time Allowed: 3 hours + 10 minutes reading time

GENERAL INSTRUCTIONS TO CANDIDATES:
Open Book exam
Calculator required

Total Marks = 110

Attempt **all 5** questions, marks are shown in brackets.

Please ensure front of answer books are completed with your name, student I.D. number course and section of the examination.

ABBREVAITIONS AND CONSTANTS USED IN THIS EXAM

DATUM	ABBREVIATION	SEMI MAJOR AXIS	FLATTENING
Australian Geodetic Datum 1984	AGD84	6378160 metres	1/298.25
World Geodetic System 1984	WGS84	6378137 metres	1/298.257223563
Geocentric Datum of Australia 1994	GDA94	6378137 metres	1/298.257222101

UTM – Universal Transverse Mercator
GRS80 – Geodetic Reference System 1980
GPS – Global Positioning System

QUESTION 1

(a) In the 1790's Menchain and Delambre measured an arc of earth between Dunkirk and Barcelona to establish the meridian arc distance between the pole and the equator. They then defined the metre to be 1/10,000,00 of this pole to equator distance. Using the parameters for GDA94, (those of GRS80), calculate the percentage error in their calculation.

(10)

(b) The WGS84 spheroid and GDA94 spheroid have different flattening. Calculate the semi-minor axis, b, for each. Comment on the difference and when you would need to take it into account.

(10)

(c) When quoting eastings and northings in UTM metres it is often necessary to show four decimal places of a metre. Approximately what number of decimal places of a second of arc would this equate to for longitude and latitude in Adelaide, (latitude and longitude of Adelaide approximately 35^0S, 138^0 30'E)? Show all calculations.

(10)

QUESTION 2

Earth-centred cartesian coordinates can be derived from latitude and longitude by the following formulae:

$$X = (\nu+h)\cos\phi\cos\lambda$$

$$Y = (\nu+h)\cos\phi\sin\lambda$$

$$Z = ((b^2/a^2)\nu + h)\sin\phi$$

Where ν is the radius of curvature in the prime vertical at the point and h is the height above the spheroid (or ellipsoid) of the point.

Show that these formulae give meaningful results, in terms of the semi-major axis, a, or semi-minor axis, b, at the following three points on the spheroid

- At either pole
- On the equator at the zero meridian
- On the equator at a point 90° around from the zero meridian

(20)

QUESTION 3

(a) Define the following terms as they apply to map projections

1) Conformality
2) Equidistance
3) Equivalence

(6)

(b) The Stereographic, Universal Transverse Mercator and Lambert Conical Conformal projections are all examples of conformal projection. Discuss the differences between the three projections, including the projection surfaces, points/lines of contact, and distortion patterns. Also discuss appropriate applications for each projection.

(14)

QUESTION 4

When recording and exchanging positional data in either geographical coordinate or projection coordinate form can be used.
What are the advantages of storing in either manner, (include problems in processing the data into and out of each form).

(20)

QUESTION 5

"When converting AGD84 coordinates to GDA94 coordinates there is no magic switch that be thrown, or algorithm that will achieve this precisely, rather there are several ways of carrying out the process, some more accurate than others"

Discuss AGD84 to GDA94 conversion methods outlining the advantages and disadvantages of each.

(20)