GEOG205 Winter 2023: Midterm exam - sample questions

Exam is in 7-150 on Thursday 16 Feb, 10.30-11.20 (class lecture time) NOT on Moodle

Content: all lecture material until today - not including today (phew!)

Multiple choice

In the 19th century surveying techniques enabled accurate heights to be determined and the drawing of contours. Before that time, which was the main technique used to show the terrain on general or topographic maps ?

a. Hillshading	b. Hypsometric tints	c. Hachures
d. Shaded relief	e. Slope zones	

Italic lettering on maps is usually reserved for:					
a. Major features	b. Smaller features	c. Water features			
d. Mountain peaks	e. Political areas				

Short Answers

What is meant by grouping features using a NOMINAL (Categorical) classification ? For the full mark, give an example.

Coordinate systems and Georeferencing



Registered / georeferenced map layers

digital mapping needs coordinates

- Local for local mapping
- global for global datasets

Bear Sightings, Prince George 2004-2006



Registration vs Referencing

Registration: -lining up the layers together

Georeferencing: Linking layers to coordinates





Flat Earth options:- if only it was flat, this would be a very short lecture

We're pretty sure the Earth is not 'flat': the Rockies from Space Station



Eratosthenes, 240 BC: https://www.facebook.com/businessinsider/videos/10154023449809071

Coordinate map systems 1. The Earth's Graticule Latitude and Longitude

Political Map of the World, June 2002



- The graticule is the imaginary grid of lines running east-west lines of latitude (parallels) and north-south lines of longitude (meridians)
- The system was first devised by Hipparchus (190-120 BC)



Latitude

- Latitude = the vertical angle from the centre of earth to the location
- e.g. Prince George is at 54°N
 Quesnel is at 53°N
- [1° = ~ 111km]
- Latitude is 0 on the equator
- 'Sexagesimal system'
- 1 degree = 60' (minutes)
 [1' = ~ 2km]
- 1' = 60" (seconds)
 [1"=~30m]





Longitude

Longitude = the angle formed between line from centre of earth to the (arbitrary) <u>'prime meridian</u>' running through Greenwich, England and the local meridian. The O location is arbitrary (1884)



The Greenwich Meridian

Location

WGS84 lat/long

Marking date

Type

Access

...where east meets west

Home
Interactive UK map
Interactive World map
Visit
Royal Observatory Greenwi
Latitude and Longitude
Airy Transit Circle (ATC)
WGS84 and the Greenwich Meridian

The Greenwich Meridian before the ATC

The Quest for Longitude

International Meridian Conference (1884)

Meridian Day (1984)

The Millennium

Millennium Tree Line (MTL)

Meridian Laser

Astronomers Royal

Telescopes used with Meridian Marks

England
West Sussex

East Grinstead S side of: B2110 (Lewes Road) Distance (S) from 39.39 Km: 24.48 miles Greenwich OS map details OS Explorer: 135 OS grid ref TQ 39945.37948 (539945,137948)

51.123729, -0.001647

Marker 'stone' 2000 Unrestricted Show satellite view





1a. 'Geographic Referencing' We identify locations by latitude, longitude

e.g. UNBC campus agora

In decimal degrees: 53.892381, -122.813699 (N, W)

See: http://maps.google.ca (right-click)

In degrees, minutes, seconds: 53° 53' 33" (N) 122° 48' 50" (W)

In degrees and decimal minutes (e.g. GPS) 53° 53.543' N 122° 48.822' W

1b. The Geoid

Earth is not a perfect sphere, it is ellipsoidal ..

The difference between the length of the two axes = the amount of 'polar flattening' is about 1/300 (0.3%)



Official Ellipsoids

(from J. Snyder, Map Projections--A Working Manual)

		Equatorial	Polar	An ellipsoid is formed by rotating ar on its shorter axis
Name	Date	Radius <i>a</i> (metres)	Radius <i>b</i> (metres)	Polar Flattening
WGS 84	1984	6,378,137	6,356,752	1/298
GRS 80	1980	6,378,137	6,356,752	1/298
WGS 72	1972	6,378,135	6,356,750	1/298
International	1924	6,378,388	6,356,912	1/297
Clarke	1866	6,378,206	6,356,584	1/295
Everest	1830	6,377,276	6,356,075	1/301

Pole Shorter (semi-minor) axis-Longer (Semi-major) axis Rotation Equator

ellipse

Datums

'Datum' = "a set of values that serve as a base for mapping"
a. North American Datum, NAD27 (1927) based on Clarke 1866
b. North American Datum, NAD83 based on GRS80/WGS 1984

-> NAD27 was the datum for mapping in the 20th century

-> NAD83 is the current datum for digital mapping / GIS data

-> The two can differ by ~ 70 metres (x) and 170 metres (y)

New millennium mapping: you can 'almost' forget about NAD27 as all new data are collected according to NAD83 in North America

The datum shift: e.g. Greenwich prime meridian 1884 - 1984



W000.00149°

Meridian Room (or Cassini Room) at the Paris Observatory, The Paris meridian is traced on the floor... since 1634





'Geographic' referencing issues

- a. Geographic is <u>not decimal</u>, it is '<u>sexagesimal</u>' (= base 60)
- 1 degree = 60 minutes 1 minute = 60 seconds
- b. Geographic referencing is suitable for storing global datasets, but has <u>negative values</u> south and west of 0,0



C. The main issue with Geographic referencing



Latitude and Longitude

Length of One Degree of Longitude			Length of a Degree of Latitude			
Latitude Kilometres Mile			Latitude	Kilometres	Miles	
0 °	111.32	69.17	0 °	110.57	68.71	
10°	109.64	68.13	10°	110.61	68.73	
20°	104.65	65.03	20°	110.70	68.79	
30°	96.49	59.95	30°	110.85	68.88	
40°	85.39	53.06	40°	111.04	68.99	
50°	71.70	44.55	50°	111.23	69.12	
60°	55.80	34.67	60°	111.41	69.23	
70°	38.19	23.73	70 °	111.56	69.32	
80°	19.39	12.05	80°	111.66	69.38	
90°	0.00	0.00	90°	111.69	69.40	

45th Parallel Halfway Between Equator-North Pole

GEOLOGICAL MARKER

This spot in Section 14, in the Town of Rietbrock. Marathon County is the brace of the northern half of the Western Hemisphere. It is here that the 90th meridian of longtitude bisects the 45th parallel of latitude, meaning it is exactly halfway between the North Pole and the Squator, and is a guarter of the way around the earth from Greenwich, England.

MARATHON COUNTY PARK COMMISSION

ut in 45° North really holfway 2

PARALLEL

OF LATITUDE

But is 45° North really halfway ?

Welcome To

Bracebridge

Home of Santa's Village

HALFWAY BETWEEN THE NORTH POLE

YOU ARE

OW AT THE

-1 degree longitude varies from 0 - 111 km ->East-west stretching away from equator (as a degree is treated uniformly)

OK for data storage, not for display





Local example from the phone book

2007-scale is consistent

2008: horizontal scale is almost double





2. UTM map coordinates - a rectangular system



Universal Transverse Mercator (UTM) System this bit is harder so pay attention ...

The world is divided into 60 x 6 ° longitude (vertical) strips numbered 1 - 60 from 180 degrees West to 180 degrees East



Canada: UTM zones - adopted in 1947 for mapping



the width of each zone varies from 666 km (6 x 111km) at the equator
 ...to ~338 km (6 x 55.8 km) at 60 ° N/S, with a 'central meridian' in the middle



Figure 1 - Zone UTM

UTM coordinates

are in <u>metres</u>

Within each zone ...

The 'Y' coordinate Northings (N):

measured from the Equator (0) – to the north pole (10,000,000) ... in metres



UTM coordinates The 'x' coordinate

- this is the hardest part ...

Eastings (E) for each zone

based on the zone
 <u>Central Meridian at 500,000</u>

the easting value increases to the east, but not > 1,000,000

the easting value decreases to the west but not below zero e.g. UNBC 512,000

Zone must also be given as Coordinates repeat for each zone Grrrr ... who came up with this crazy scheme !?

the system was developed by United States Army Corps of Engineers or the German Wehrmacht



UTM : Eastings are 6 digit, Northings are 7-digit (in Canada)

Blue grid squares in this map are 1000m = 1km

BC: UTM zones



See google earth: Tools-> options Select UTM

Many provinces fit into 1 (or 2) UTM zones

How to deal with multiple UTM zones: Eastings switch from \sim 300,000 at the west edge of one zone to \sim 700,000 at the east edge of the next ?

BC Albers coordinate system



BC uses UTM for local areas

But Albers for the whole province

Developed by provincial ministry geomaticians in Smithers, BC

British Columbia Albers Equal Area Conic Central meridian: -126.0 Degrees West longitude Latitude of projection origin: 45.0 Degrees North latitude





Download NTDB data using Geographic, Albers, UTM ... or Web Mercator (2019)

Summary: BC mapping coordinates

Could be one of:

- 1. Geographic lat. / long. global reference
- 2. UTM zones 7-11 local /regional mapping
- 3. BC Albers BC provincial data
- 4. Canada Albers Federal data
- Why is it important: because we 'import' data from different sources .. and they need to line up

It may make more sense here : - view these also in the lab

PGMAP: <u>http://pgmappub.princegeorge.ca/Html5Viewer/?viewer=PGMapMobile</u> UTM coordinates - or lat/long (geographic)

BC IMAP: http://maps.gov.bc.ca/ess/hm/imap4m/

UTM, geographic and Albers

Google Earth: Geographic and UTM

Natural Resources Canada and BC Forestry– UTM grid https://www.nrcan.gc.ca/earth-sciences/geography/topographic-information/maps/9779

UTM coordinates quiz on Moodle - Friday 17th, due Wednesday 1 March

The last 3 words on coordinates https://what3words.com



Divides the world into 57 trillion squares, each 3 x 3m .. easier to recall than 16 digit lat/long or UTM ?

What3words: The app that can save your life:

https://www.bbc.com/news/uk-england-49319760

https://what3words.com/news/emergency/three-words-to-tellcanadian-emergency-services-exactly-where-you-are

	Contraction of the second s							
canny. steer. quilty	stone. firmly.	grant. shade.	gums. clubs. terms	label. drill. shave	flight. result.	bunk. show. retail	lock <mark>er.</mark> flip. shack	quiz. wants. trade
ganty	cones	Big Be	n clock	tower	31103	Tetali	SHECK	induc
bets. hooked. firms	deals. nuns. colleague	amuse. tuck. lows	loud. rising. bravo	spike. stir. singer	rushed. woven. exchange	when. agent. grab	apple. flats. noted	elbow. cafe. memory
cooks. total. putty	tubes. page. forced	bond. motel. excuse	gravel. chart. burn	deed. cross. times	hills. moods. dunes	sorters. stem. both	causes. scared. shiny Spe	pepper. mobile. seated aker's
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trick. throw. fully	pile. knots. debit	tower. bigger. salon	alone. enter. belong	camp. dragon. fortunate	fresh. hurt. dress	hints. alien. fund	after. vision. guard	fees. aura. escape
toxic. appear. owners	vocal. passes. jump	solved. toned. eager	push. nods. shift	level. poem. flips	issue. bright. slip	cuts. saving. sang	pushes. risen. comet	rods. epic. very
rots. tasty. wallet	ahead. above. candy	mice. task. scuba	sleep. rings. driver House	risk. rides. string s of Pa	stuff. finely. skip	funds. pans. digs nt	tasty. each. hobby	river. degree. dimes