ISTA 352

Lecture 31

2/3 done retrospective

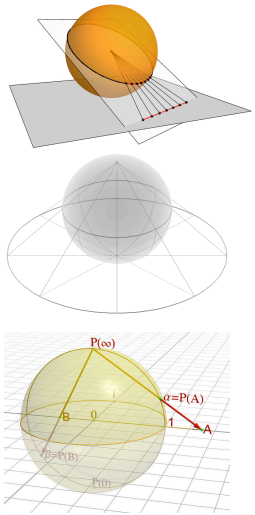
Quiz two

- Mean was 14.6 +/- 3.3
  - Better than the previous

Q2, #1

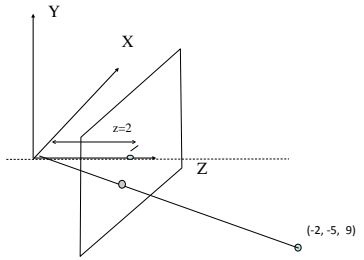
1. Sketch your favorite **point** projection method to map a sphere to a plane (we considered three different methods. Your sketch should clearly show one of the them. **(2 marks)**

One of the following is sufficient, ideally with a few embellishments.



Q2, #2

2. Consider the projection of the point (-2, -5, 9) onto the image plane (z=2). Sketch the imaging situation and provide the coordinates of the projected point (show work) (**2 marks**).

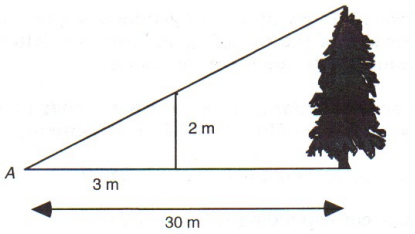


This was suppose to be a lot like a question on quiz one. For the point, we get

(-2*(2/9), -5*(2/9), 2)

Q2, #3

3. How tall is the tree in the picture shown? (Show your work!) (**1 mark**)



By similar triangles h/30 = 2/3, and h=20.

Q2, #4

4. Use the homography matrix below to map the 2D point (2,3) to a second 2D point. Show work! (**2 marks**):

$$H = \begin{vmatrix} 2 & -1 & 1 \\ -3 & 5 & 2 \\ 4 & -2 & 3 \end{vmatrix}$$

H*(2,3,1)' = (2,11,5)' (Ideally more work shown than that)

Then we get (1/5)*(2,11)

Q2, #5

5. **Mercator properties**. (1/3 mark for each T/F, **2 marks total**):

(check all that apply).

i) (T / F) Conformal mapping

ii) (T / F) Distorts relative distance as one moves from the tangent line

iii) (T / F) Routes of constant course are straight lines

iv) (T / F) Great circles are always straight lines

v) (T / F) Angles are **not** preserved

vi) (T / F) Must use the equator as the tangent to work

Q2, #6

6.

a) Draw the steepest possible mountain bike trail route down from the top of Tabor hill on the map to the left (**1 mark**) *(The route needs to be perpendicular to the contours).*

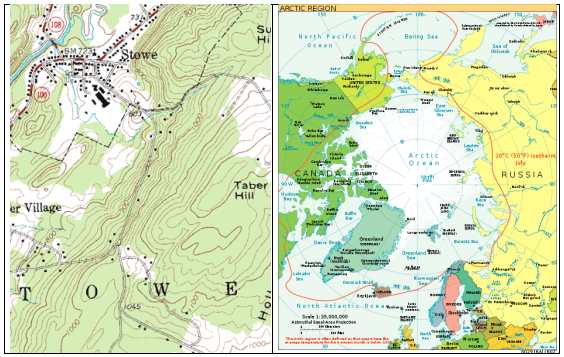
b) On the map on the right, the line shows (check all that apply) (**1 mark** total)

i) (T / F) An elevation contour

ii) (T / F) A level curve

iii) (T / F) A gradient

iv) (T / F) An isoline

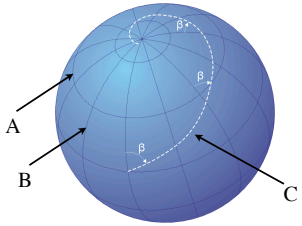


Q2, #7

7. For each of A, B, C, corresponding to the lines shown in the figure, put the following numbers that apply. Be careful that some of A,B,C may get more than one number. (**3 marks total**):

1. Rhumb line
2. Great circle
3. Meridian
4. Equator
5. Pole
6. Line of longitude
7. Line of latitude
8. Geodesic

Numbers for A:	Numbers for B:	Numbers for C:
7	2,3,6,8	1



Q2, #8

8. This figure can help explain (1/3 mark for each T/F, **2 marks total**):

i) ([T] / F) Dielectric specular reflection color

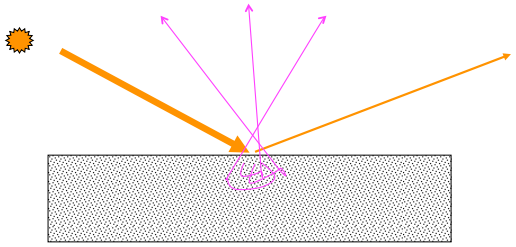
ii) ([T] / F) Why purple paint is purple

iii) ([T] / F) Lambertian reflection

iv) ([T] / F) Why the sky is blue

v) ([T] / F) Highlights in photographs on people's forehead

vi) ([T] / F) Brightness of matte paper as a function of viewing angle



Q2, #9,10

9. **SLIC**. (1/4 mark for each T/F, **2 marks total**):

a) The SLIC method enables (check all that apply).

i) ([T] / F) Browsing lecture video

ii) ([T] / F) Improving quality of slide part of videos

iii) ([T] / F) Automatically enlarging bullet points

iv) (T / [F]) Creating cool 3D animations

b) The SLIC method uses (check all that apply).

i) ([T] / F) Homographies

ii) (T / [F]) Structure from motion

iii) (T / [F]) Camera sensor functions

iv) ([T] / F) Keypoints

10. **Understanding indoor scenes**. (1/4 mark for each T/F, **2 marks total**):

a) The method that Luca described enables (check all that apply to his talk).

i) ([T] / F) Inserting virtual objects into an indoor image

ii) (T / [F]) Improving quality of indoor images

iii) ([T] / F) Identifying objects

iv) (T / [F]) Compression

b) The method that Luca described uses (check all that apply).

i) ([T] / F) Manhattan world assumption

ii) ([T] / F) Edges

iii) ([T] / F) Vanishing points

iv) ([T] / F) Inference

Q2, #11

11. **Pictorial spaces**. Do only **two** of the following. Once you are done, put a big **X** to the left of the one you do **not** want graded. (1/2 mark each, **1 mark total**)

(Thanks to those who emailed me the questions)

a) What book did Sheila say was recommended to her by Kobus

i) *Visual intelligence* by Ann Marie Seward Barry

[ii] *Envisioning information by* Edward Tufte

iii) *Essential of Visual Communication* by Bo Bergstrom

iv) None of these

b) Which of these questions was **not** posed by Sheila as key organizing questions?

i) What is art?

[ii] Does representation matter?

iii) Who gets to call themselves an artist?

iv) What is good (or bad) art?

c) What best describes the relationship between Kobus and Sheila?

i) Mother

ii) Aunt

iii) Cousin

[iv] Mother-in-law

v) Collaborator

Assignment 4B

1. A standard pencil has a diameter of about 0.5cm (perhaps a bit more). The diameter of the moon is about 3,474 km, and its average distance from the earth is 384,400 km. Estimate how far from your eye you need to hold the pencil to just cover the moon ($). Provide a nicely labeled picture that shows how you worked this out ($). Check your answer by going outside with a pencil or other object and make any comments regarding your experience (no deliverables, but could be considered for bonus marks if described in an interesting way that convinces the TA that you actually did so---include the date and time and the phase of the moon).
2. The angle that the moon's diameter spans is its angular size. Estimate this in both degrees and radians (many of you will have to remind yourselves how to convert between these two units of angles). Again, you should draw a picture that helps explain how to solve such a problem.
3. (+) As part of the discussion of the Airy disc, we learned a formula that related the theoretical resolution of an optical system under ideal (and very rare) conditions. Develop a formula the size of a crater on the moon that can be resolved by a telescope with an aperture of size *d* ($). Note that it will help to think through what you learned from the previous questions. Your formula will include the wavelength of light (you can use 500nm which is green), and the distance of the moon to the earth stated in question #1. Now plot crater size versus telescope aperture starting at 5cm (binocular sized) to 50cm ($). Note that 30cm is a relatively hefty telescope to own as a hobby.
4. Using the web to get the needed data (try http://www.lunasociety.org/atlas/index.shtml) embellish your graph with the names and sizes of craters that are visible by a telescope of the given aperture, where we can arbitrarily define "visible" as having a size that is 10 times the theoretical resolution. Adding images of the craters and/or some other visual explanations are encouraged and could lead to bonus marks (channel Tufte).

Guest Lectures (main points)

- Ravi Palanivelu
  - Extreme importance and complexity of plant fertilization
  - Pollen tube growth and pollen tube / ovule interaction studied in *vitro*
  - Imaging with GFP and scanning confocal microscope
  - Time lapse photography of multiple trajectories --> tracking
  - Complex behavior studied using mutants

Guest Lectures (main points)

- Linda Restifo
  - Neuron cells have specialized secretion mechanisms for communicating
  - Neuron form is directional. Information goes from axons to dendrites
  - Importance of neuron morphology for brain development
  - Growing neurons in *vitro* exposes defects due to mutations / chemicals
  - High throughput screening for drugs that can help
  - Automated image understanding a big need to scale up

Guest Lectures (main points)

- Tom Christensen
  - Brain quiz
    - 100 billion neurons
    - 90% fat (a lot is due to the myelin sheath cells)
    - 1 million neurons in an MRI voxel
    - Most of the brain is used (not 10%!)
  - MRI signals measure how proton spins adapt to magnetic fields
    - Main magnet establishes a base state, pulses lead to EM waves as the spins go back to the direction established by the main magnet
    - Changing pulse characteristics along three axis gives localization
  - MRI shows gray matter (cells) vs white matter (axons)
    - Tumors show up as being out of place gray matter
  - fMRI (functional MRI) shows metabolism
  - Magnet safety