Name:____________________

GIS in Water Resources Midterm Quiz Fall 2003

There are 5 questions on this exam. Please do all 5. They are of equal credit.

1. Data Representation

(a) In ArcGIS, vector and tabular data have a number of ways of being represented. For each of the three representation classes below, give an example of data that would be stored this way, make a sketch of how those data might be graphed or mapped, and explain how the three representations differ from one another.

Object class

Feature class

Network feature class

(b) We have done two exercises using spatial analysis of raster data. Show, using a sketch, how point, line and area vector features are related to their equivalents in the raster representation.

	Vector	**Raster**
Point		
Line		
Area		

2. Geodesy, Map Projections and Coordinate Systems

(a) Geospatial data are represented either in geographic coordinates or in projected coordinates. For each of these coordinate systems, draw a sketch of how a point is represented on the earth or on a map, and give an example of what its coordinates might be.

Geographic coordinates | **Projected coordinates**

(b) Here is the coordinate system description of the map of Texas used in Exercise 1. Show on the map of Texas items (2) through (7) on the coordinate system list. Geographic coordinates of two evaporation stations are given to provide you with spatial orientation.

Coordinate System | **Definition Sketch**

1. Albers

2. False_Easting: 1000000.000000

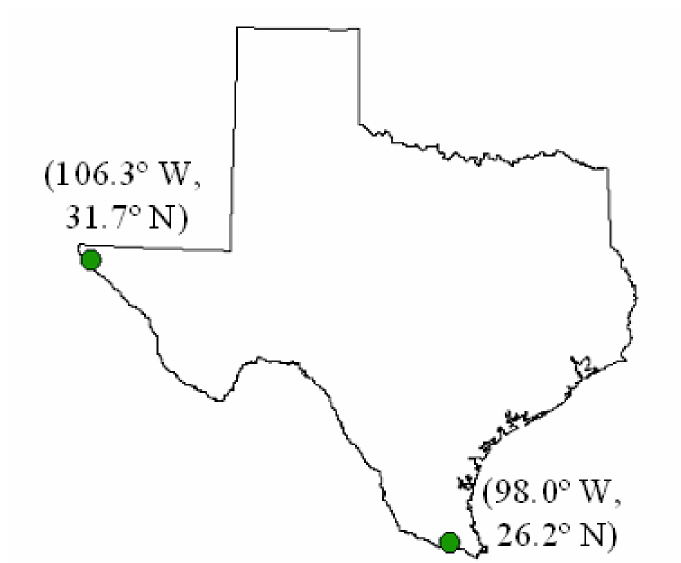
3. False_Northing: 1000000.000000

4. Central_Meridian: -100.000000

5. Standard_Parallel_1: 27.416667

6. Standard_Parallel_2: 34.916667

7. Latitude_Of_Origin: 31.166667



(c) Standard parallel number 1 is at 27.416667°. Express this location in degrees, minutes and seconds.

3. Data Sources, Networks and Arc Hydro

(a) We have discussed two national datasets in this course, the National Elevation Dataset, and the National Hydrography Dataset. Briefly describe using a sketch what each of these datasets contains:

National Elevation Dataset

National Hydrography Dataset

How have you used these two datasets together?

(b) The connectivity table for a network feature class depicting a stream network is given.

Junction	Adjacent Junction and Edge
J1	(J2, E1), (J3, E2), (J4, E3)
J2	(J1, E1)
J3	(J1, E2)
J4	(J1, E3), (J5, E4), (J6, E5)
J5	(J4, E4)
J6	(J4, E5)

(i) Draw the network depicted by this connectivity table. Label the junctions and edges in your drawing.

(ii) Junction J3 is a network sink. Indicate using arrows on your sketch the direction of flow along each edge towards this sink.

4. Spatial Analysis using Grids

The grids below depict initial snow depth and average temperature over a day for an area.

100 m × 100 m cells

40	50	55
42	47	43
42	44	41

(a) Initial snow depth (cm)

150 m × 150 m cells

4	6
2	4

(b) Temperature (^{o}C)

One way to calculate decrease in snow depth due to melt is to use a temperature index model that uses the formula

$$D_{new} = D_{old} - m \cdot T$$

Here D_{old} and D_{new} give the snow depth at the beginning and end of a time step, T gives the temperature and m is a melt factor. Assume melt factor m = 0.5 cm/^{O}C/day.

(i) Interpolate from grid (b) a temperature for each of the nine 100 x 100m grid cells in grid (c) below. Briefly describe how you did the interpolation.

100 m × 100 m cells

(d) Final snow depth (cm)

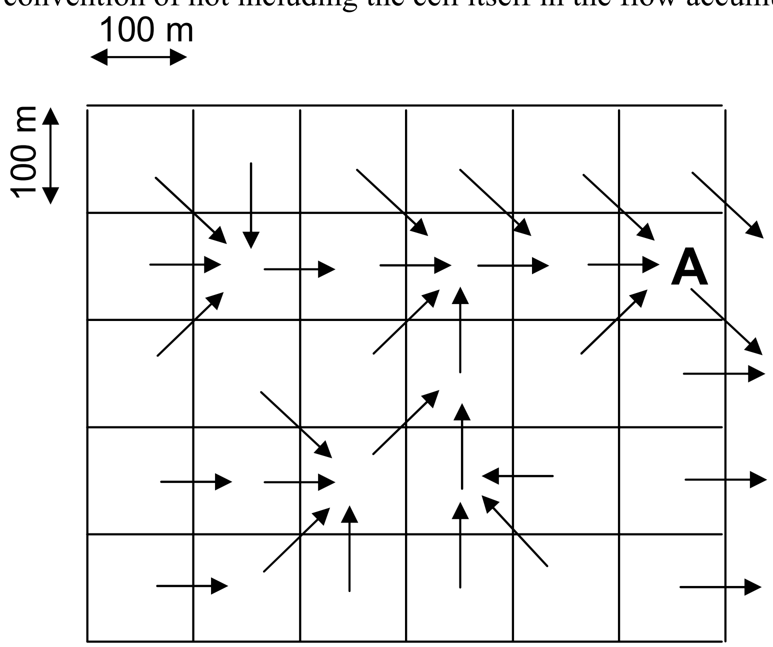
100 m × 100 m cells

(c) Temperature (^{o}C)

(ii) Calculate the new snow depth for each cell in grid (d) using raster calculations that apply the above formula.

5. Catchment and Stream network from DEM's

(a) Consider the grid below with D8 flow directions as indicated. Determine the **flow accumulation grid**. Label each grid cell with the number of upstream cells draining into it. Follow the ESRI convention of not including the cell itself in the flow accumulation value.

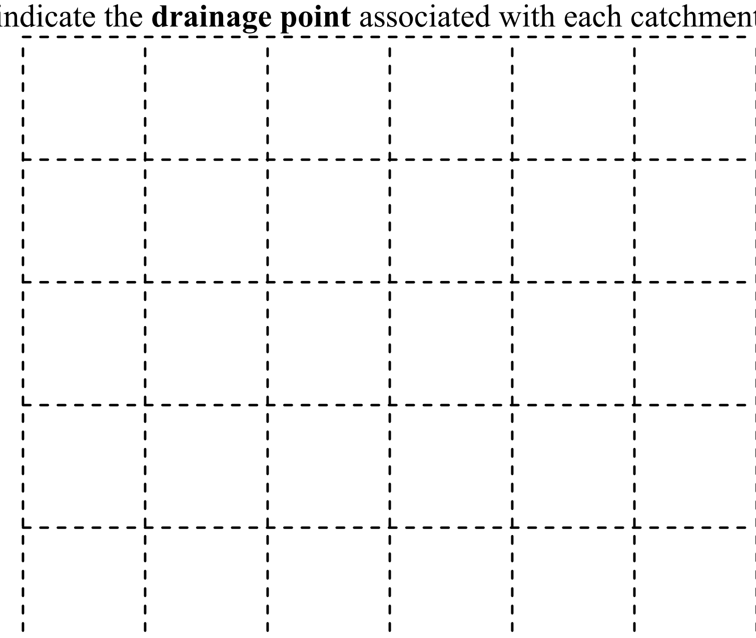


b) In the blank grid copy below,

(i) Draw lines between the centers of appropriate grid cells to depict the **vector stream network** defined using a flow accumulation threshold of 4 grid cells or greater.

(ii) Classify the stream network into **links** and label each link with a unique identifier

(iii) Indicate the **catchment grid** by labeling catchment grid cells with a unique identifier (number) indicating the catchment draining directly into each stream link. On this figure indicate the **drainage point** associated with each catchment.



c) Evaluate the drainage area of the watershed that drains to grid cell A.