Name:____________________

CEE6440 GIS in Water Resources Midterm Quiz Fall 2002

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

1. (a) In GIS, geographic data has a number of ways of being represented. Give a brief description (including a sketch) of the following geographic data types.

Vector

Raster

Triangulated Irregular Network

(b) You should be aware of the National GIS datasets listed below. Indicate the data type for each of these from (A) **Vector**, (B) **Raster**, (C) **Triangulated Irregular Network**.

EPA River Reach files

National Elevation Dataset

National Hydrography Dataset

(c) Explain what the **HydroID** is and why this is important in the Arc Hydro data model.

2. (a) Consider the one degree box surrounded by parallels 42^{o}N and 43^{o}N and meridians 111^{o}W and 112^{o}W. Approximate the earth as a sphere with radius 6370 km.

(i) Calculate the length (km) from north to south of this box.

(ii) Calculate the length (km) from east to west of the north and south ends of this box.

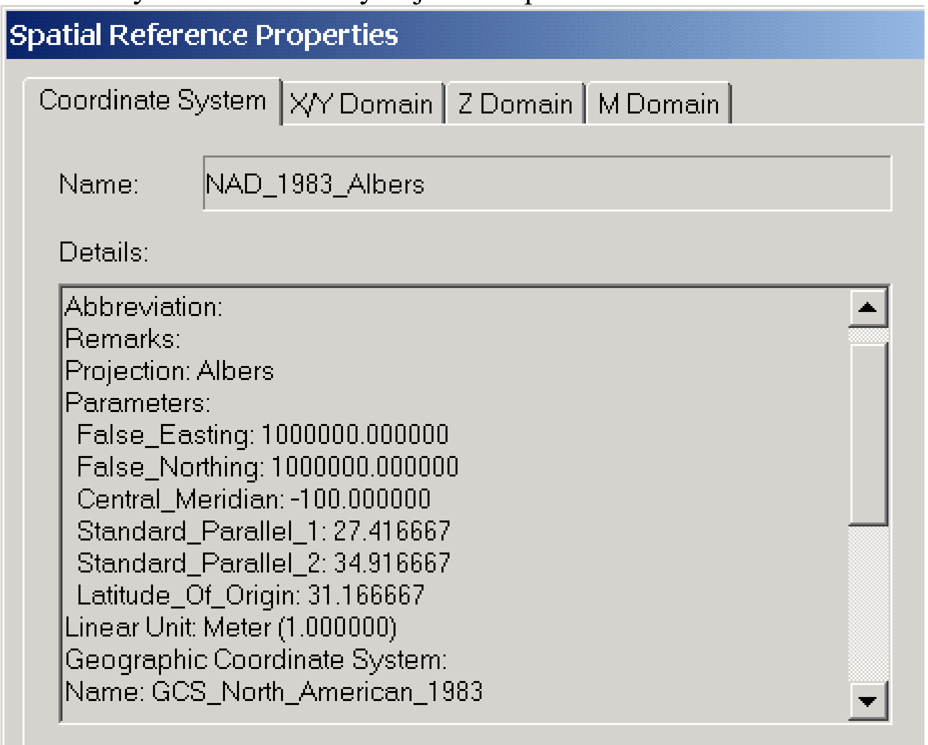
(iii) Calculate the area of this box (km^2).

(iv) Sketch this box as it would be shown in ArcGIS (1) using geographic coordinates and (2) in an equal area projection. Your sketch does not have to be exact, but should be sufficiently precise to show the difference in shape between (1) and (2).

(b) Explain the difference between the terms **Geodatabase** and **Feature Dataset**.

(c) Explain the difference between feature selection using a **tabular query** and feature selection using a **spatial query**.

3. (a) Here are the spatial reference properties of the coordinate system for the San Marcos basin DEM analysis exercise that you just completed..



(i) What horizontal earth datum is used?

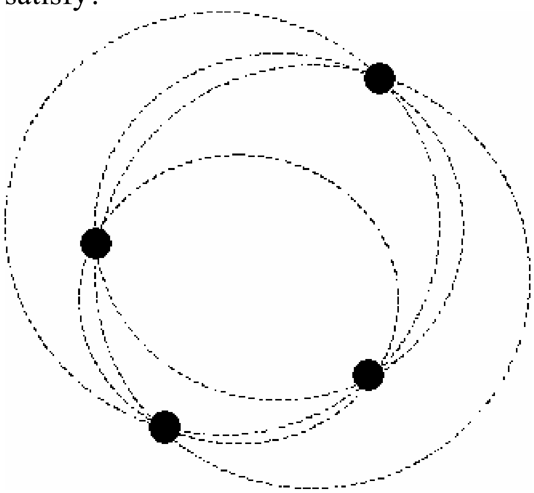
(ii) What map projection is used? Why is this particular projection used for this exercise?

(iii) What are the geographic coordinates of the origin (ϕ_o, λ_o)?

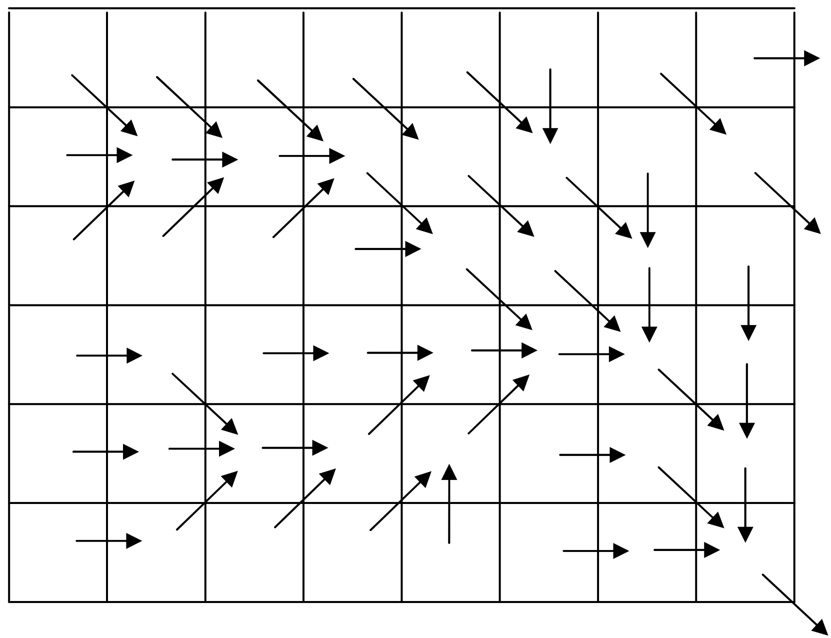
(iv) What are the projected coordinates of the origin (X_o, Y_o)?

(v) At what latitudes does the projection cone cut through the earth's surface?

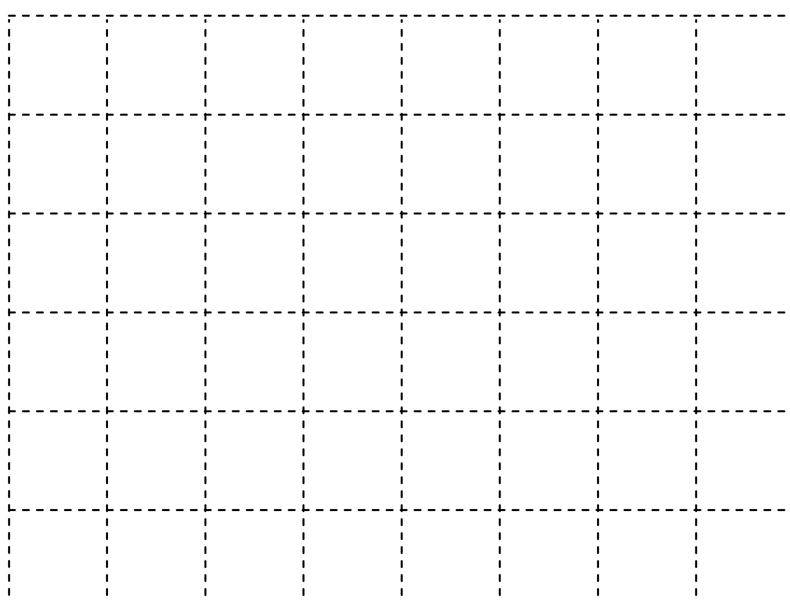
(b) Construct a Delauney triangulation of the points below. From the dotted circumcircles given draw the circumcircles of the triangles you've created. What criterion must these circles satisfy?



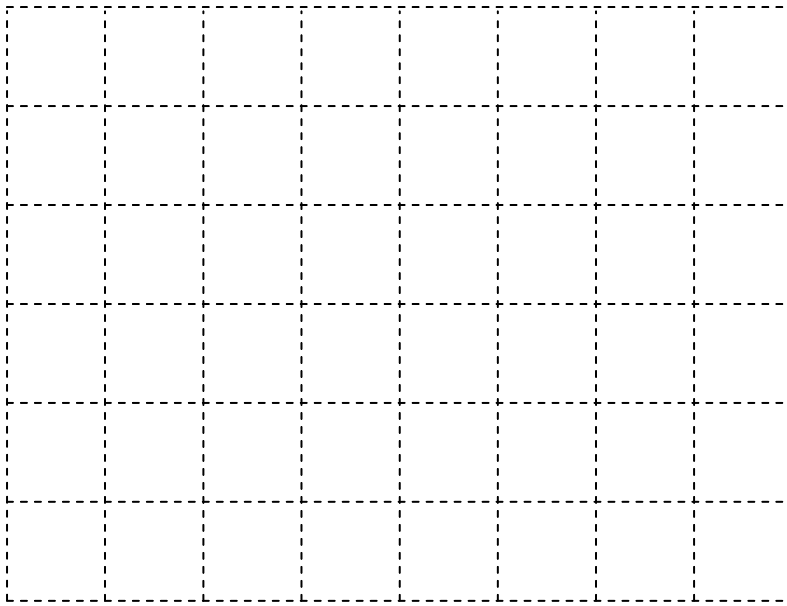
4. a) Consider the grid below with D8 flow directions as indicated. Determine the **flow accumulation grid**. Label each grid cell with the number of upstream cells draining into it. Follow the ESRI convention of not including the area of the cell itself in the flow accumulation.



b) The blank grid below is a copy of the DEM grid above. On the grid below indicate the **link cell network** of stream segments defined using a flow accumulation threshold of 6 grid cells or greater. Label each stream segment link with a unique identifier.



c) In the blank grid copy below, draw lines between the centers of appropriate grid cells to depict the **vector stream network** obtained from the link cell network of (b). Indicate the **subwatershed grid** by labeling grid cells with a unique identifier (number) indicating the watershed draining directly into each stream segment.



5. In question 4 (above) you should have delineated a **vector stream network** and **subwatershed grid**. In this question you are to build the geometric network and related edge and watershed feature classes for this small stream network and its subwatersheds. The grid cell size is 10m.

a) On the figure for 4(c) above label each network edge E1, E2, E3 … and each junction J1, J2, J3 … Include a terminal junction J0 at the center of the last grid cell before the river network exists the domain. Each subwatershed should already have been given a label as part of question 4.

b) Fill in the network connectivity table.

Network Connectivity table

Junction identifier	**Adjacent junction and edge identifiers (in pairs)**					
	Junction	Edge	Junction	Edge	Junction	Edge
J0						
J1						

c) Fill in the edge feature class table. Determine the length of each edge as the sum of length of line segments between grid cell centers.

Edge Feature Class table

Edge identifier	**Junctions**	**Length (m)**
E1		
E2		

d) Fill in the watershed feature class table. Determine the area of each watershed as the sum of the areas of grid cells in each watershed.

Watershed Feature Class table

Watershed identifier	**Next downstream watershed identifier**	**Related junction identifier**	**Area (m^2)**

e) Fill in the watershed to junction relationship class table indicating the junction into which each watershed drains.

Watershed to Junction Relationship class table (many to one)

Watershed identifier	**Junction identifier**