Name:_____

GIS in Water Resources Midterm Exam **Fall 2007**

There are 4 questions on this exam. Please do all 4.

1. [25 points] **Concepts**

(a) The NHDPlus contains the synthesis of three large national geospatial datasets. What are they?

(b) A geometric network of a set of streams combines three different data models. Explain what each of these data models does:

(i) Geometric model

(ii) Logical model

(iii) Addressing model

(c) Arc Hydro uses the concept of a HydroID.

(i) What is a HydroID?

(ii) What does having a HydroID add to the approach normally used in ArcGIS to label feature classes?

(iii) Why is a HydroID needed to build geodatabases for water resources?

(d) Explain the difference between a geodatabase and a feature dataset.

2. [20 points] **Geodesy, Map Projections and Coordinate Systems**

Below are the spatial reference properties of the HucReg12 feature class used for Exercise 2

```
Projection: Albers
False_Easting: 0.000000
False_Northing: 0.000000
Central_Meridian: -96.000000
Standard_Parallel_1: 29.500000
Standard_Parallel_2: 45.500000
Latitude_Of_Origin: 23.000000
Linear Unit: Meter (1.000000)

Geographic Coordinate System: GCS_Clarke_1866
Angular Unit: Degree (0.0174532925199433299)
Prime Meridian: Greenwich (0.000000000000000000)
Datum: D_Clarke_1866
  Spheroid: Clarke_1866
```

(a) What ellipsoid is used?

(b) What horizontal earth datum does this correspond to?

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

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

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

(e) Draw the Central Meridian and the Latitude of Origin on the map below

3. [20 points] **Earth Surface Areas**

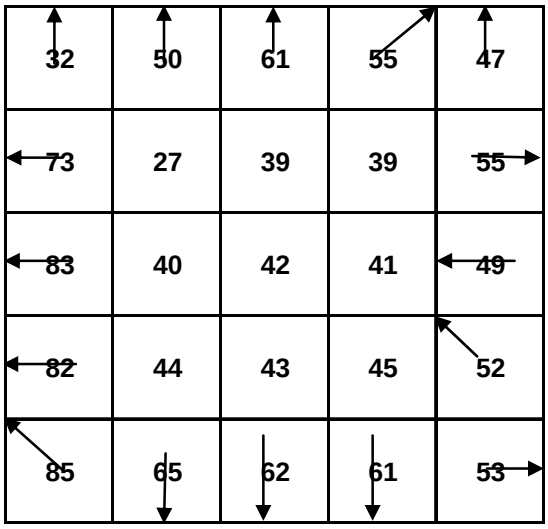
2. (a) Consider the one degree box near Austin, Texas, surrounded by parallels 29^{o}N and 30^{o}N and meridians 97^{o}W and 98^{o}W. Approximate the earth as a sphere with radius 6370 km. Calculate the area of this box (km^2).

(b) Similarly calculate the area (km^2) of a one degree box near Logan, Utah, surrounded by parallels 42^{o}N and 43^{o}N and meridians 111^{o}W and 112^{o}W.

(c) Is a one degree box near Austin, Texas larger or smaller in terms of land area than the one near Logan, Utah? What is the % difference in area between these two boxes?

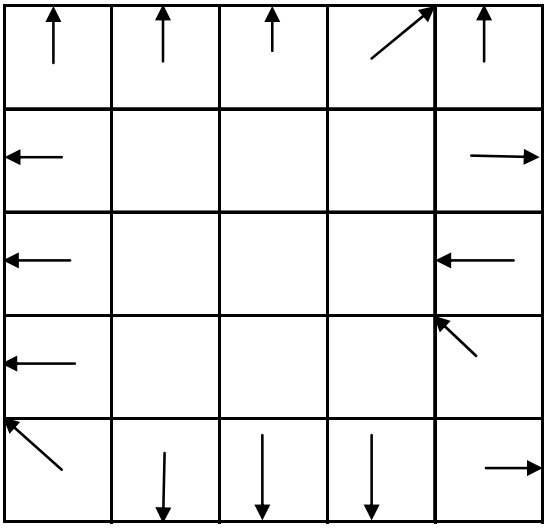
4. [35 points] **Hydrologic Variables derived from DEM's**

Given the following grid of elevations with the flow around the edges specified, answer the questions below

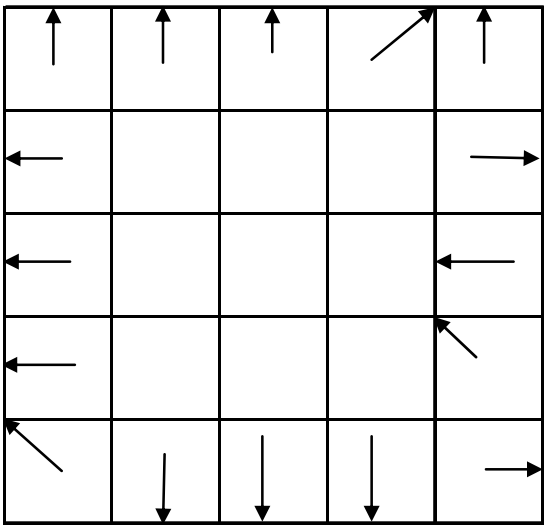


a) **Identify any pits** by drawing a circle around the elevation and indicate the elevation to which they need to be raised to **fill** them.

b) Determine the **flow direction grid** using the 8-direction pour point method (D8) for the 9 internal grid cells. Indicate the flow direction by using an arrow in each cell on the grid below. Use the space around the diagram to show how you've calculated the hydrologic slope for cells whose flow direction is not obvious.



c) Determine the **flow accumulation grid** corresponding to the D8 flow directions. Label each cell on the grid below with the number of upstream cells draining **into it** (ESRI convention). What is the maximum flow accumulation value in this internal grid (the 9 cells with no arrows in them)?



d) Determine the slope of the cell with elevation 42 using the **ESRI standard slope function**. Determine both the magnitude of the slope and also its aspect as measured in degrees clockwise from the North direction.

27	39	39
40	42	41
44	43	45