Name:_____

GIS in Water Resources Midterm Exam **Fall 2009**

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

1. Basic Concepts

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

ii) Explain the difference between a geodatabase and a feature dataset.

iii) If you were drawing the following features in ArcMap, which type of data type would you most likely use? (A) Vector, (B) Raster, (C) Triangulated Irregular Network, and (D) vector and time series graph (E) NetCDF file. Also indicate the *data source* (i.e. organization) that provides datasets for each of these information types.

a. stream _____

b. well _____

c. stream gauging station _____

d. rainfall _____

e. landuse _____

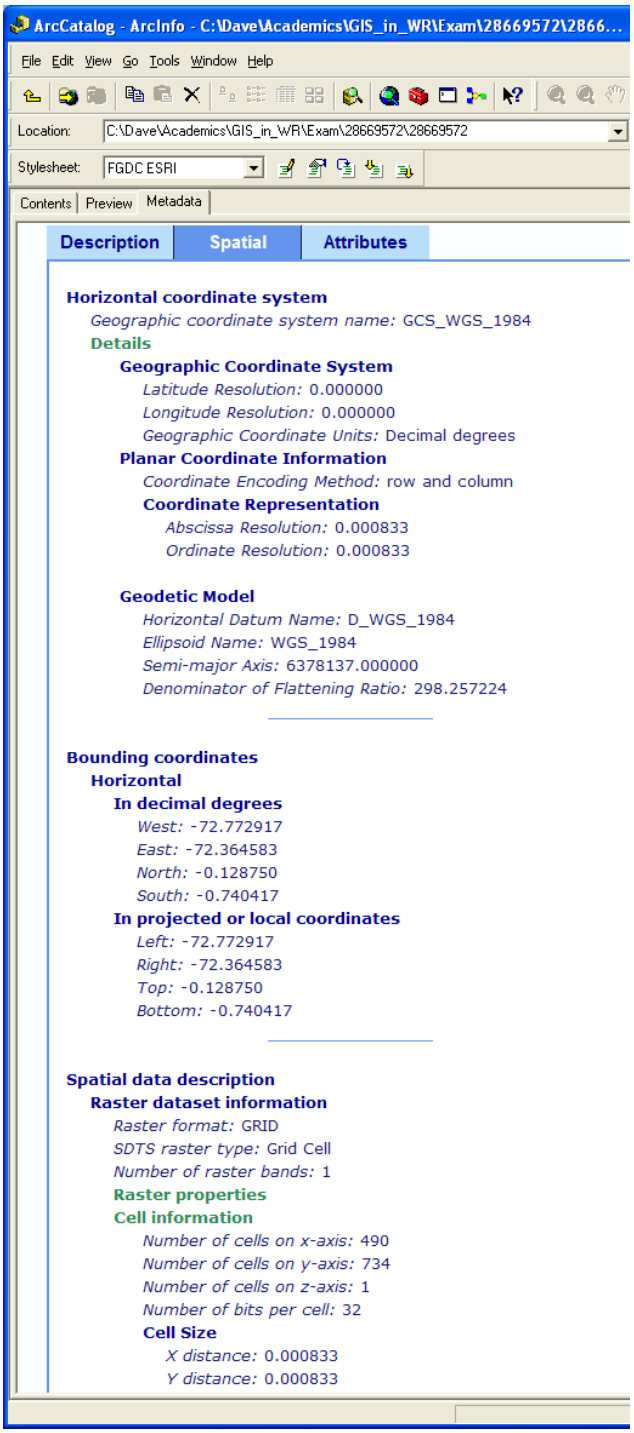
f. elevation _____

iv) A set of points and lines are used to form a geometric network. Explain how the network has additional information beyond what the points and lines possessed by themselves.

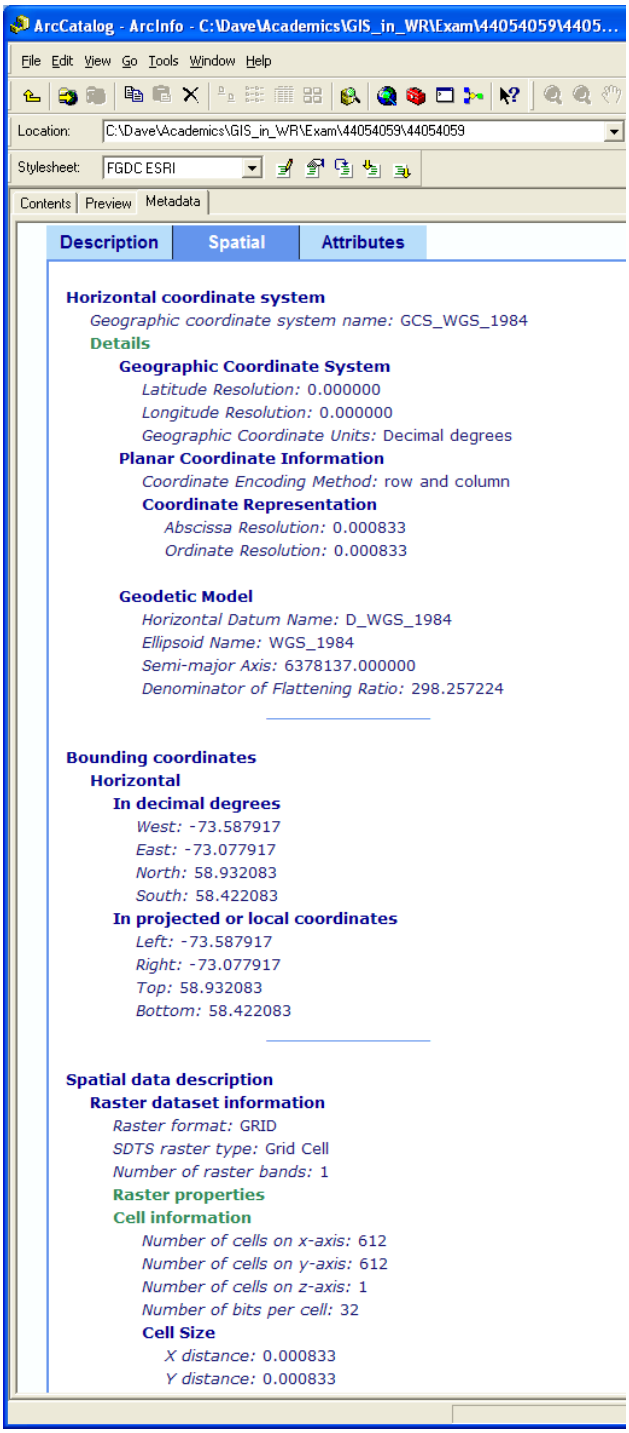
2. Digital Elevation Models and Projections

a) Two SRTM 3' DEMs have been downloaded from the seamless data server (http://seamless.usgs.gov), one from Northern Canada and the other from Central America. In ArcCatalog the spatial metadata reports the following information

Grid A



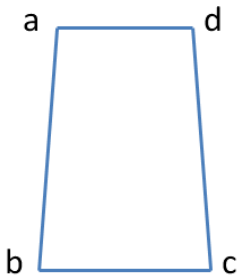
Grid B



Indicate which of these (A or B) is from Northern Canada

b) For Grid B shown on the previous page, determine the lengths of its outer edges ab, bc, cd, and ad, in km, assuming that the radius of the earth is 6371 km.

Distance ab



Distance bc

Distance cd

Distance ad

c) Determine the surface area of the earth covered by this grid in km^2.

3. Hydrology and Digital Elevation Models

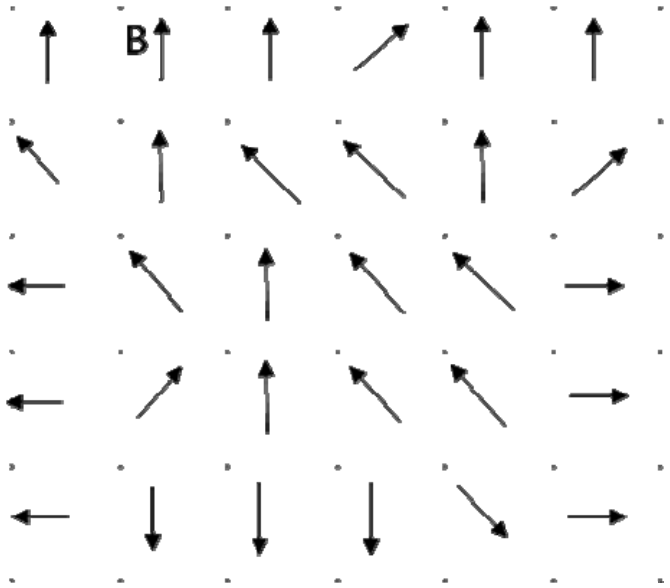
Following is a grid of elevations in a 30 m digital elevation model.

29	31	34	58	37
41	28	35	A 39	42
36	34	37	36	43
58	33	32	50	55
52	50	45	50	53

a) On the above grid, determine **which grid cells are pits** and indicate the elevation to which they need to be raised to **fill** them.

b) For the grid cell labeled A determine the slope and flow direction using the 8 direction pour point model

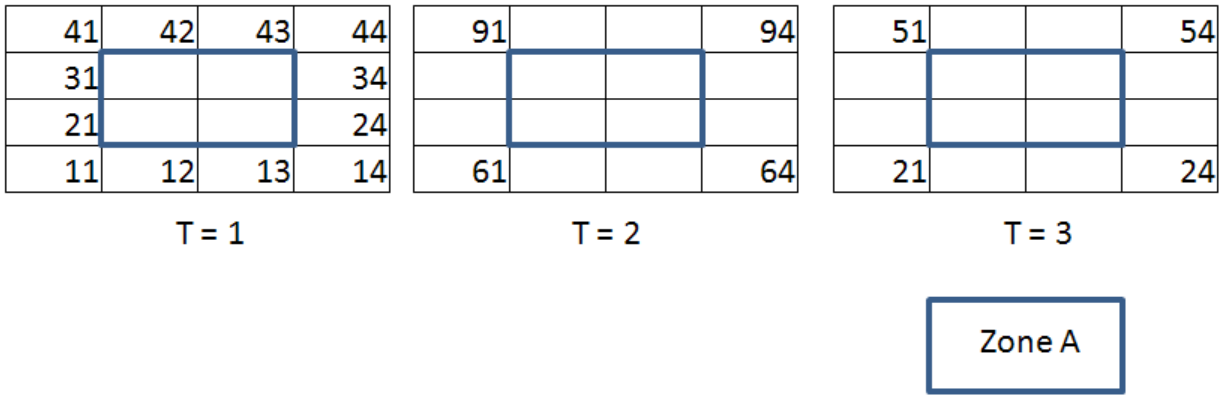
c) Given the following flow direction grid for a 30 m DEM calculate the contributing area and demarcate the watershed draining to grid cell B.



d) Given the same 30 m resolution flow direction grid as above and the 75 m resolution precipitation grid shown below, with precipitation values in cm, compute the volume of runoff in m^3 from grid cell B and its contributing grid cells assuming a runoff ratio of 0.3. The top left corners of these grids align. State any assumptions.

0.75	**0.9**	**1.1**
0.8	**1.2**	**1.3**

4. Precipitation in Space and Time



The grids shown above are for precipitation over a region in mm and the time steps are in hours. The spatial gradient of the precipitation in the x-y plane is linear in the x-direction and in the y-direction in all three grids. The box highlighted over the 4 cells in the center of each grid is a study area, Zone A.

(a) Determine the precipitation in the cells having missing values in each of the three grids. Fill the values in the cell grid shown above.

(b) Determine the average precipitation (mm) in Zone A for T = 1, T = 2, T = 3 and plot a graph of this precipitation as a function of time.

(c) Determine the total precipitation (mm) in Zone A over the three hours of this storm.