Name:______________________

GIS in Water Resources Midterm Exam **Fall 2013**

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

Question 1

The table below gives the geographic location of two points.

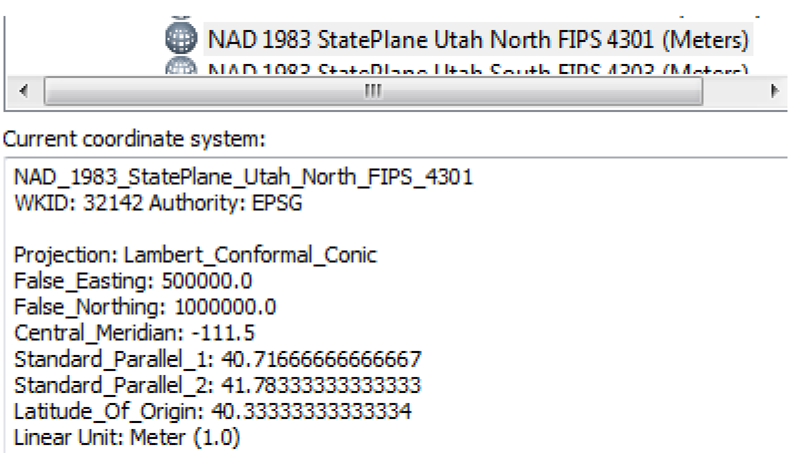
A	39° 27' 45" N, 111° 30' 0" W
B	40° 20' 0" N, 111° 30' 0" W

Note that the "W" coordinates are the same.

a) Calculate the latitude and longitude of each point in decimal degrees.

b) Calculate the distance from A to B in km. For these calculations assume a spherical earth with radius 6371 km.

Now consider the location of these points in the Utah North State Plane Coordinate System with the following attributes from ArcGIS.



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

d) What are the projected coordinates (X_o,Y_o) of the origin of this coordinate system in m?

e) What are the projected coordinates (X, Y) of point A above in this coordinate system in m?

f) We have used four main national GIS data sets in our class exercises. Name and briefly describe each dataset.

(i)

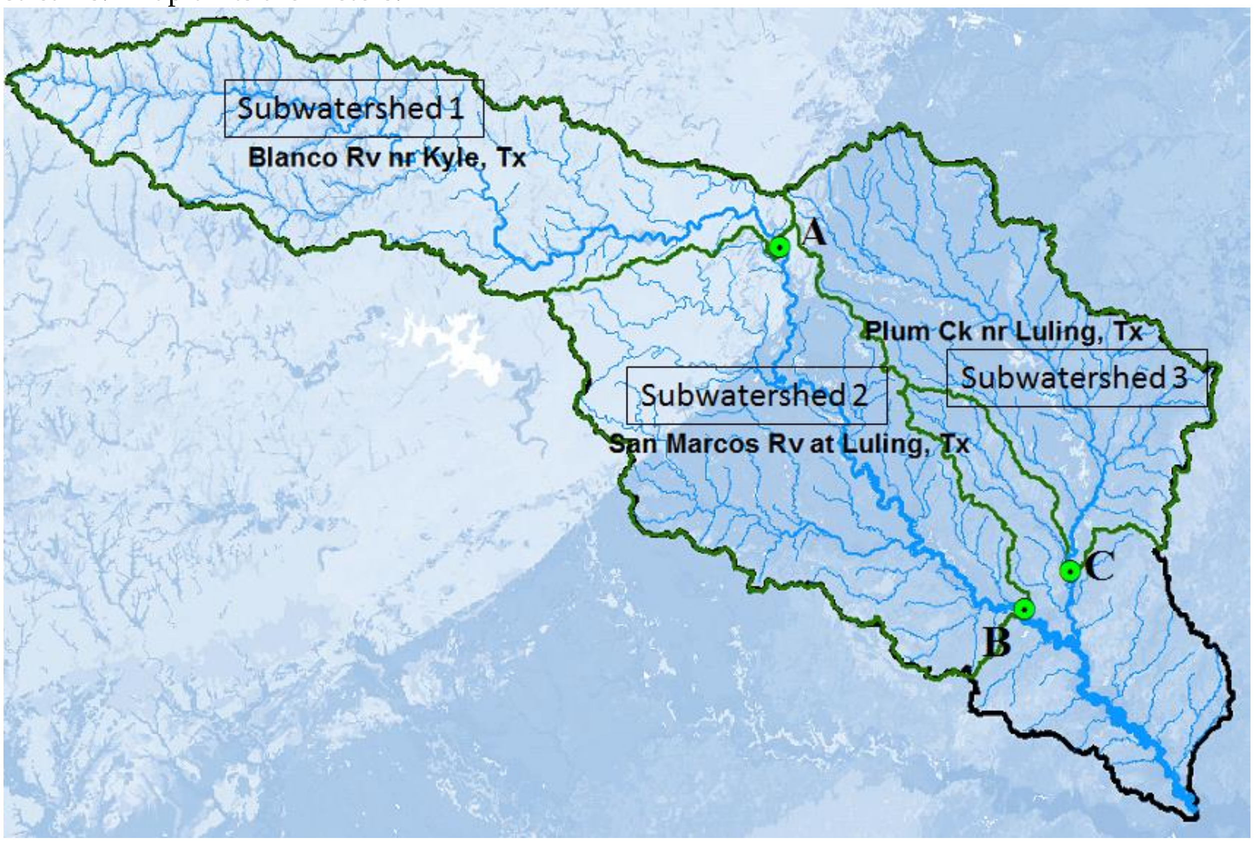
(ii)

(iii)

(iv)

Question 2

The following shows a map of the San Marcos Basin with three subwatersheds indicated similar to those you worked with in the exercises (To reduce calculations I have combined some of the subwatersheds). The blue/gray background layer is USA Soils Available Water Storage as used in Exercise 2. Available soil water storage is in units of cm. The streams indicated are NHDPlus streams. Map units are meters.



Following is the subwatershed attribute table.

Table

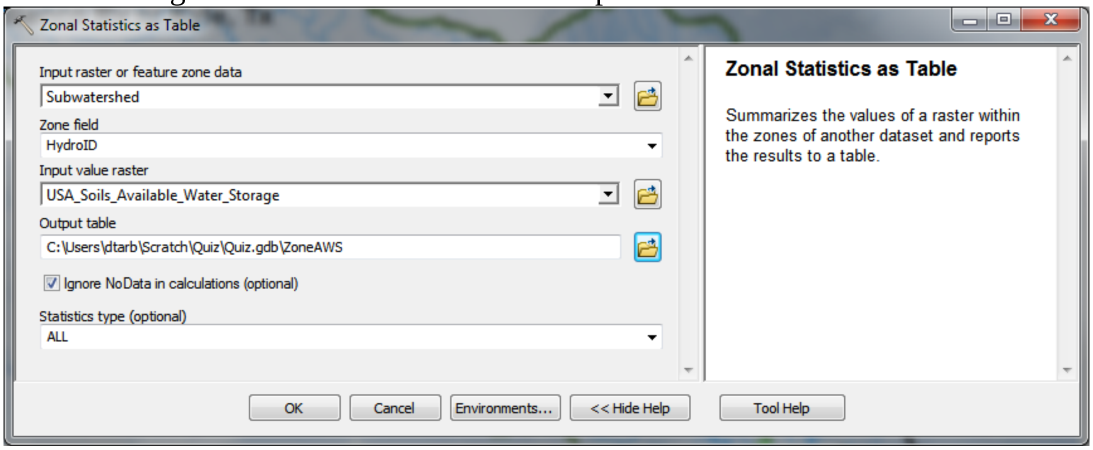
Subwatershed

OBJECTID *	Shape *	HydroID	SiteID	SiteName	Shape_Length	Shape_Area
1	Polygon	330	08173000	Plum Ck nr Luling, Tx	218999.999491	812050000.136302
2	Polygon	331	08171300	Blanco Rv nr Kyle, Tx	277399.996536	1070319999.818522
3	Polygon	333	08172000	San Marcos Rv at Luling, Tx	238800.000892	1106909999.963009

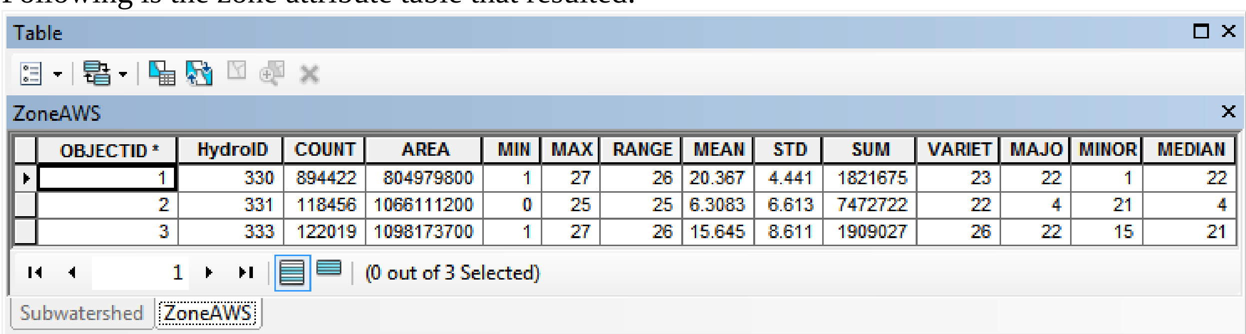
(0 out of 3 Selected)

Subwatershed | ZoneAWS

The following zonal statistics calculation was performed.



Following is the zone attribute table that resulted.



Table

ZoneAWS

OBJECTID *	HydroID	COUNT	AREA	MIN	MAX	RANGE	MEAN	STD	SUM	VARIET	MAJO	MINOR	MEDIAN
1	330	894422	804979800	1	27	26	20.367	4.441	1821675	23	22	1	22
2	331	118456	1066111200	0	25	25	6.3083	6.613	7472722	22	4	21	4
3	333	122019	1098173700	1	27	26	15.645	8.611	1909027	26	22	15	21

1 (0 out of 3 Selected)

Subwatershed ZoneAWS

a) Report the area of each subwatershed in Km^2. Report the area draining to each gage in Km^2.

Subwatershed	Area (Km^2)
1	
2	
3	

Gage	Area (Km^2)
A	
B	
C	

b) Report the average depth of available water storage (cm) in each subwatershed and the corresponding volume (Km^3).

Subwatershed	Depth (cm)	Volume (Km^3)
1		
2		
3		

Question 3

The following diagram gives elevation values on a 30 m DEM grid.

a) Identify any pits and indicate the elevation to which they need to be raised to drain the DEM.

7	7	7	7	5	4.5
7	8	7.1	8	7	5
7	6.3	6.5	6	6.6	4.5
7	8	6.4	6.1	6.2	5
7	8	7.5	7	6.5	6

b) Calculate the **flow direction** and **flow accumulation** for all cells in the inner block. Show **arrows** for the flow direction and **numbers** for the flow accumulation.

Flow Direction

Flow Accumulation

c) On the above flow accumulation diagram draw a **border around the watershed** draining to and including the grid cell in the inner block with largest flow accumulation. What is the **area** of this watershed (square meters)?

Question 4
Consider a network specified by the following topology table

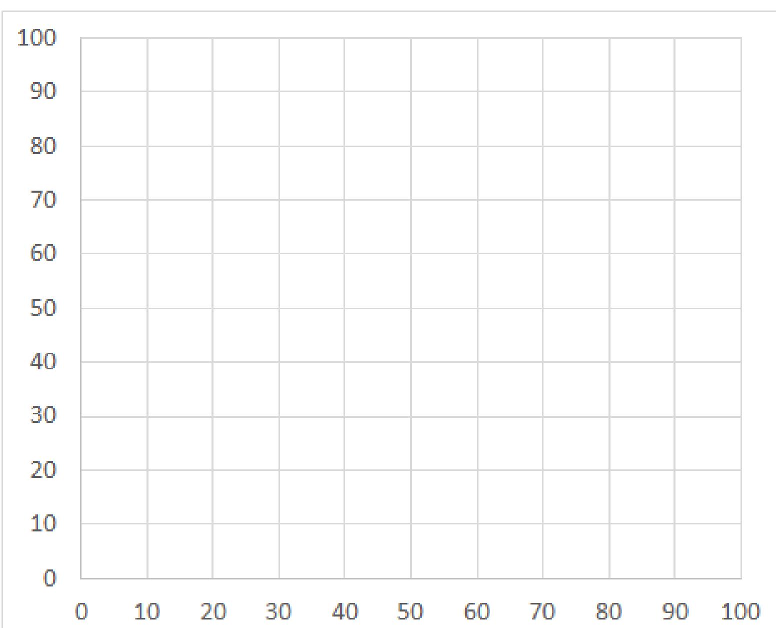
Network Tolology			
Junction	Edge,Junction	Edge,Junction	Edge,Junction
J1	E5, J2		
J2	E5, J1	E4, J3	E3, J5
J3	E4, J2		
J4	E1, J5		
J5	E3, J2	E1, J4	E2, J6
J6	E2, J5		

The coordinates of each junction are

Junction	X	Y	Z
J1	10	30	8
J2	40	30	6
J3	40	10	7
J4	50	60	7
J5	70	60	5
J6	70	100	4

The z coordinate gives the elevation. Flow is in the down elevation direction.

a) Draw a plan of this network based on X and Y coordinates. Label each edge and junction. Indicate with arrows the flow direction associated with each edge.



b) What edges are selected by an upstream trace with an edge flag placed on E3?