Name: _____

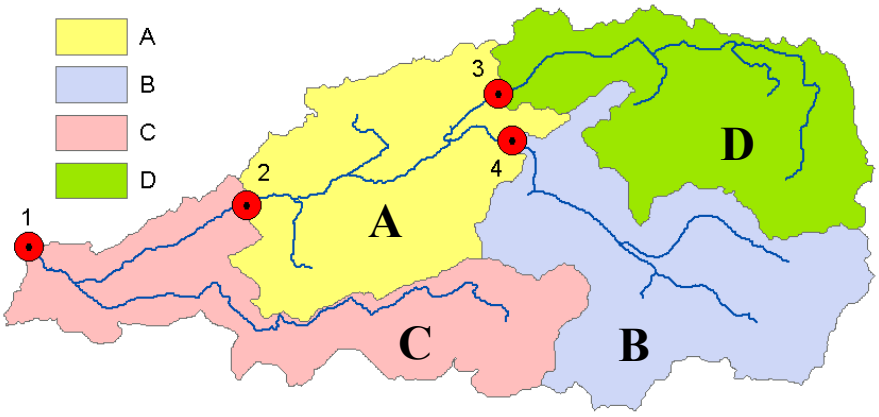
Utah State University
Department of Civil and Environmental Engineering
CEE 6400 Physical Hydrology

Final exam. Date: 12/9/2009
D.G. Tarboton Time: 20 min 20 points

Closed book portion. Answer all questions. Answer on these sheets.

Calculator use. You may use a programmable calculator or equivalent calculating device (e.g. calculator functionality on a phone). You should limit the use of the calculating device to the performance of calculations. You may use programs that you have written to evaluate quantities commonly used in this class (e.g. saturation vapor pressure). You may not use your calculating device to retrieve stored reference material in any form. You may not send messages or access the internet or communicate in any way with anyone other than the instructor or moderator regarding solutions to these questions.

1. Consider the following watershed with four stream gages and subwatersheds draining directly to each gage as indicated.



Mean annual streamflow at each gage

Gage #	m^3/s
1	6.8
2	5.7
3	2.46
4	2.05

This mean annual streamflow includes baseflow.

Area and mean annual precipitation for each subwatershed

Region	Area (km^2)	Precip (mm)
A	45	1400
B	60	1600
C	50	1300
D	55	1900

Calculate the **mean annual evapotranspiration** and **runoff ratio** for **subwatersheds A and B only**, assuming that deep infiltration losses to groundwater are negligible.

Solution to 1. [10 points]

2. Indicate whether the following statements are true or false. [10 points]

a) Relative humidity is the ratio of water vapor density to air density (ρ_v/ρ_a).

b) Relative humidity is the ratio of actual vapor pressure to saturation vapor pressure (e_a/e_s).

c) Relative humidity is the ratio of dew point temperature to air temperature (T_d/T_a) as long as absolute (Kelvin) temperature units are used.

d) Actual vapor pressure is the saturation vapor pressure at dewpoint $e_a=e_s(T_d)$.

e) Volumetric water content is the ratio of the volume of water to the volume of pore space in a soil.

f) The degree of saturation is the ratio of the volume of water to the volume of pore space in a soil.

g) Porosity is the ratio of the volume of void space to the total volume in a soil.

h) The capillary fringe is below the water table.

i) Orographic precipitation occurs primarily in flat areas.

j) Macropores and other preferential flow pathways result in reduced overland flow but increased direct storm runoff.