CEE3430 Engineering Hydrology

Practice Test (There are six practice questions here – A 50 min test will likely not have more than three)

1. Frequency Analysis

Following is peak annual flow data from a stream in Utah

Mean	294.7		Mean of Logs	2.389
Variance	29693		Var Logs	0.0786
Std Dev	172.3		Std Dev Logs	0.280
Skewness	0.864		Skewness Logs	-0.407
Count	78		**Logs are to base 10**	

Q (cfs)						
787	436	368	276	224	160	74
774	436	355	264	206	151	73
705	432	351	255	201	141	72
678	429	342	253	195	138	72
621	424	341	252	193	122	69
604	415	331	251	184	118	66
546	408	327	249	179	115	
510	404	321	248	178	107	
505	398	309	244	174	87	
490	391	303	228	172	82	
459	381	287	228	170	82	
447	372	280	227	164	78	

a) What is the probability of a flow of 500 cfs being exceeded in any one year

b) It is the end of the first year of a 5 year project and the flow of 500 cfs was not exceeded. What is the probability of a flow of 500 cfs being exceeded at least once in years 2 to 5 of the project.

c) Assume that this data fits a log-normal distribution, what is the flood with 50 year return period. Comment on whether this is consistent with the data.

d) Based on the information given is a normal or log-normal distribution likely to be a better fit for this data.

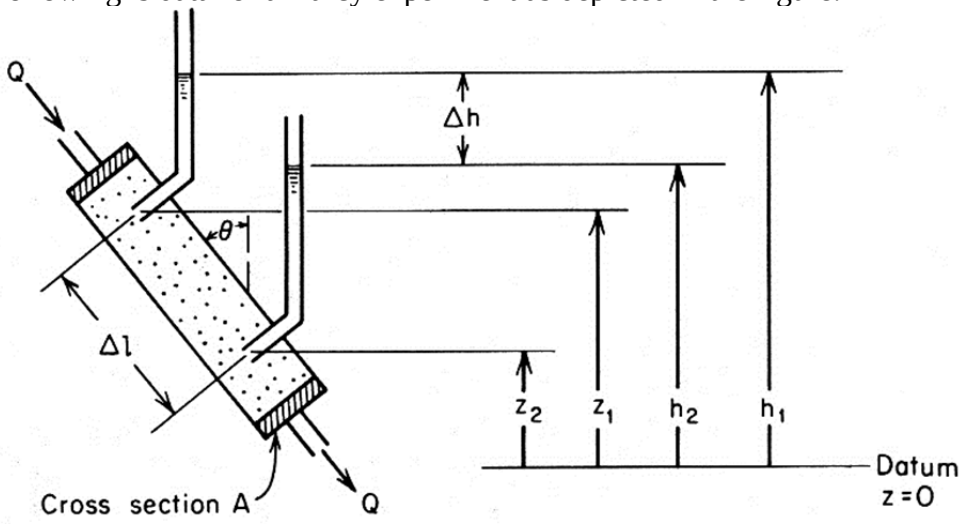
2. The relationship between infiltration capacity and cumulative infiltration at a site has been determined from measurements to be given by

Cumulative infiltration (cm)	0	1	2	3	4	5	6	7	8	9	10
Infiltration capacity (cm/hr)	20	10	6	3	2	1	1	1	1	1	1

Consider a storm in which 12 cm of precipitation falls during 2 hours.

a) Calculate the time to ponding.
b) Calculate the depth of direct runoff from this storm.

3. Following is data for a Darcy experiment as depicted in the figure.



h_1 (cm)	62	
h_2 (cm)	51	
z_1 (cm)	46	
z_2 (cm)	29	
n	0.45	Porosity
Q (cm^3/hr)	300	Discharge
g (m/s)	9.81	Gravitational acceleration
ρ_w (kg/m^3)	1000	Density of water
A (cm^2)	50	Tube internal cross section area
Δl (cm)	40	Length between piezometers

a) Calculate the hydraulic gradient

b) Calculate the hydraulic conductivity

4. Consider a soil with the following Green-Ampt infiltration parameters.

K_{sat}	0.6 cm/h
$\|\psi_f\|$	20 cm
$\Delta\theta$	0.2

a) Calculate the cumulative infiltration required for ponding and time to ponding for a constant water input rate of 1.5 cm/h.

b) Assume the following storm

Time (hours)	Rainfall (cm)
0-1	1.5
1-2	2

Calculate the runoff generated in each 1 hour time interval

5.

4.5. A reservoir has a linear S-Q relationship of

$$S = KQ,$$

where $K = 1.21$ hr. The inflow hydrograph for a storm event is given in the table.

a) Develop a simple recursive relation using the continuity equation and S-Q relationship for the linear reservoir [i.e., $aQ_2 = bQ_1 + c\bar{I}$, where a, b, and c are constants and $\bar{I} = (I_1 + I_2)/2$].

b) Storage route the hydrograph through the reservoir using $\Delta t = 1$ hr.

c) Explain why the shape of storage-discharge relations is usually not linear for actual reservoirs.

For test

Time (hr)	Inflow (m^3/s)
0	0
1	200
2	100
3	0

Time (hr)	Inflow (m^3/s)
0	0
1	100
2	200
3	400
4	300
5	200
6	100
7	50
8	0

6.

4.6. Given the reservoir with a storage-discharge relationship governed by the equation

$$S = KQ^{3/2},$$

route the inflow hydrograph for problem 4.5 using storage routing techniques and a value of $K = 1.21$ for Q in m^3/s and S in m^3/s-hr. Discuss the differences in the outflow hydrograph for this reservoir and for the reservoir of problem 4.5. Use $\Delta t = 1$ hr.