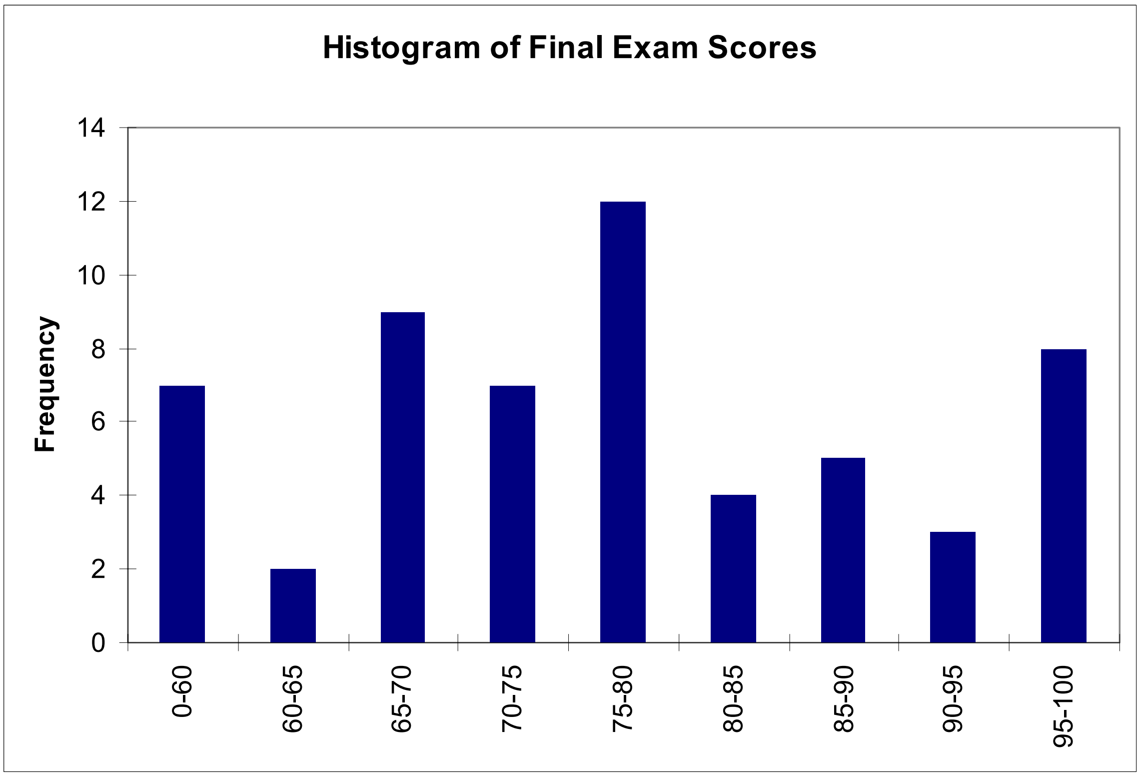
CVEN 339 – Final Exam – Spring 2003

Grade Statistics

Median	80.9
Mean	79.7
Std. Dev.	9.0
Maximum	95.9
Minimum	57.2



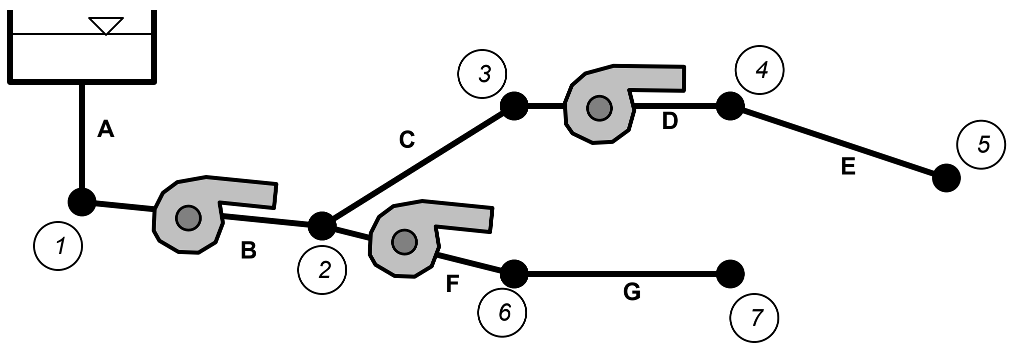
Name: ____

CVEN 339 – Water Resources Engineering
Spring Semester 2003
Dr. Kelly Brumbelow, Texas A&M University

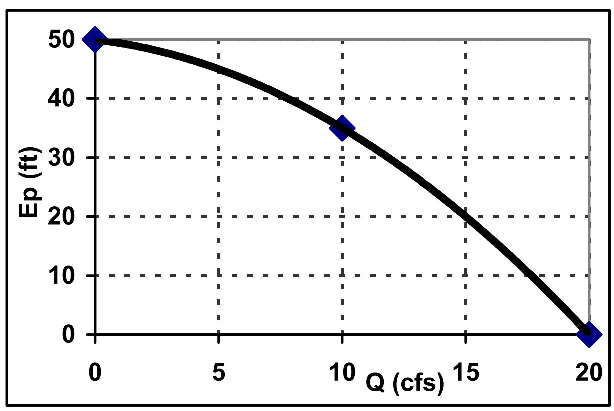
Final Exam

Open-book, Open-notes (7 pages, 4 questions)

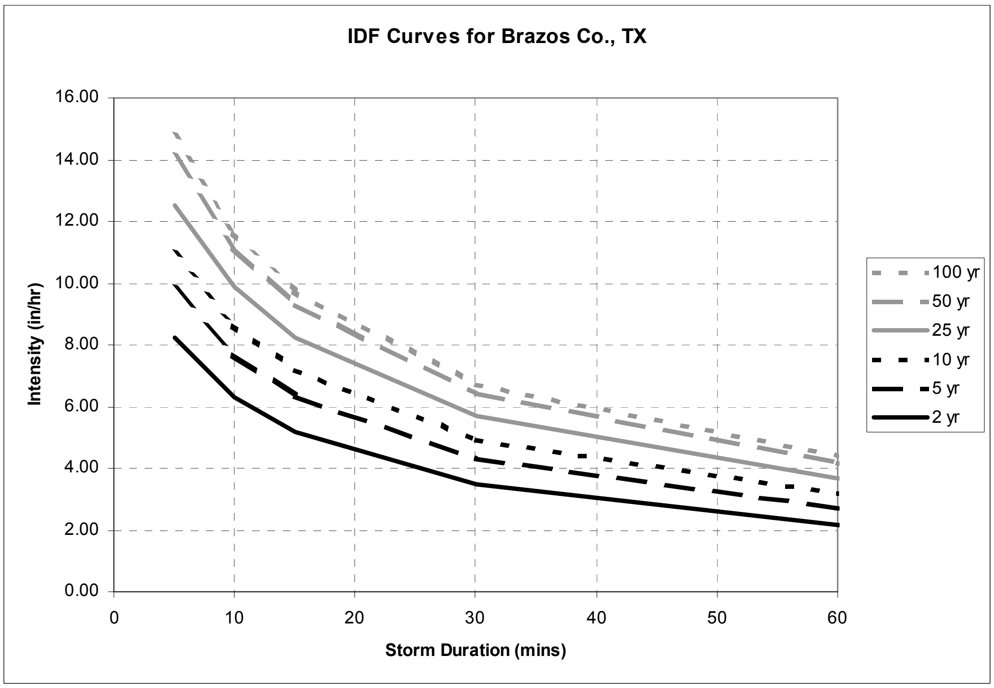
1. A small pipe network is diagrammed below. All pipes are 750 ft long, 12 in diameter, galvanized iron. You may assume that all flows are fully turbulent. The three pumps shown are identical and have the characteristic curve shown below. The table below gives ground elevation and demand for each node. Solve for flow in all 7 pipes (units of cfs) and pressure at all 7 nodes (units of psi). (30 points)



Node	Demand (cfs)	Ground Elevation (ft msl)
1	0.2	2,995
2	1.6	3,056
3	0.8	2,877
4	3.0	3,102
5	1.5	3,021
6	1.1	3,095
7	2.2	2,983
Tower		WSEL = 3,267

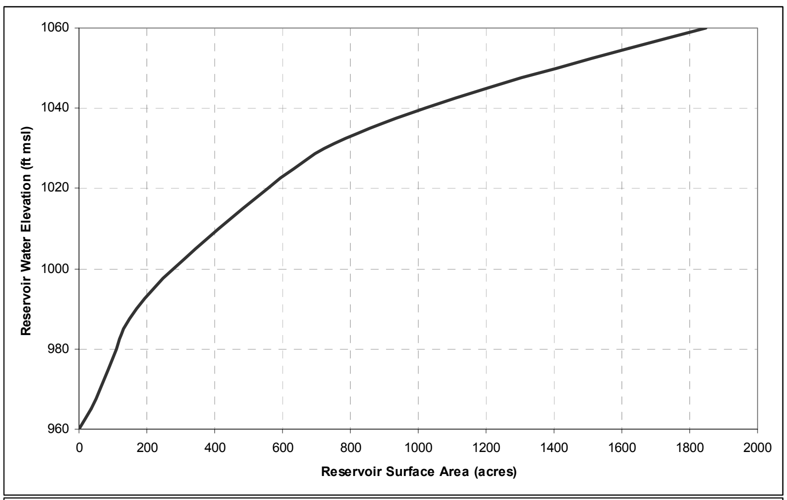


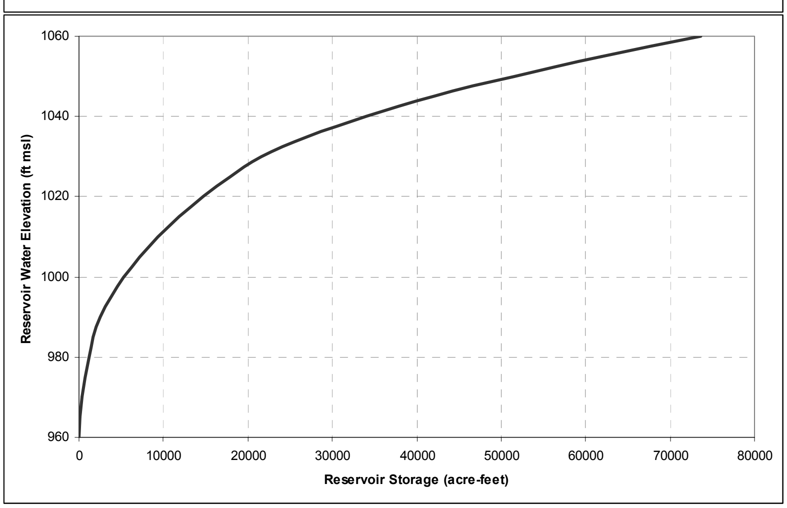
2. Given below are IDF curves for Brazos County, Texas. A 0.43 mi^2 watershed near Bryan will be developed as a heavy industrial area, and local regulations require design for the event having 4% annual probability of exceedence. No baseflow is present, but runoff from the site will flow through a ditch before entering a culvert. Muskingum routing parameters for the ditch have been estimated as K = 15 min and X = 0.15. If time of concentration for this watershed has been estimated as 45 min, what will be the peak flow rate that the culvert must accommodate? (Hint: Be careful of the Δt you use in Muskingum routing. If necessary, adjust Δt so that it is within the limits specified in lecture.) (30 points)



3. A reservoir has surface area versus elevation and storage versus elevation relationships given in the graphs below. Forecasted inflows and potential evaporation rates for the reservoir for a period of several months are also given in the table below. No precipitation is expected. It is also known that the reservoir is "leaky" with significant infiltration of water from the reservoir into the underlying aquifer. The rate of infiltration as a function of storage has been estimated as $I = 0.00097 \cdot S^{1.24}$ (infiltration in ac·ft/month, storage in ac·ft). The reservoir will be operated during this period with the outflow rates shown in the table. Calculate the expected reservoir storage on June 1, July 1, August 1, and September 1. To simplify calculations, you may calculate evaporation and infiltration rates each month assuming constant reservoir elevation equal to the value at the start of the month. (25 points)

Date	Forecast Inflow for next 30 (or 31) days (ac·ft/month)	Forecast Pot. Evap. for next 30 (or 31) days (in/month)	Reservoir Release for next 30 (or 31) days (ac·ft/month)	Reservoir Storage (ac·ft)
May 1	1,950	6.2	542	20,000
June 1	742	10.7	862	?
July 1	61	13.4	1,350	?
Aug. 1	48	13.2	1,770	?





4. A wellfield is under development to supply large quantities of groundwater from a confined aquifer. In the vicinity of the wellfield, the aquifer is 54 ft thick and has saturated hydraulic conductivity of 0.472 ft/day. It is anticipated that all wells in the field will be 24 inches in diameter and be pumped at a rate of 4 gpm. Local groundwater conservation district regulations require that the drawdown of the piezometric surface be no greater than 40 ft. Regulations also require that wells in intensively pumped wellfields such as this one do not have intersecting cones of depression. What will be the minimum allowable well spacing for this wellfield? (15 points)