

**53:078 Principles of Hydrology
Spring 2004**

Homework Guidelines

General Guidelines

The engineering problem solving approach will be used in this class for all homework submissions. The specific format to use is described below.

Your homework submission is meant to document an engineering problem and its solution. Equations and numbers alone are insufficient to document the problem and solution. Instead, you need to describe the problem (in sentences) and the steps in the solution so that another engineer can follow the work. Also, your submission is meant to represent your final solution. Use scratch paper to figure out how to solve the problem. Afterwards, document the problem and solution on your homework submission in an orderly and professional manner.

Homework assignments must be neat and legible. Use engineering paper for your submission. Solutions must be clearly marked (underline and label). Sketches and figures must be drawn using a straight-edge. Plots and graphs may be done using a computer, when appropriate. Assignments that are messy, or do not follow the format shown below, will be returned for no credit.

Specific Format

Use the following format for your homework submissions:

Date: 1 January 2004	53:078, HW #1 Problem: 2	Name
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Problem 2. Problem Title

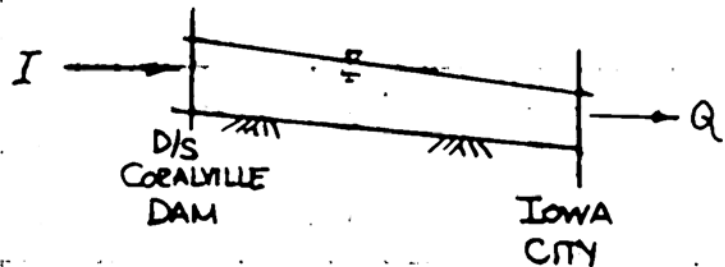
Statement: Briefly describe the problem to be solved. Note all the given information and draw any necessary figures. Clearly state the desired result.

Solution: Write-out in detail the formulation of the solution. Provide comments for each major step (or part) of the solution. Your text should explain the equations, numbers, and figures that follow, as well as any necessary assumptions. Reference any materials (spreadsheet tables and/or figures) that are attached. Underline the final answer for each part.

PROBLEM 2: RIVER ROUTINGSTATEMENT:

THE HYDROGRAPH (SHOWN BELOW IN TABLE 1) IS MEASURED AT THE GAGE DIRECTLY DOWNSTREAM OF CORALVILLE RESERVOIR. ESTIMATE THE DISCHARGE HYDROGRAPH AT IOWA CITY (BURLINGTON STREET) USING THE MUSKINGHAM ROUTING METHOD.

$$\begin{aligned}x &= 0.2 \\k &= 120 \text{ min} \\ \Delta t &= 60 \text{ min (1 hr)}\end{aligned}$$

SOLUTION:

FOR THE MUSKINGHAM ROUTING METHOD:

$$Q_{j+1} = C_1 I_{j+1} + C_2 I_j + C_3 Q_j$$

THE MUSKINGHAM CONSTANTS ARE:

$$C_1 = \frac{\Delta t - 2kx}{2k(1-x) + \Delta t} = \frac{60 - 2(120)(0.2)}{2(120)(1-0.2) + 60} = 0.04762$$

$$C_2 = \frac{\Delta t + 2kx}{2k(1-x) + \Delta t} = \frac{60 + 2(120)(0.2)}{2(120)(1-0.2) + 60} = 0.42857$$

$$C_3 = \frac{2k(1-x) - \Delta t}{2k(1-x) + \Delta t} = \frac{2(120)(1-0.2) - 60}{2(120)(1-0.2) + 60} = 0.52381$$

THE MUSKINGHAM RIVER ROUTING WAS CARRIED OUT USING A SPREADSHEET. THE RESULTS ARE SHOWN IN TABLE 1.

Table 1: Muskingham Routing

Time (hour)	(Given)				Outflow
	I (cfs)	C ₁ I (cfs)	C ₂ I (cfs)	C ₃ Q (cfs)	Q (cfs)
0	1000				1000.0
1	2500	119.0	428.6	523.8	1071.4
2	4500	214.3	1071.4	561.2	1846.9
3	3130	149.0	1928.6	967.4	3045.1
4	2750	131.0	1341.4	1595.0	3067.4
5	2500	119.0	1178.6	1606.7	2904.4
6	2130	101.4	1071.4	1521.3	2694.2
7	1750	83.3	912.9	1411.2	2407.4
8	1350	64.3	750.0	1261.0	2075.3
9	1000	47.6	578.6	1087.1	1713.3

