CE 4333 – Practical Computational Hydraulics in R
Exercise 7

Purpose

Apply the Newton-Raphson technique to compute flows and heads in a pipe network.

Exercises

1. Figure 1 is a five-pipe network with a water supply source at Node 1, and demands at Nodes 1-5. Table 1 is a listing of the node and pipe data.

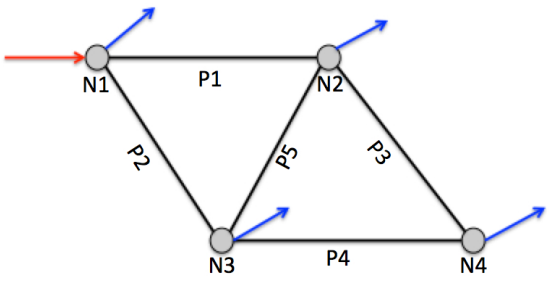

Figure 1: Layout of Simple Network

Code the script, build an input file, and determine the flow distribution In your solution you are to supply

(a) An analysis showing the development of the node-arc incidence matrix based on the flow directions in Figure 1,

(b) The input file you constructed to provide the simulation values to your script, and

(c) A screen capture (or output file) showing the results.

Table 1: Node and Pipe Data

Pipe ID	Diameter (inches)	Length (feet)	Rougnhess (feet)
P1	8	800	0.00001
P2	8	700	0.00001
P3	8	700	0.00001
P4	8	800	0.00001
P5	6	600	0.00001
Node ID	**Demand (CFS)**	**Elevation (feet)**	**Head (feet)**
N1	2.0	0.0	100
N2	4.0	0.0	?
N3	3.0	0.0	?
N4	1.0	0.0	?

2. Use the script and determine the flow distribution in Figures 2 and 3. Assume Node N1 has a total head of 300 feet.

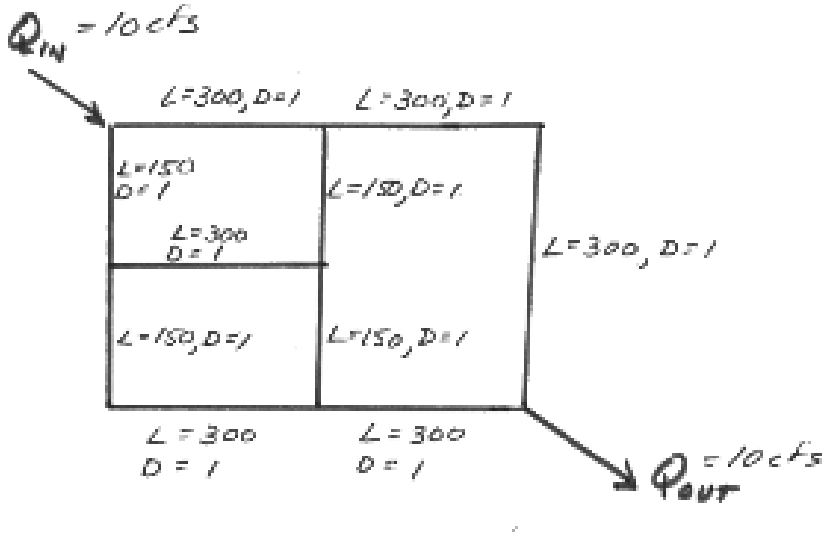

Figure 2: Pipe network for illustrative example with supply and demands identified. Pipe lengths (in feet) and diameters (in feet) are also depicted.

In your solution you are to supply

(a) An analysis showing the development of the node-arc incidence matrix based on the flow directions in Figure 3,

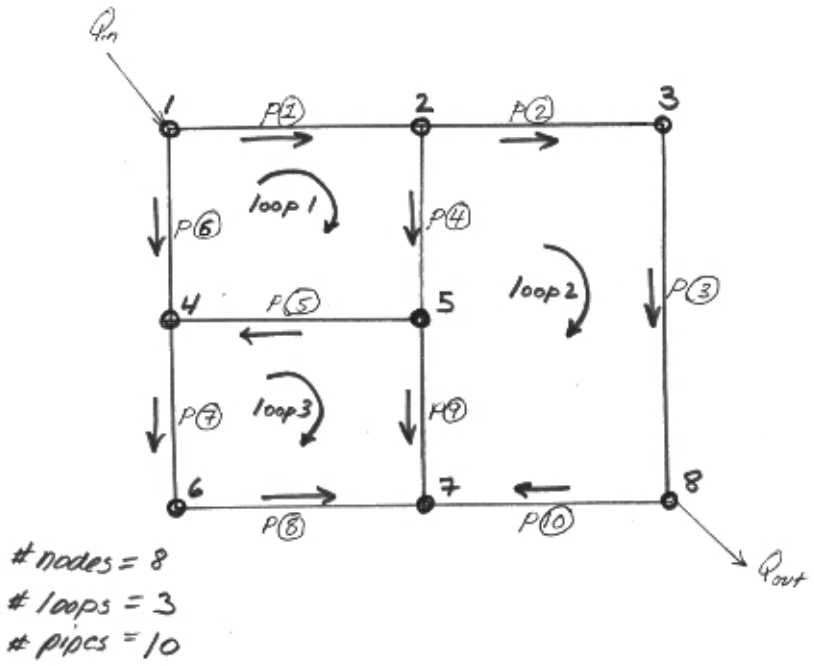

Figure 3: Pipe network for illustrative example with pipes and nodes labeled.

(b) The input file you constructed to provide the simulation values to your script, and

(c) A screen capture (or output file) showing the results.

3. Modify the script to include node elevation information to compute pressures. Assume all nodes are at elevation 200 feet.