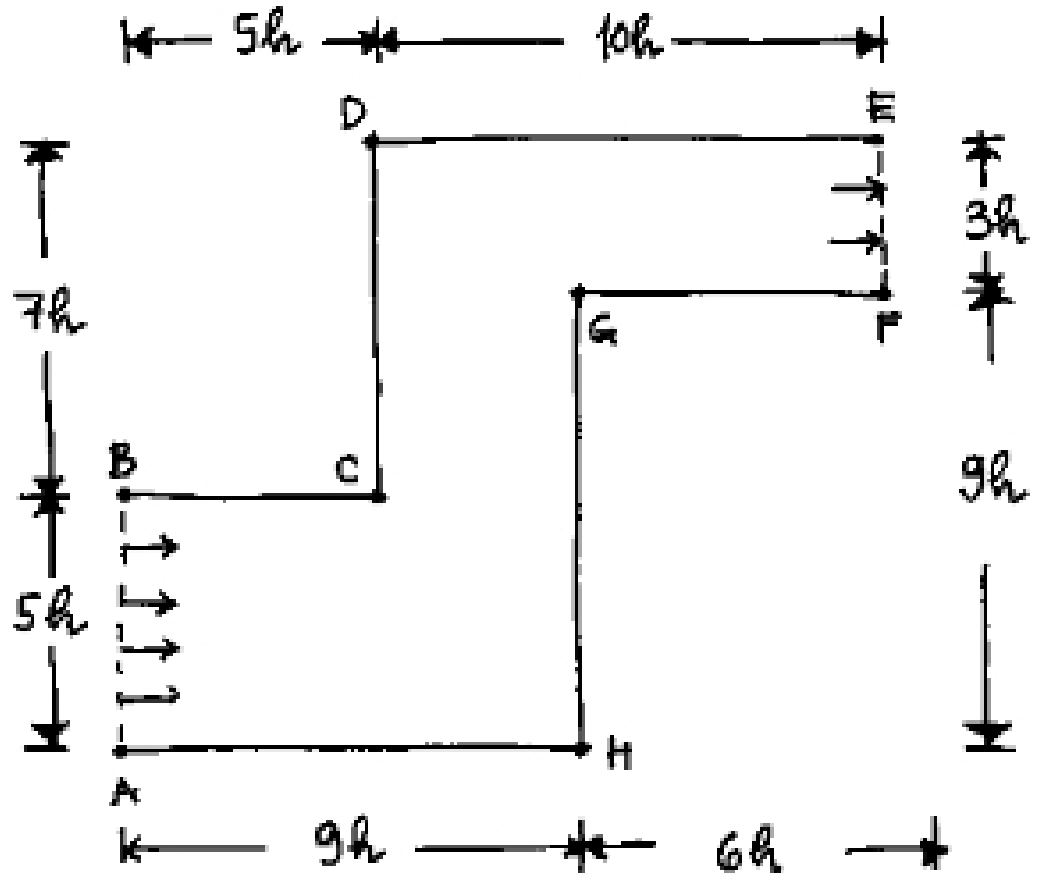
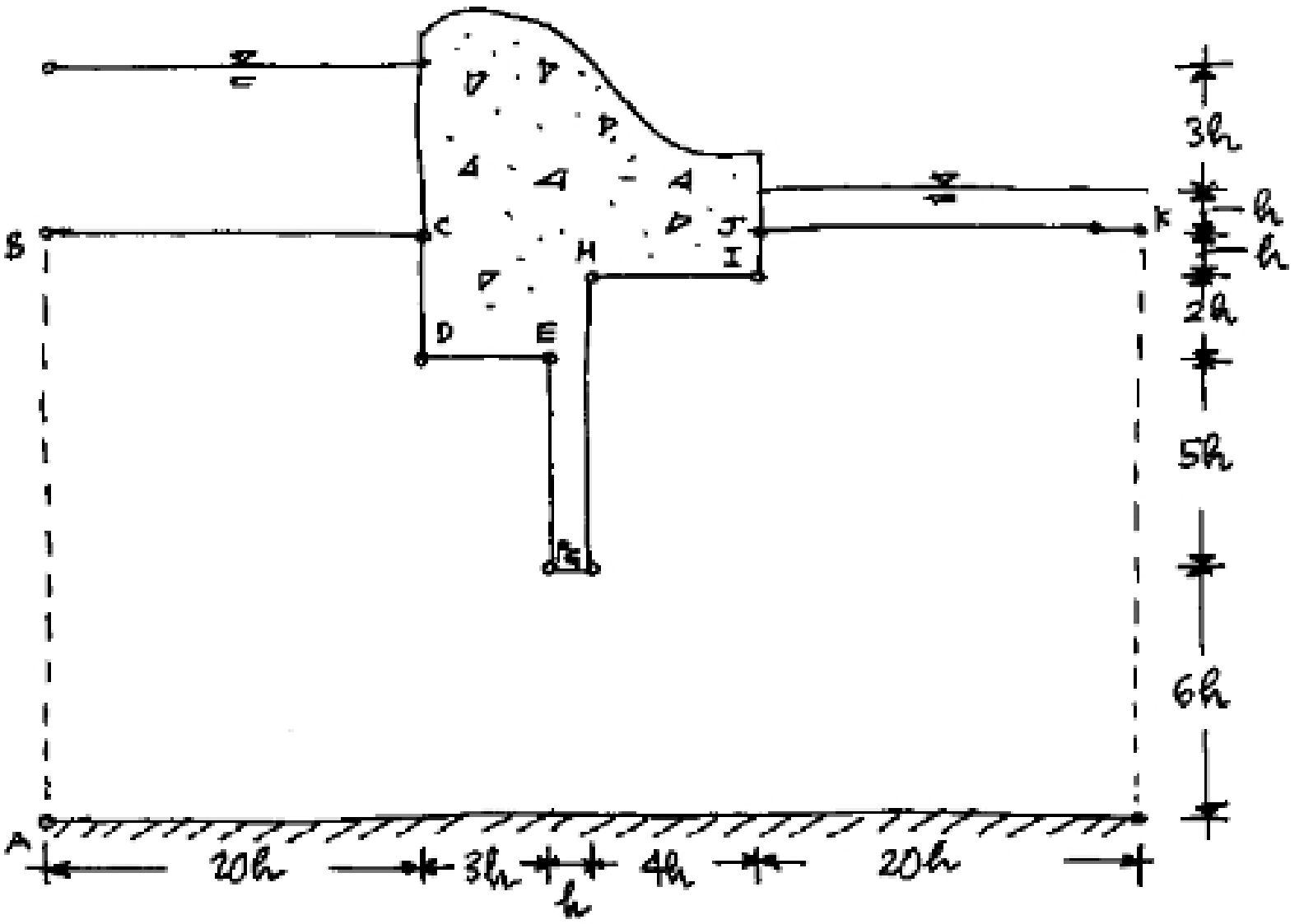
CEE 6510 – Fall 2004 – Assignment No. 8

[1] Potential flow in S-shaped domain. Solve the Laplace equation for the streamfunction ψ in the S-shaped domain shown below. Also, solve for the velocities at the grid points. Plot the grid, the streamlines, and the velocity vectors. Determine and plot the pressure distribution along walls *BCDE* and *AHGF*.

Water enters the domain through section *AB* with a constant velocity $U = 2.5$ *m/s*. Let $h = 1$ *m*. Use as boundary conditions, $\psi = 0$ along *AHGF*, and $\psi = 5hU$ along *BCDE*. Also, use the fact that the vertical velocity is zero in sections *AB* and *EF*. Solve the problem using (a) $\Delta x = \Delta y = 1$ *m;* (b) $\Delta x = \Delta y = 0.5$ *m;* and (c) $\Delta x = \Delta y = 0.25$ *m*.



[2] Flow under a dam.
The figure in next page shows an unconfined aquifer underlined by a horizontal impermeable bed, and open in the left and right-hand ends of the domain. A dam is located atop of the aquifer and a thick cut-off wall provided under the dam. Solve the Laplace equation for the velocity potential ϕ, then calculate the velocity components in the grid points, and the pressure distribution along the bottom of the dam, the cut-off wall, and the bottom of the aquifer. Plot contours of ϕ and velocity vectors. Calculate the discharge under the cut-off wall. Assume that the velocity at the left and right-hand sides of the aquifer is horizontal. Use $h = 0.5$ *m*, and try the following cases: (a) $\Delta x = \Delta y = 1$ *m;* (b) $\Delta x = \Delta y = 0.5$ *m;* and (c) $\Delta x = \Delta y = 0.25$ *m*.



Submit:

- Word document showing problem statement, functions or scripts used to solve problem, and output showing solution. Include your name in this document.
- M-files with Matlab scripts and functions.
- Input or output text files.

How to submit your assignment:

Place the Word document, *m*-files, and input and output text files in a zip file. E-mail the zip file to: gurro@cc.usu.edu