CE 3305 Engineering Fluid Mechanics
Exercise Set 23
Summer 2018 – GERMANY

Purpose : Apply computational hydraulics principles to compute steady water surface profiles in an open channel.
Assessment Criteria : Completion, results plausible, format correct, **R** script shown

Exercises:

1. Modify the (variable space step method) **R** code for U.S. Customary units. Use the modified function to compute the water surface profile for a wide rectangular channel with Manning's $n = 0.022$, bottom slope $S_0 = 0.0048$, and discharge per unit width of $\frac{Q}{W} = 5\frac{ft^3}{sec}$. Determine how far along the channel $x = L$ does it take for the flow depth to rise from a value of $y = 3.0ft$ to $y = 4.0ft$. Is the 4-ft depth position upstream or downstream of the 3-ft depth position? Plot the water surface profile.[1].

2. Modify the (variable space step method) `area` and `perimeter` functions as well as the `backwater` functions for a trapezoidal channel. Apply the modified functions for a trapezoidal channel with a $[2:1]$ side slope, $3.5ft$ bottom width, 0.012 bed slope, that discharges from a reservoir at $Q = 185\frac{ft^3}{sec}$. You should assume the upstream value is at critical depth ($\approx$ $2.7ft$) and compute the profile to within 2% of normal depth. Plot the profile[2] .

3. Convert the fixed space step example problem into US customary units. Then modify the script for US customary units and repeat the example.

[1]Guideline: The profile should extend less than 400 feet for this problem — if your profiles are going further, there is probably something wrong with your functions or input values.
[2]Guideline: The profile should extend less than 100 feet for this problem — if your profiles are going further, there is probably something wrong with your functions or input values.