Dalhousie University
Department of Industrial Engineering
IENG 6920: Advanced Topics in Linear and Integer Programming

Assignment 2
Due date: March 1st, 2021

Consider the Stock Cutting Problem (SCP) with *raws* of 100-inch length and the following *finals* ordered:

Final's index	1	2	3	4	5	6	7	8
Length in inches (w_i)	7	11	15	19	23	27	35	42
Number ordered (b_i)	52	97	140	191	85	129	26	20

1. Implement a *Column Generation* algorithm based on *Gilmore-Gomory formulation* of the SCP, presented in slide # 6 of *Lecture 4* notes, to solve the problem (note that since you will NOT perform branching on α_h, you'll only get a fractional solution and a lower bound).

2. Starting from the *Kantorovitch formulation* of the SCP, presented in slide # 4 of *Lecture 4* notes, apply *Dantzing-Wolfe* decomposition by *convexifying* the last constraint and decomposing the resulting subproblem into $|K|$ identical subproblems.

3. Apply Lagrangian relaxation on *Kantorovitch formulation* of the SCP by relaxing the last constraint. Show the resulting *master problem* and *subproblems*. Use *Kelly's cutting planes method* to update the multipliers.

4. Repeat part 4 while using *subgradient optimization* to update the Lagrangian multipliers.

5. Try to use the subset of columns (patterns) you generated while implementing *Column Generation* on *Gilmore-Gomory formulation* to obtain a feasible integer solution of the problem. This can simply be done by solving the last restricted master problem while requiring all convexity variables $\alpha_h,\ h \in H'$ to take integer values. Report the objective value.

Show your work. For each approach, report the *optimal solution*, the *optimal value* and the *computational time*. You can use a programming language of your choice (e.g., C#, Julia, Matlab, Python) to code the algorithms. Submit your solution report as a single PDF file (typed). Upload all the codes used for this assignment.