Faculty of Engineering
Civil Engineering Department
CIVENG 3C03 – Fall 2022

Assignment 3
Due: Friday, November 11, 2022 – 11:59 PM
Late submission is not permitted

Question 1 (20 Points)

For the following LP model, find the optimal solution and the allowable range of all cost coefficients and stipulations, using Microsoft Excel (Please, submit your Excel file along with your assignment).

Max $Z = 25X_1 + 15X_2 + 40X_3 + 12X_4$

Subject to
$3X_1 + 4X_2 + 4X_3 + 7X_4 \leq 178$
$4.2X_1 + 1.5X_2 + 3.15X_4 \leq 112$
$X_1 + 2X_2 \geq 23$
$X_3 + 3X_4 \geq 46$

And
$X_1, X_2, X_3, X_4 \geq 0$

Question 2 (40 points)

A Highway contractor has four locations A, B, C, and D on a road contract to which crushed stone is to be delivered. The stone, which is all of the same quality is to be supplied from two quarries 1 and 2. The table below shows the relative transportation cost per cubic meter of transporting stone from each quarry to each site.

	Location				
Quarry	A	B	C	D	Quarry output (m^3)
	Relative transportation costs ($ per m^3)				
1	9	10	15	11	120
2	12	8	6	3	255
	45	105	150	135	
	Quantities required at each location (m^3)				

a) What is the optimal allocation of the crushed stone from each quarry to each location?

b) What is the transportation cost corresponding to the solution obtained in part a?

Question 3 (40 points)

A car rental company runs multiple offices in Ontario. Over a course of a week, the company received four one-way rental bookings, in which the renters pick up the car from a local office and drop off the vehicle at another location for a small fee. The first booking involved a renter who rented a vehicle from a local office in downtown Hamilton (Main Street and James Street) and left the vehicle at Toronto Pearson International airport (YYZ). The second renter picked up a vehicle from square one shopping center in Mississauga and drove to Buffalo-Niagara International Airport (BUF) where she left the vehicle. The third booking involved a renter who picked up a vehicle from a local office in Downtown Toronto (Bay Street and Wellington Street) and dropped off the vehicle at London International Airport (YXU). The last renter picked up a vehicle from a Kitchener office (Queen Street and Duke Street) and dropped off the car at Milton GO Station. You are appointed to develop a plan to return the four vehicles to the four local offices, one vehicle per office. Each vehicle can be returned to any of the four office and not necessarily the office from which it was rented. Use an appropriate optimization technique to develop a plan for returning the four vehicles to the four local offices (List any assumptions you made to develop your answer).