ASSIGNMENT 3 **CHE 4273**

Submit all files to the TA directly including Excel and Simulation files. Make sure files can be opened.

DUE: April 12, no later than 5:00 pm.

PROBLEM #1:

Consider the ethanol-water separation column with a feed of 2000 lb-mol/hr containing 7.5 wt% ethanol. You want a desired concentration of ethanol close to the azeotrope. Any alcohol that goes with the water stream is economical loss (waste).

Assume the following uncertainty in the mean value: Year 1: current values, Rest of the years: use a 4% inflation rate for prices (the rest does not change). Assume next that around the mean value in each year values fluctuate following a normal distribution around the mean with the following standard deviations: Feed flowrate=5%, Feed Ethanol concentration= 25 %, Energy cost=85%, cooling water cost=30%. Assume that the capital costs as calculated using P&T and the Marshall and Swift index are accurate. a) *Calculate the expected net present value and the expected Return of Investment for 5 designs having different number of trays. Make sure these numbers of trays are reasonable. b) Perform a regret analysis and pick the best design accordingly*.

PROBLEM #2:

Consider the following problem: An oil refinery has to blend gasoline. Suppose that the refinery wishes to blend four petroleum constituents into three grades of gasoline: *A*, *B*, and *C*. Determine the mix of the four constituents that will maximize profit. The availability and costs of the four constituents are given in the following table:

Constituent*	Maximum quantity Available (bbl/day)	Cost Per barrel ($)
1	3500	13.50
2	2500	16.30
3	3500	14.80
4	1100	15.90

*1 = butane , 2 = straight-run, 3 = thermally cracked, 4 = catalytic cracked

To maintain the required quality for each grade of gasoline, it is necessary to specify certain maximum or minimum percentages of the constituents in each blend. These are shown in the following table, along with the selling price for each grade.

Grade	Specification	Selling price per barrel ($)
A	Not more than 17% of 1	17.60
	Not less than 40% of 2	
	Not more than 50% of 3	
B	Not more than 10% of 1	16.25
	Not less than 10% of 2	
C	Not more than 20% of 1	15.30

Assume that all other cash flows are fixed so that the "profit" to be maximized is total sales income minus the total cost of the constituents. Set up an excel model and solve.

a) Assume a 15% variability (Std. Dev) in prices of products and Use @Risk to determine the Expected Profit and show its distribution (histogram) and risk curve.

b) Use Risk Optimizer (when running @risk) to obtain the most profitable decision. You can also use EVOLVE.

c) Assume the same variability in process and also normal distributions of availabilities of constituents (prices of constituents are fixed) as indicated in the next table. Your first stage variables here are the products to be sold (a commitment is made to deliver these products to customers through a contract). Once that decision is made, for each scenario (availability of constituents and prices), you will produce as much of the committed amount of each product and give a discount to your customers of 22% of the selling price per barrel that you are short. Determine what is the optimal set of products you can offer your customers. Use GAMS. A GAMS template to do the generation of solutions and risk curve data generation for each is available in the lecture section. It solves a simple problem. All you need to do is to replace the model by one of your own.

Constituent*	Availability Mean (bbl/day)	Std. Dev (bbl/day)
1	3700	210
2	2900	150
3	3800	140
4	1300	80