Name(s) \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

**(15 points) BA 353: Take Home Exam 2 Key**

a) Paste the LP model here. Work together to very carefully enter the data into Excel, double-checking your numbers versus the actual values to ensure accuracy.



b) Try to solve the LP Model on Excel with the ten food items as they are above as variables and ten constraints. What do the Solver results say? (DO NOT JUST WRITE DOWN THE ANSWER THAT POPS UP, READ THE SOLVER RESULTS!!!). What does this imply about eating a healthy diet at McDonald’s by eating regular menu items?

Solver says no feasible solution. It is impossible to eat healthy eating regular menu items.

c) Until this summer, McDonald’s sold side salads. Read this [article](https://www.msn.com/en-us/foodanddrink/eatingout/the-surprising-reason-mcdonalds-ditched-salads-for-good/ar-BB15Sg3k). Why did they stop selling them?

COVID hurt the supply chain. Too costly to have salads.

d) Add a new food item variable for a Side Salad that costs $1. Each side salad has only 35 calories, 0 fat, 3 carbs, 20 sodium, 1 fiber, 1 protein, 2% vitamin D, 2% calcium, 6% iron and 3% potassium. Re-solve the LP Model. What items should you eat at McDonald’s daily to meet FDA requirements **and** what is the minimum cost? (Allow the answers to not be integers, **round them to one decimal place**.)

1.5 Egg Mc, 3.1 Fries, 3.1 Milk and 15.8 Salads! $23.41.

e) How many of the items in your answer to d) cost $1 (or less). **Why?**

All of them since we are minimizing cost.

f) Add a constraint that all the menu items must be integers (since you can’t buy half an Egg McMuffin). Re-solve the LP Model. Now what should you eat **and** what’s the minimum cost? Would you feel even remotely “healthy” after eating like this for a day?

1 Egg Mc, 3 Fries, 4 Milk, 3 Ketchup and 17 salads. $25.

g) Eliminate the integer constraint, again allowing fractional items. Assume that you take a supplemental vitamin pill every day that meets your requirements for vitamin D, calcium, iron and potassium (but not protein or fiber). In other words, eliminate the last four constraints. Now what should you eat **and** what’s the minimum cost?

1.4 Egg Mc, 5.8 Fries, 0.1 Milk, 7.7 Salads. $15.02.

h) What’s the integer solution for part g)?

1 Egg Mc, 5 Fries, 1 Milk, 11 Salads. $18.

i) Eliminate the integer constraint, again allowing fractional items. Requiring all ten constraints to be met, maximize the number of free ketchup packets you can include in your diet. What should you eat **and** what’s the ~~minimum~~ cost if you have the bizarre goal of eating a lot of free ketchup?

2.8 Milk, 16.6 Ketchup!!!, 28 salads. $30.75.

j) Enough of these side salads!!! As a McDonald’s *purist*, you want to develop a meal plan that only includes the first five sandwiches (from Big Mac to Filet-O-Fish), French fries and ketchup packets; of course, this is infeasible. So now:

* Change your goal from minimizing cost to minimizing calories.
* Force all answers to be integers.
* Only allow the first five sandwiches, fries and ketchup.
* Ignore the first four constraints but try to meet the last six constraints.

Try to solve this LP, but you should find that there is no solution. Why not? Which of the six last constraints is impossible to meet with the seven menu items above and why?

Vitamin D, since all of the items have 0%.

Eliminate the constraint that is impossible to satisfy (assume that you take a supplement or get a lot of sunshine {hint} or something like that} and now re-solve the LP. What should you eat and what’s the cost?

3 Double QP, 7 ChzB, 3 Fries, $24.37

What are your percentages of calories, fat, carbs and sodium compared to FDA limits?

249%, 317%, 160%, 420%