The McDonalds Diet Optimation Problem[a]

The problem: how can you reach your recommended daily nutritional allowances at McDonald's for the least amount of money?

This is an *optimization* problem, because we're trying to minimize the cost function. We also have *constraints*, because we need to meet certain requirements: 2000 calories, 55 grams of protein, 100% of our RDA of Vitamin C, and so on.

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[a]See "Examples" at www.ampl.com.

The computer gives us the following solution.

- 4.39 Quarter Pounders with Cheese
- 6.15 Small Fries
- 3.42 Milks

Total Cost: \$14.85. (Total Calories: 3965)

The computer has given us insight. We left out an important constraint: we want integer solutions!

The new, more practical solution, looks like this.

- 4 Quarter Pounders with Cheese
- 5 Small Fries
- 4 Milks
- 1 Filet-O-Fish

Total Cost: $15.05. (Total Calories: 3950)

If we give the computer all 63 items on the McDonald's menu, we get the following solution.

- 2.06 Cheeseburgers
- 4.12 Sweet'n'Sour Sauces
- 16.2 Honeys
- 0.04 Chunky Chicken Salads
- 2.27 Cheerios
- 1.78 Milks
- 0.41 Orange Juices

Total Cost: \$5.36. (Total Calories: 2018)

The computer has given us the insight to add *three* new constraints:

1. We should ask for integer solutions.
2. You can't get certain items (such as Sweet'n'Sour Sauce) without the accompanying meal.
3. Variety would be good – we should limit ourselves to no more than two of the same item.

We can also add other constraints, such as "one drink per meal."

The "Final" Solution (organized into three meals)

Meal 1	**Meal 2**	**Meal 3**
Cheerios	Cheeseburger	2 Hamburgers
English Muffin	Side Salad	Chocolate Shake
Cinn Raisin Danish	Croutons	
Orange Juice	HiC Orange (large)	

Conclusion

During the rest of your studies – and career – remember that calculators and computers can be valuable tools, but they are only tools. They can give you insights into a problem, but you still need to do the thinking.