The Sandwich Project:

Your goal is to create three sandwiches and use matrix multiplication to calculate the cost of each sandwich. *Use the Rubric to assist you in getting the best grade possible*

Creating your Sandwich:

You will create three different sandwiches by using the ingredients listed below. You will Then construct a 3x9 Matrix that represents your sandwiches and the ingredients they use. This matrix will be called the Sandwich Matrix, or Matrix A.

Rules:

1. No Ingredient can be ignored! There must be Some sandwich that uses at least one serving/slice of an ingredient.
2. Sandwiches must have at least 2 ingredients.
3. Matrix cannot contain only 1's and 0's! Be creative when making your sandwiches!

Ingredients for Sandwich:

Bread Slices (B), Ham Slices (H), Turkey Slices (Tu), Swiss Cheese Slices (S), American Cheese Slices (A), Peanut Butter Servings (PB), Jelly Servings (J), Lettuce Leaves (L), Tomato Slices (To).

Example Matrix:

	B	H	Tu	S	A	PB	J	L	To
Sandwich 1	2	2	2	1	0	0	0	2	1
Sandwich 2	2	0	0	0	0	2	2	0	0
Sandwich 3	2	0	3	1	1	0	0	2	1

In the example matrix, the rows represent the three sandwiches. Sandwich 1 and its ingredients are in row one. Sandwich 2 and its ingredients compose row two. Sandwich 3 and its ingredients compose row three.

By this example: Sandwich 1 consists of: 2 slices of bread, 2 slices of ham, 2 slices of turkey, 1 slice of Swiss cheese, 2 leaves of lettuce, and 1 slice of tomato.

Finding the Cost of Ingredients:

After you have created your sandwich matrix, follow the steps below:

1. Take a trip to a grocery store of your choosing.

2. Browse the store to find the cost of each ingredient in your sandwiches. You should be locating nine items. *Be sure to record (write on a piece of paper) which brand of ingredient you are using, as well as how many slices or ounces are in each package.*
3. Calculate the cost of each slice or each serving by using division. *If there are 20 slices of bread in a package and the packages costs $2.75, you will take your cost and divide by 20 to figure out the price per slice/serving.* For Lettuce, Peanut Butter, Jelly, and Tomatoes use the conversions listed below to figure out how much each serving is.
4. After you have recorded the price for each slice/serving and the brand of each product, you will combine the data into a matrix. For instructions on creating the matrix, read below.

Conversions for special ingredients:

- 1 Tomato = 5 Slices
- Peanut Butter Serving = 2 oz
- Jelly Serving = 2 oz
- 1 Lettuce Head = 36 Leaves

Reminder: You **Must** write down which brand/product you are using for your ingredients! You will Turn in your ingredients calculation work!

Now you should have the price of each slice or ingredient. Using your findings, create a 9x1 matrix that contains the data. Each row will contain the price of a different ingredient serving/slice, listed in the same order as the Sandwich Matrix (A) above.

Below is the template for the matrix you will create. Notice how each row represents the cost of a different ingredient. Your ingredients will not have any $0.00 costs. This matrix will be called Ingredient Matrix, or Matrix B.

Bread Slice	$0.00
Ham Slice	$0.00
Turkey Slice	$0.00
Swiss Cheese Slice	$0.00
American Cheese Slice	$0.00
Peanut Butter Serving	$0.00
Jelly Serving	$0.00
Lettuce Leaf	$0.00
Tomato Slice	$0.00

Calculating the Cost of Each Sandwich!

Now you should have two matrices, the Sandwich Matrix and the Ingredient Matrix. You will do the following equation to calculate the price of each sandwich.

Sandwich Matrix * Ingredient Matrix = Price Matrix

or alternatively...

A x B = C, where C is the Price Matrix.

After you have multiplied your matrices together, your resulting matrix (which we will call the Price Matrix) should be a 3x1 Matrix. The rows will represent each sandwich, and the columns will represent the total cost for each sandwich.

Listed below is an example of what your matrix will look like. X will be the price of Sandwich 1, Y will be the price of Sandwich 2, and Z will be the price of Sandwich 3.

	Total Cost
Sandwich 1	x
Sandwich 2	y
Sandwich 3	z

Congratulations! You have successfully applied Matrix Multiplication to the real world!

Listed Below is a what you will need to turn in for this assignment.

- List of Ingredients you used in your sandwich. This includes the Brand and Name of each ingredient.
- Your serving calculations. This includes the work you did to calculate the price of each serving or slice for your ingredients. *This may be on the same page as the list of ingredients*
- Your Sandwich Matrix, Ingredient Matrix, and Price Matrix. This page should show the work needed to create the price matrix.
- Systems of Equations for your Sandwich Matrix: You will write out a system of equations that describes the data from your Sandwich Matrix. You have had lots of practice with converting systems to matrices, now reverse the process and convert a matrix to a system. *Make sure to include what ingredient each variable represents in a legend or key.*
- Finally, on a separate piece of paper, explain using whole sentences why this project worked. *Explain the inner workings of how matrix multiplication gave you the price of each sandwich.*

Your Presentation:

After you have completed your project and have all of the required data and calculations, you will give a brief presentation to the class.

You will present one of your sandwiches. *The sandwich you present must have a name! Try to be creative or funny when naming your sandwich!* You will tell the types of ingredients you used, and you will give the price for each ingredient. You will then tell the price for the sandwich and compare its cost to the other sandwiches you created.