

**DOLLAR GENERAL®**

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**DAT-201**  
**Database Project**  
Spring 2019

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Simpson**

**Paula  
Shubock**

# Our Final Project Presentation includes the following items:

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1. A question that can be answered with data.
2. A quick tour of our database, with a sample view of one of the flat files upon which it was based.
3. A sample view of the visualization tool generated by querying our database.
4. Data-backed claim (or claims) that address our question. Visualization(s) that support the data-backed claim we are making.
5. Brief plan for answering more detailed questions.
6. A detailed description of our individual contributions to the project.

1. A question that can be answered with data:
- 

**What is the cheapest  
healthy diet  
that you can purchase  
at a dollar store?**

**Dollar Store:** A store that sells a variety of inexpensive items priced at a dollar and usually under ten dollars.



*“There are now more than 30,000 dollar stores in the United States. That's more locations than Walmart, Walgreens, CVS, Costco, Kroger and Home Depot combined.”*

How Do Dollar Stores Make Money?  
BY DAVE ROOS

<https://money.howstuffworks.com/personal-finance/budgeting/dollar-store.htm>

## ***Why shop in a dollar store?***

**Price – Convenience – No Alternative**

<https://www.babson.edu/academics/executive-education/babson-insight/strategy-and-innovation/the-high-price-of-dollar-stores/>

# There are three major national “dollar” stores in the U.S.:



- **Small Town-Rural** 1955 Springfield, KY
- **15,300+** stores in U.S.
- 2.0% same store profit increase in 2019

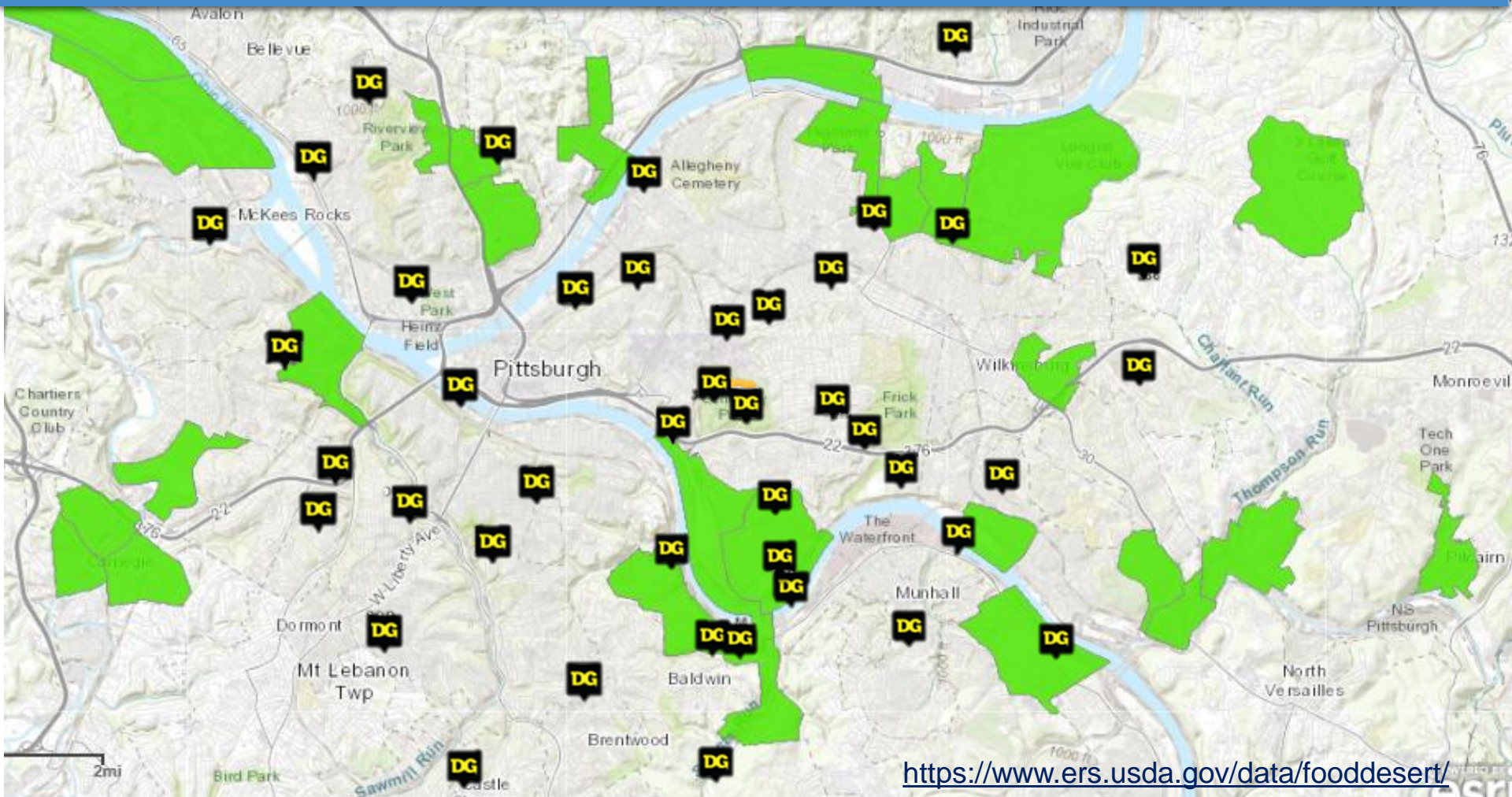


- **Urban** 1959 Charlotte, NC
- **8000+** stores in U.S.
- 1.4% same store profit increase in 2019
- *Purchased by Dollar Tree in 2016*




- **Suburban** 1986 Norfolk, VA
- **14,800+** stores in U.S.
- 3.2% sales store profit increase in 2019

# Pittsburgh Metro Area Dollar General Distribution Network and USDA “Food Deserts”



Dollar General # 7927  
120 Penn Avenue  
Turtle Creek, PA 15145

(412) 646-6190

SEND STORE DETAILS VIA  

**OPEN NOW** 8:00 AM - 10:00 PM

**MY FAVORITE STORE**

**DIRECTIONS**

**STORE AD**

## HOURS

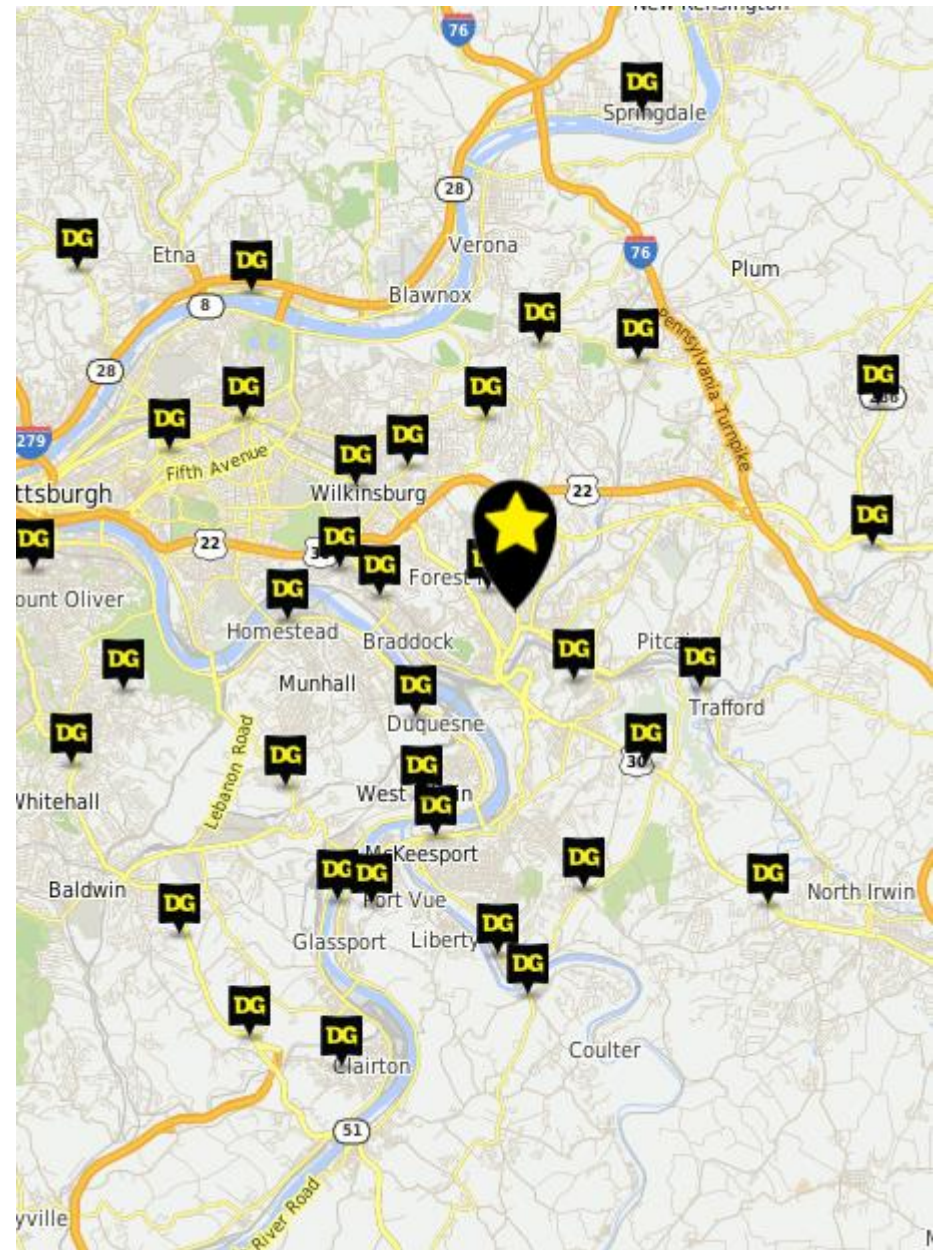
Monday: 8:00 AM - 10:00 PM  
Tuesday: 8:00 AM - 10:00 PM  
Wednesday: 8:00 AM - 10:00 PM  
Thursday: 8:00 AM - 10:00 PM  
Friday: 8:00 AM - 10:00 PM  
**Saturday: 8:00 AM - 10:00 PM**  
Sunday: 8:00 AM - 10:00 PM

## FEATURES

**RugDoctor**

MULTICULTURAL  
**HAIR CARE** 

MY STORE



# Dollar stores profit in two ways.

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- Sell large volumes of goods at heavily discounted prices: **small margin, large multiplier**
- Offer products to fit price points:
  - ✓ **generic brands or private labels**, often specially manufactured using cheaper materials and processes than usual.
  - ✓ available through the **grey market**.
  - ✓ bought at a **closeout** (seasonal or promotional goods, bankruptcy stock)
  - ✓ sold in **smaller unit sizes** than elsewhere.



## 2. Quick tour of database, with a sample view of one of the flat files upon which it was based.



## Download FoodData Central Data

Data contained in FoodData Central can be downloaded. The download files are available both as a [CSV](#) delimited ASCII file and as a Microsoft Access database (version 2007).

- The Microsoft Access database contains a few sample queries.
- [Data Type Documentation](#) provides links to documentation for each of FoodData Central's data types, and these documents provide details on the file formats.

View [Download & API Field Descriptions \(XLSX - 50K\)](#) for definitions of all the terms and labels used in the download files of FoodData Central. This guide is also included in each downloaded file.

## Access the Downloads

The following files can be downloaded:

- All foods ([CSV - 58M](#)) ([MS Access - 99M](#))
- Foundation ([CSV - 1.3M](#))
- Survey (FNDDS) ([CSV - 4.8M](#))
- Branded ([CSV - 47M](#))
- SR Legacy ([CSV - 5.7M](#))
- Supporting data ([CSV - 206K](#))



**FoodData Central is an integrated data system that provides expanded nutrient profile data and links to related agricultural and experimental research.**

FoodData Central is managed by the Agricultural Research Service and hosted by the National Agricultural Library.

The suggested citation is:

U.S. Department of Agriculture, Agricultural Research Service. FoodData Central, 2019. [fdc.nal.usda.gov](https://fdc.nal.usda.gov).

#### **FoodData Central:**

- Includes five distinct types of data containing information on food and nutrient profiles, each with a unique purpose.
- Provides a broad **snapshot in time** of the nutrients and other components found in a wide variety of foods and food products.
- Presents data that come from a variety of sources and are updated as new information becomes available.
- Includes values that are derived through a variety of analytic and computational approaches, using state-of-the-art methodologies and transparent presentation.

At this time, only a basic view of search results is available for viewing on mobile devices. Advanced filter features are not yet mobile-enabled and are available only in desktop view.

Field	Value
Authors	Pehrsson, Pamela R. ( <a href="#">ORCID</a> ); Haytowitz, David B. ( <a href="#">ORCID</a> ); McKillop, K.A.; Moore, G.; Finley, John W. ( <a href="#">ORCID</a> ); Fukagawa, Naomi K. ( <a href="#">ORCID</a> )
Product Type	Database
Publisher	USDA Agricultural Research Service
Contact Name	Haytowitz, David B.
Contact Email	<a href="mailto:David.Haytowitz@ARS.USDA.GOV">David.Haytowitz@ARS.USDA.GOV</a>
Access Level	Public
Primary Article	Kretser, A., Murphy, D., & Starke-Reed, P. (2017). A partnership for public health: USDA branded food products database. <i>Journal of Food Composition and Analysis</i> , 64(1), 10-12 DOI: <a href="https://doi.org/10.1016/j.jfca.2017.07.019">10.1016/j.jfca.2017.07.019</a>
Related Content	<a href="#">USDA National Nutrient Database for Standard Reference</a>
License	<a href="#">U.S. Public Domain</a>
Funding Source(s)	Agricultural Research Service
Program Code	005:037 - Department of Agriculture - Research and Education
Bureau Code	005:18 - Agricultural Research Service
Modified Date	2019-04-04
Release Date	2017-11-16

# First Download: 5 files

## Welcome to the USDA Food Composition Databases

This Web site allows you to search the following USDA Food Composition Databases from one location:

- USDA National Nutrient Database for Standard Reference Legacy Release, April 2018
- USDA Branded Food Products Database



Name	Type	Compressed size	Password ...	Size	Ratio	Date modified
all_downloaded_table_record_counts.csv	Microsoft Excel Comma S...	1 KB	No	1 KB	22%	4/2/2019 4:58 PM
branded_food.csv	Microsoft Excel Comma S...	18,927 KB	No	99,897 KB	82%	4/2/2019 4:56 PM
Download & API Field Descriptions-2019-04-02-14-48.xlsx	Microsoft Excel Worksheet	175 KB	No	443 KB	61%	4/2/2019 4:58 PM
food.csv	Microsoft Excel Comma S...	3,204 KB	No	17,969 KB	83%	4/2/2019 4:50 PM
food_nutrient.csv	Microsoft Excel Comma S...	25,595 KB	No	188,166 KB	87%	4/2/2019 4:51 PM

# Second Download: 14 Files

<https://fdc.nal.usda.gov/download-datasets.html>

File Explorer window showing the extraction of a zip file. The window title is "FoodData\_Central\_Supporting\_Data\_csv\_2019-04-02.zip". The "Extract" tab is active, and the "Extract To" field is empty. The main pane displays a list of 14 files with columns for Name, Type, Compressed size, Password, Size, Ratio, and Date modified.

Name	Type	Compressed size	Password ...	Size	Ratio	Date modified
all_downloaded_table_record_counts.csv	Microsoft Excel Comma Separated Values File	1 KB	No	1 KB	44%	4/2/2019 5:05 PM
Download & API Field Descriptions-2019-04-02-14-48.xlsx	Microsoft Excel Worksheet	175 KB	No	443 KB	61%	4/2/2019 5:05 PM
food_attribute_type.csv	Microsoft Excel Comma Separated Values File	1 KB	No	1 KB	43%	4/2/2019 4:59 PM
food_category.csv	Microsoft Excel Comma Separated Values File	1 KB	No	1 KB	52%	4/2/2019 4:59 PM
food_nutrient_derivation.csv	Microsoft Excel Comma Separated Values File	2 KB	No	7 KB	74%	4/2/2019 5:05 PM
food_nutrient_source.csv	Microsoft Excel Comma Separated Values File	1 KB	No	1 KB	48%	4/2/2019 5:03 PM
lab_method.csv	Microsoft Excel Comma Separated Values File	4 KB	No	11 KB	69%	4/2/2019 5:05 PM
lab_method_code.csv	Microsoft Excel Comma Separated Values File	3 KB	No	8 KB	65%	4/2/2019 5:05 PM
lab_method_nutrient.csv	Microsoft Excel Comma Separated Values File	5 KB	No	21 KB	76%	4/2/2019 5:05 PM
measure_unit.csv	Microsoft Excel Comma Separated Values File	1 KB	No	2 KB	59%	4/2/2019 5:03 PM
nutrient.csv	Microsoft Excel Comma Separated Values File	4 KB	No	9 KB	66%	4/2/2019 5:01 PM
nutrient_incoming_name.csv	Microsoft Excel Comma Separated Values File	7 KB	No	24 KB	73%	4/2/2019 5:03 PM
retention_factor.csv	Microsoft Excel Comma Separated Values File	3 KB	No	13 KB	78%	4/2/2019 4:59 PM
wweia_food_category.csv	Microsoft Excel Comma Separated Values File	2 KB	No	5 KB	61%	4/2/2019 4:59 PM

# tBrandedFood.csv in Excel

## 260,370 Records

	A	B	C	D	E	F	G	H	I	J	K
1	fdcid	brandowner	gtinupc	ingredients	servingsize	servingsizeunit	household	brandedfoodcategory	datasourc	modified_date	availabledate
2	344604	Red Gold	072940755050	Tomatoes, Tomato Juice, Less Than 2% Of: Salt, Dried Onion, Dried G	123 g		1/2 cup		GDSN	4/6/2018	4/26/2018
3	344605	Red Gold	072940755043	Tomatoes, Tomato Juice, Less Than 2% Of: Salt, Dried Onion, Dried G	123 g		1/2 cup		GDSN	4/4/2018	4/26/2018
4	344606	Cargill	642206000000	White Turkey, Natural Flavoring	112 g		4 oz.		GDSN	8/5/2016	6/13/2016
5	344607	Cargill	642206000000	Turkey Breast, Natural Flavoring	112 g		4 oz.		GDSN	8/5/2016	6/7/2016
6	344608	Cargill	642206000000	Turkey, natural Flavoring.	112 g		4 oz.		GDSN	8/5/2016	6/8/2016
7	344609	Kellogg Company US	038000934490	ENRICHED FLOUR (WHEAT FLOUR, NIACIN, REDUCED IRON, VITAMIN E	50 g		1 Pastry	Pies/Pastries - Sweet (Shelf Stable)	GDSN	1/22/2018	1/22/2018
8	344610	Kellogg Company US	038000317101	ENRICHED FLOUR (WHEAT FLOUR, NIACIN, REDUCED IRON, VITAMIN E	52 g		1 Pastry	Pies/Pastries - Sweet (Shelf Stable)	GDSN	2/5/2018	2/7/2018
9	344611	Kellogg Company US	038000116599	ENRICHED FLOUR (WHEAT FLOUR, NIACIN, REDUCED IRON, VITAMIN E	52 g		1 Pastry	Pies/Pastries - Sweet (Shelf Stable)	GDSN	9/3/2016	9/3/2016
10	344612	Kellogg Company US	024100191345	Enriched flour (wheat flour, niacin, reduced iron, vitamin B1 [thiamir	30 g		27 Cracker	Biscuits/Cookies (Shelf Stable)	GDSN	12/14/2017	2/7/2018
11	344613	Kellogg Company US	024100219131	Enriched flour (wheat flour, niacin, reduced iron, vitamin B1 [thiamir	30 g		27 Cracker	Biscuits/Cookies (Shelf Stable)	GDSN	11/7/2017	11/7/2017
12	344614	Kellogg Company US	024100705849	Enriched flour (wheat flour, niacin, reduced iron, vitamin B1 [thiamir	30 g		25 Cracker	Biscuits/Cookies (Shelf Stable)	GDSN	2/5/2018	2/6/2018
13	344615	Kellogg Company US	024100789092	Enriched flour (wheat flour, niacin, reduced iron, vitamin B1 [thiamir	30 g		25 Cracker	Biscuits/Cookies (Shelf Stable)	GDSN	2/5/2018	2/5/2018
14	344616	Kellogg Company US	024100794829	Whole wheat flour, enriched flour (wheat flour, niacin, reduced iron	21 g		1 Pouch	Biscuits/Cookies (Shelf Stable)	GDSN	11/10/2017	11/10/2017
15	344617	Kellogg Company US	030100100355	ENRICHED FLOUR (WHEAT FLOUR, NIACIN, REDUCED IRON, VITAMIN E	28 g		2 Cookies	Biscuits/Cookies (Shelf Stable)	GDSN	2/5/2018	2/5/2018
16	344618	Kellogg Company US	038000151477	ENRICHED FLOUR (WHEAT FLOUR, NIACIN, REDUCED IRON, VITAMIN E	100 g		1 Package	Pies/Pastries - Sweet (Shelf Stable)	GDSN	11/7/2017	11/7/2017
17	344619	Kellogg Company US	079126008306	APPLE PUREE CONCENTRATE, NATURAL APPLE FLAVOR WITH OTHER N	14 g		1 Fruit Lea	Fruit - Prepared/Processed (Shelf Stable)	GDSN	1/25/2018	1/26/2018
18	344620	Kellogg Company US	018627103004	WATER, WHOLE GRAIN SORGHUM FLOUR, WHOLE OAT FLOUR, DRIED O	72 g		2 Waffles	Cakes - Sweet (Frozen)	GDSN	1/25/2018	1/25/2018
19	344621	Kellogg Company US	100841000000	COOKED BROWN RICE (LONG GRAIN BROWN RICE, WATER), WATER, M	142 g		1 Patty	Vegetable Based Products / Meals - Not Re	GDSN	11/16/2017	11/16/2017
20	344622	Kellogg Company US	024100103003	Whole wheat flour, enriched flour (wheat flour, niacin, reduced iron	21 g		1 Pouch	Biscuits/Cookies (Shelf Stable)	GDSN	11/6/2017	11/7/2017
21	344623	Kellogg Company US	024100104819	Whole wheat flour, enriched flour (wheat flour, niacin, reduced iron	28 g		1 Pouch	Biscuits/Cookies (Shelf Stable)	GDSN	2/7/2018	2/7/2018
22	344624	Kellogg Company US	024100105236	Enriched flour (wheat flour, niacin, reduced iron, vitamin B1 [thiamir	25 g		1 Pouch	Biscuits/Cookies (Shelf Stable)	GDSN	12/5/2017	12/5/2017
23	344625	Kellogg Company US	024100108213	Cheese crackers (enriched flour [wheat flour, niacin, reduced iron, vi	30 g		1/2 Cup	Biscuits/Cookies (Shelf Stable)	GDSN	2/7/2018	2/7/2018
24	344626	Kellogg Company US	024100109517	Enriched flour (wheat flour, niacin, reduced iron, vitamin B1 [thiamir	42 g		1 Package	Biscuits/Cookies (Shelf Stable)	GDSN	5/16/2017	5/16/2017
25	344627	Kellogg Company US	024100109876	Cheese crackers (enriched flour [wheat flour, niacin, reduced iron, vi	30 g		1/2 Cup	Biscuits/Cookies (Shelf Stable)	GDSN	2/7/2018	2/7/2018
26	344628	Kellogg Company US	024100122639	Cheese crackers (enriched flour [wheat flour, niacin, reduced iron, vi	30 g		1/2 Cup	Biscuits/Cookies (Shelf Stable)	GDSN	2/7/2018	2/7/2018
27	344629	Kellogg Company US	024100788842	Enriched flour (wheat flour, niacin, reduced iron, vitamin B1 [thiamir	30 g		26 Cracker	Biscuits/Cookies (Shelf Stable)	GDSN	11/7/2017	11/7/2017

# tDGInventory: 300+ Records

**DOLLAR GENERAL**

Current Ad **DG DIGITAL COUPONS** Find A Store Careers

Categories Save Get Inspired Search entire store here... Sign In / Up My Cart

Deals of the week!

PRICES VALID THRU SAT, 5/11 AT PARTICIPATING STORES AND ONLINE

**DOLLAR GENERAL** Save time. Save money. Every day!

2 for \$5 - \$1 Final Price With Coupon\*

2 for \$4

Instantly Save \$3

Tide \$8.95 - \$2 Final Price With Coupon\* = \$6.95

Colgate \$1.50 - 50¢ Final Price With Coupon\* = \$1

II

**Weekly Ad**

**DOLLAR GENERAL** Save time. Save money. Every day!

**DG Digital Coupons**

**DG DIGITAL COUPONS**

**Believe Beauty**

Makeup deals under \$5

**Mother's Day**

Celebrate MOM on May 12th



# UPC barcodes are 12 digit barcodes and are used exclusively in the United States and Canada.

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*Source: ASAP Systems - an example of a custom SKU used together with a UPC barcode.*

<https://www.shopify.com/retail/what-is-a-sku-number>

# What is the difference between SKU and UPC?

## SKU (Stock Keeping Unit)

- Internal
- Between 8–12 characters
- Identifies product traits
- Alphanumeric
- The retailer determines their SKU architecture
- Accompanies a barcode

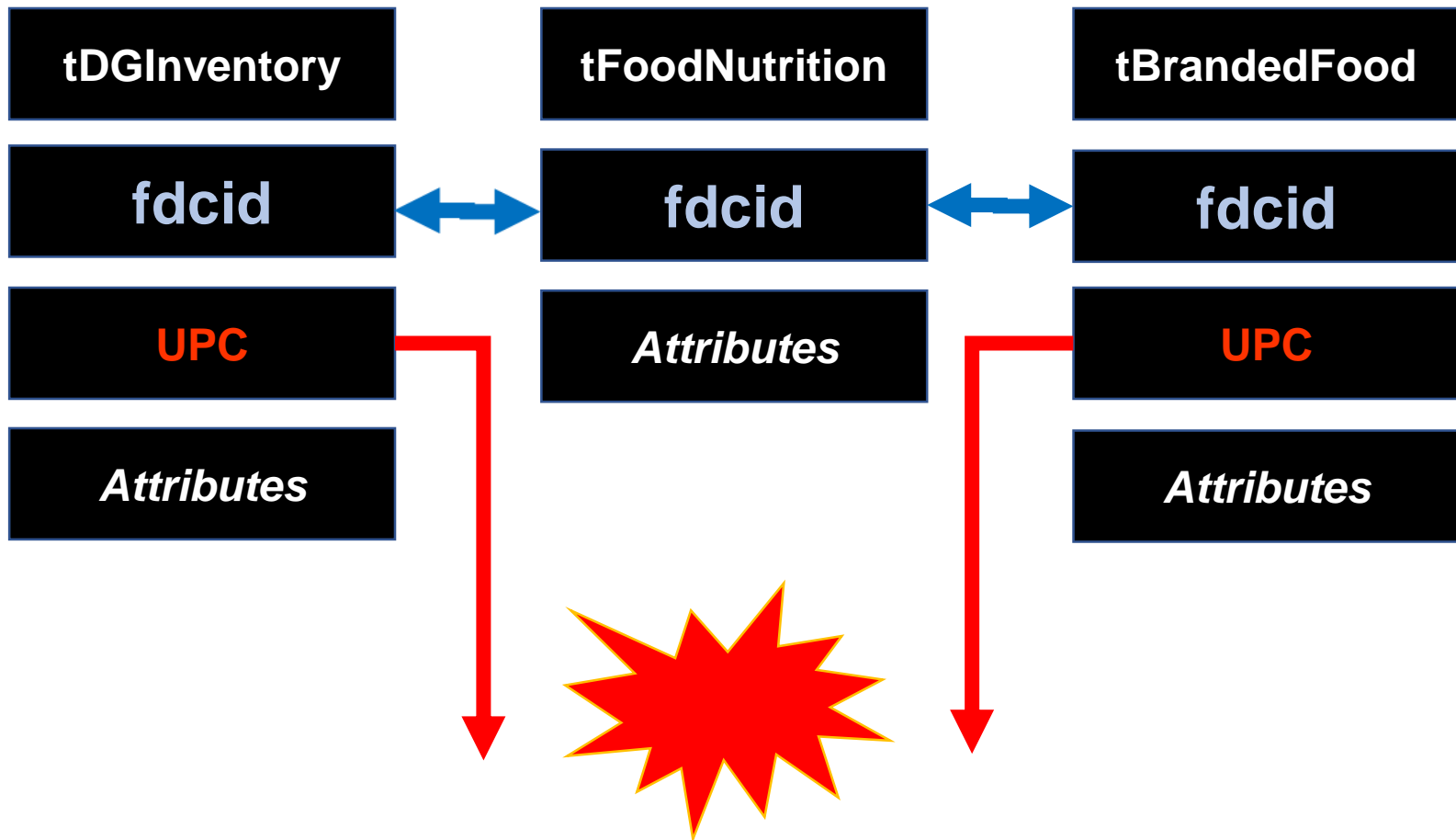
tdginventory.dgitemid

## UPC (Universal Product Code)

- Universal
- Always 12 characters
- Identifies manufacturer and item
- Numeric
- Issued by the Global Standards Organization

tdginventory.gtinupc =  
tbrandedfood.gtinupc

DGDiet Database: DGInventory and Branded Food Tables could not be linked by UPC. **fdcid** was used instead.



# Most DG Clover Valley brand products were not listed in the USDA branded foods database.

Description	Type	Published Date	FDC ID
<a href="#">CLOVER VALLEY, TOMATO CONDENSED SOUP</a>	Branded	2019-04-01	357446
<a href="#">CLOVER VALLEY, CONDENSED SOUP, CREAM OF MUSHROOM</a>	Branded	2019-04-01	359544

	A	B
1	<b>NO LISTING IN USDA DATABASE</b>	
2	DGID	DGDescription
3	883502	Clover Valley Vegetable Beef Soup, 10.5oz
4	820801	Clover Valley Onion Soup Mix, 2oz
5	881701	Clover Valley Chicken Noodle Soup, 10.5oz
6	883602	Clover Valley Bean & Bacon Soup, 11.25oz
7	17752401	Clover Valley Broccoli Cheese Soup, 10.75 Oz
8	880901	Clover Valley Vegetarian Vegetable Soup, 10.5oz
9		

# 10 fdc\_id Codes for “Original Kraft Macaroni & Cheese Dinner”

Kraft Original Flavor Macar

[Search Operators](#)

Require All Words

**Filter Search Results**

Data Type Definitions:

[About Data Type Definitions](#)

Foundation (8)

Survey (FNDDS) (1,148)

Branded (144,550)

SR Legacy (544)

[Experimental](#)

Ingredients

Press enter to search.

Brand Owner

[Search Tips](#)

Press enter to search.

144,550 results

Description	Type	Published Date	FDC ID	Ingredients
<a href="#">ORIGINAL MACARONI &amp; CHEESE DINNER</a>	Branded	2019-04-01	549594	<b>Ingredients:</b> ENRICHED <i>MACARONI</i> PRODUCT: : ENRICHED FLOUR (WHEAT FLOUR, MALTED BARLEY FLOUR, NIACIN, REDUCED IRON
<a href="#">ORIGINAL MACARONI &amp; CHEESE DINNER</a>	Branded	2019-04-01	363138	<b>Ingredients:</b> ENRICHED <i>MACARONI</i> PRODUCT: ENRICHED FLOUR (WHEAT FLOUR, MALTED BARLEY FLOUR, NIACIN, REDUCED IRON
<a href="#">ORIGINAL MACARONI &amp; CHEESE DINNER</a>	Branded	2019-04-01	580384	<b>Ingredients:</b> ENRICHED <i>MACARONI</i> PRODUCT (WHEAT FLOUR, GLYCEROL MONOSTEARATE, NIACIN, IRON [FERROUS SULFATE
<a href="#">ORIGINAL MACARONI &amp; CHEESE DINNER</a>	Branded	2019-04-01	571158	<b>Ingredients:</b> ENRICHED <i>MACARONI</i> (WHEAT FLOUR, NIACIN, IRON [FERROUS SULFATE], THIAMINE MONONITRATE, RIBOFLAVIN
<a href="#">ORIGINAL MACARONI &amp; CHEESE DINNER</a>	Branded	2019-04-01	506918	<b>Ingredients:</b> ENRICHED <i>MACARONI</i> (WHEAT FLOUR, NIACIN, IRON [FERROUS SULFATE], THIAMINE MONONITRATE, RIBOFLAVIN
<a href="#">ORIGINAL MACARONI &amp; CHEESE DINNER</a>	Branded	2019-04-01	555498	<b>Ingredients:</b> ENRICHED <i>MACARONI</i> (WHEAT FLOUR, NIACIN, REDUCED IRON, THIAMINE MONONITRATE, RIBOFLAVIN, FOLIC ACID
<a href="#">ORIGINAL MACARONI &amp; CHEESE DINNER</a>	Branded	2019-04-01	361812	<b>Ingredients:</b> ENRICHED <i>MACARONI</i> PRODUCT: (WHEAT FLOUR, MALTED BARLEY FLOUR, NIACIN, REDUCED IRON, THIAMINE
<a href="#">ORIGINAL MACARONI &amp; CHEESE DINNER</a>	Branded	2019-04-01	590145	<b>Ingredients:</b> ENRICHED <i>MACARONI</i> PRODUCT (WHEAT FLOUR, NIACIN, IRON [FERROUS SULFATE], THIAMINE MONONITRATE
<a href="#">ORIGINAL MACARONI &amp; CHEESE DINNER, ORIGINAL</a>	Branded	2019-04-01	447633	<b>Ingredients:</b> ENRICHED <i>MACARONI</i> PRODUCT: ENRICHED FLOUR (WHEAT FLOUR, MALTED BARLEY FLOUR, NIACIN, REDUCED IRON
<a href="#">ORIGINAL MACARONI &amp; CHEESE DINNER, ORIGINAL</a>	Branded	2019-04-01	582212	<b>Ingredients:</b> ENRICHED <i>MACARONI</i> PRODUCT (WHEAT FLOUR, GLYCEROL MONOSTEARATE, NIACIN, IRON [FERROUS SULFATE

# CLOVER VALLEY, CREAM STYLE CORN

**Data Type:** Branded      **Food Category:** Canned Vegetables      **Brand Owner:** Public Label Brands, Inc.      **FDC ID:** 399132      **GTIN/UPC:** 793396851089  
**Published:** 4/1/2019      **Available Date:** 11/2/2017      **Modified Date:** 11/2/2017

# CLOVER VALLEY, SWEET PEAS

**Data Type:** Branded      **Food Category:** Canned Vegetables      **Brand Owner:** Public Label Brands, Inc.      **FDC ID:** 399133      **GTIN/UPC:** 793396851096  
**Published:** 4/1/2019      **Available Date:** 7/14/2017      **Modified Date:** 7/14/2017

# CLOVER VALLEY, WHOLE KERNEL CORN

**Data Type:** Branded      **Food Category:** Canned Vegetables      **Brand Owner:** Public Label Brands, Inc.      **FDC ID:** 399139      **GTIN/UPC:** 793396851072  
**Published:** 4/1/2019      **Available Date:** 11/1/2017      **Modified Date:** 11/1/2017

	A	B	C	D	E	F
42779	399128	Meijer, Inc.	00041250941569	GREEN BEANS, WATER, SALT.	120	g
42780	399129	Meijer, Inc.	00041250941545	GREEN BEANS, WATER, SALT.	120	g
42781	399130	Public Label Brands, Inc.	00793397000000	GREEN BEANS, WATER, SALT.	120	g
42782	399131	Woeber Mustard Mfg. Company	00074680805224	WATER, VINEGAR, #1 MUSTAR	5	g
42783	399132	Public Label Brands, Inc.	00793397000000	CORN WATER, SUGAR, MODIFI	125	g
42784	399133	Public Label Brands, Inc.	00793397000000	PEAS, WATER, SUGAR, SALT.	125	g
42785	399134	Video Theater Inc	00081269746113	PREPARED GARBANZO BEANS,	126	g
42786	399135	Transnational Foods, Inc.	00876941000000	MUSHROOMS, WATER, SALT, C	130	g
42787	399136	Public Label Brands, Inc.	00793397000000	CARROTS, WATER, SALT, CALC	120	g
42788	399137	Quality Bakery Products, LLC	00886490000000	ENRICHED FLOUR [FLOUR, MAI	28	g
42789	399138	Mount Olive Pickle Company Inc.	00009300008013	CUCUMBERS, CORN SYRUP, HIK	15	g
42790	399139	Public Label Brands, Inc.	00793397000000	CORN, WATER, SUGAR, SALT.	125	g
42791	399140	Public Label Brands, Inc.	00793397000000	WATER, CARROTS, POTATOES,	125	g
42792	399141	Bay Valley Foods, LLC	00051974171449	CUCUMBERS, WATER, VINEGAI	28	g
42793	399142	Western Family Foods, Inc.	00015400190015	ORGANIC ROLLED OATS, ORGA	40	g

# Different type of oil used in Campbell's Cream of Mushroom Soup: *same can, different UPC & FDC ID*

5 results

Description	Type	Published Date	FDC ID	
<a href="#">CAMPBELL'S CONDENSED SOUP CREAM MUSHROOM</a>	Branded	2019-04-01	355836	<b>Brand Owner:</b> <i>CAMPBELL SOUP</i> COMPANY <b>Ingredients:</b> INGREDIENTS: WATER, <i>MUSHROOMS</i> , VEGETABLE OIL (CORN, COTTONSEED, CANOLA, AND/OR SOYBEAN), MODIFIED
<a href="#">CAMPBELL'S CONDENSED SOUP CREAM OF MUSHROOM</a>	Branded	2019-04-01	356027	<b>Brand Owner:</b> <i>CAMPBELL SOUP</i> COMPANY <b>Ingredients:</b> INGREDIENTS: WATER, <i>MUSHROOMS</i> , VEGETABLE OIL (CORN, CANOLA, AND/OR SOYBEAN), MODIFIED FOOD STARCH



The USDA Branded Food Products Database is the result of a Public-Private Partnership, whose goal is to enhance public health and the sharing of open data by complementing USDA Food Composition Databases with nutrient composition of branded foods and private label data **provided by the food industry**.

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Members of the Public-Private Partnership include:

- Agricultural Research Service (ARS), USDA ([www.ars.usda.gov](http://www.ars.usda.gov))
- International Life Sciences Institute (ILSI) North America ([www.ilsina.org](http://www.ilsina.org))
- GS1 US ([www.gs1us.org/](http://www.gs1us.org/))
- 1WorldSync ([www.1worldsync.com](http://www.1worldsync.com))
- Label Insight ([www.labelinsight.com](http://www.labelinsight.com))
- University of Maryland, Joint Institute for Food Safety and Applied Nutrition ([jifsan.umd.edu](http://jifsan.umd.edu))



# USDA does not list all items for a brand in its online database.

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- Kraft lists only 22 items with its brand name. Does not include Miracle Whip (except Light).
- Zatarain's lists 163 items.
- Smucker's lists only 12 items, and does not include Jif Peanut Butter or Smucker's Strawberry Jam

Brand listing is voluntary; a brand owner need not participate.

# tDGInventory.csv in Excel

	A	B	C	D	E	F	G	H
1	dgid	fdcid	UPCintBrandedFood	dgitimid	dgdescription	dgprice	totaloz	totalg
2	100	346901	64144043156	865101	Chef Boyardee Beef Ravioli	1	15	425.25
3	101	405600	80000003409	16914601	StarKist Chunk Albacore Tuna In Water 3PK	4.25	15	425.25
4	102	409410	54100925022	15297002	Armour Sausages Vienna 6pk	2.95	4.75	134.6625
5	103	600839	15400841627	825103	Stove Top Stuffing Chicken	1.95	6	170.1
6	104	367043	17000013237	830001	Armour Treet Original	1.65	12	340.2
7	105	485085	29700131456	18613502	Idahoan Four Cheese Mashed Potatoes	1	4	113.4
8	106	347687	50100142261	875301	Banquet Homestyle Bakes Country Chicken, Mashed Potatoes & Biscuits	3.5	30.9	876.015
9	107	383514	29700321475	18616302	Idahoan Mashed Potato Roasted Garlic	1	4	113.4
10	108	376212	37600143943	15293901	Hormel Compleats Beef Pot Roast	2	9	255.15
11	109	407533	29700131388	20357901	Idahoan Baby Reds Mashed Potatoes	1	4.1	116.235
12	110	570257	51933626751	873201	Kraft Mac & Cheese Deluxe	3	14	396.9
13	111	366143	17000019260	5897102	Armour Corned Beef Hash	2	14	396.9
14	112	469980	37600722551	16933501	Hormel Hearty Creations Chicken Pot Pie	2.95	20	567
15	113	361110	29700001667	18756401	Idahoan Potatoes Au Gratin	1.35	4.94	140.049
16	114	549594	36800046597	873501	Kraft Macaroni & Cheese Dinner Original	1	7.25	205.5375
17	115	357187	75069153004	829602	Bristol Chunk Ham	1	5	141.75
18	116	484445	29700001483	18613602	Idahoan Mashed Potato Loaded Baked	1	4	113.4
19	117	360233	71846922153	829401	Southgate Chicken Chili With Beans	1	15	425.25
20	118	356229	51000269287	868905	Campbell's SpaghettiOs With Meatballs	0.85	15.6	442.26
21	119	405195	80000515803	15134201	Starkist Chunk Tuna In Water Light 3 Pack	2.8	15	425.25
22	120	346898	64144043026	865001	Chef Boyardee Beefaroni	1	15	425.25
23	121	413111	17000009506	829201	Armour Potted Meat	0.5	3	85.05
24	122	348894	16000402126	874304	Betty Crocker Hamburger Helper - Cheeseburger Macaroni	1.5	6.6	187.11
25	123	484401	86600707419	15295102	Bumble Bee Chicken Salad With Crackers Kit	1.1	3.25	92.1375
26	124	541571	37600138727	829801	Spam Classic Can	2.65	12	340.2
27	125	385712	47117097158	16892101	Clover Valley Shredded Pulled Pork - BBQ Sauce	2.5	9.5	269.325
28	126	394712	41000022739	5918902	Knorr Asian Sides Chicken Fried Rice	1	5.7	161.595
29	127	378038	70662096338	1903601	Nissin Top Ramen Noodle Soup - Beef 12 Count	2.25	36	1020.6
30	128	405033	80000502391	5834102	StarKist Tuna Salad, Original Deli Style Chunk Light Tuna Single Serve Pouch	1.25	3	85.05
31	129	484809	86600707402	15295002	Bumble Bee Tuna Salad With Crackers Kit	1.1	3.25	92.1375
32	130	405143	80000513083	15295801	StarKist Tuna Creations Sweet & Spicy	1.25	2.6	73.71
33	131	386203	37600482523	877601	Hormel Compleats Beef Tips With Mashed Potatoes	2	9	255.15
34	132	439385	19722167236	16018901	Clover Valley Chunk White Chicken Breast	1.95	10	283.5
35	133	484738	20100400111	15294602	Beach Cliff Sardines in Oil	1	3.75	106.3125
36	134	504926	39000031288	831201	Libby's Gravy Sausage	1.5	15	425.25
37	135	346126	27000442128	830201	Manwich Original Sloppy Joe Sauce	1	15	425.25

# tDGInventory.csv in Notepad

```
tDGInventoryMay11.csv - Notepad
File Edit Format View Help
dgid,fdcid,UPCintBrandedFood,dgItemid,dgdescription, dgprice ,totaloz,totalg
100,346901,64144043156,865101,Chef Boyardee Beef Ravioli,1,15,425.25
101,405600,80000003409,16914601,StarKist Chunk Albacore Tuna In Water 3PK,4.25,15,425.25
102,409410,54100925022,15297002,Armour Sausages Vienna 6pk,2.95,4.75,134.6625
103,600839,15400841627,825103,Stove Top Stuffing Chicken,1.95,6,170.1
104,367043,17000013237,830001,Armour Treet Original,1.65,12,340.2
105,485085,29700131456,18613502,Idahoan Four Cheese Mashed Potatoes,1,4,113.4
106,347687,50100142261,875301,"Banquet Homestyle Bakes Country Chicken, Mashed Potatoes & Biscuits",3.5,30.9,876.015
107,383514,29700321475,18616302,Idahoan Mashed Potato Roasted Garlic,1,4,113.4
108,376212,37600143943,15293901,Hormel Compleats Beef Pot Roast,2,9,255.15
109,407533,29700131388,20357901,Idahoan Baby Reds Mashed Potatoes,1,4.1,116.235
110,570257,51933626751,873201,Kraft Mac & Cheese Deluxe,3,14,396.9
111,366143,17000019260,5897102,Armour Corned Beef Hash,2,14,396.9
112,469980,37600722551,16933501,Hormel Hearty Creations Chicken Pot Pie,2.95,20,567
113,361110,29700001667,18756401,Idahoan Potatoes Au Gratin,1.35,4.94,140.049
114,549594,36800046597,873501,Kraft Macaroni & Cheese Dinner Original,1,7.25,205.5375
115,357187,75069153004,829602,Bristol Chunk Ham,1,5,141.75
116,484445,29700001483,18613602,Idahoan Mashed Potato Loaded Baked,1,4,113.4
117,360233,71846922153,829401,Southgate Chicken Chili With Beans,1,15,425.25
118,356229,51000269287,868905,Campbell's SpaghettiOs With Meatballs,0.85,15.6,442.26
119,405195,80000515803,15134201,StarKist Chunk Tuna In Water Light 3 Pack,2.8,15,425.25
120,346898,64144043026,865001,Chef Boyardee Beefaroni,1,15,425.25
121,413111,17000009506,829201,Armour Potted Meat,0.5,3,85.05
122,348894,16000402126,874304,Betty Crocker Hamburger Helper - Cheeseburger Macaroni,1.5,6.6,187.11
123,484401,86600707419,15295102,Bumble Bee Chicken Salad With Crackers Kit,1.1,3.25,92.1375
124,541571,37600138727,829801,Spam Classic Can,2.65,12,340.2
125,385712,47117097158,16892101,Clover Valley Shredded Pulled Pork - BBQ Sauce,2.5,9.5,269.325
126,394712,41000022739,5918902,Knorr Asian Sides Chicken Fried Rice,1,5.7,161.595
127,378038,70662096338,1903601,Nissin Top Ramen Noodle Soup - Beef 12 Count,2.25,36,1020.6
128,405033,80000502391,5834102,"StarKist Tuna Salad, Original Deli Style Chunk Light Tuna Single Serve Pouch",1.25,3,85.05
Windows (CRLF) Ln 1, Col 1 100%
```

3. A sample view of the visualization tool generated by querying our database.

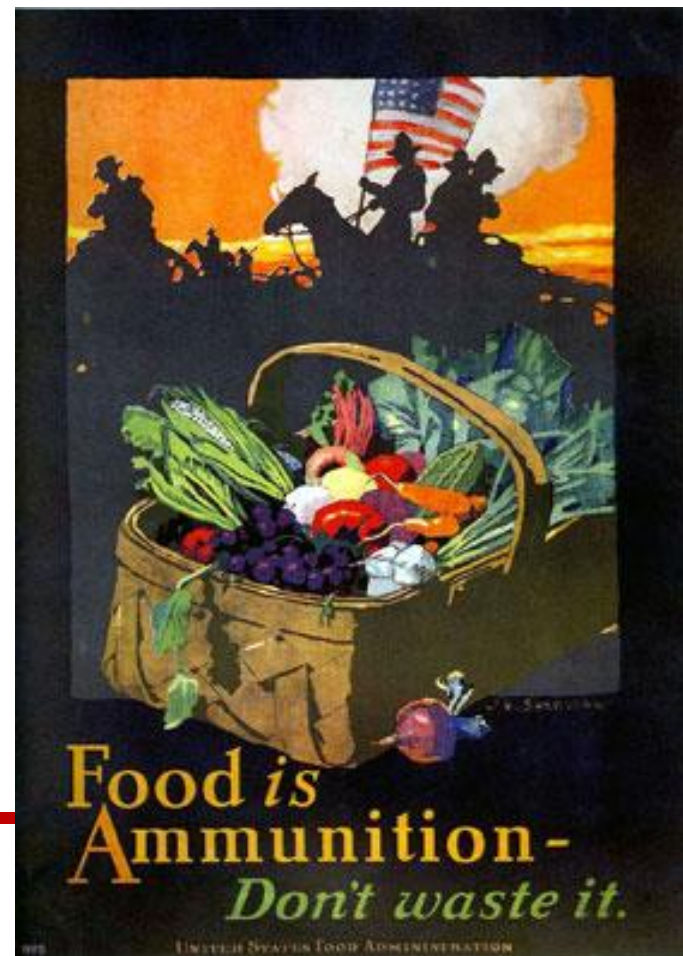
---

4. Data-backed claim (or claims) that address our question.  
Visualization(s) that support the data-backed claim we are making.

The **Diet Problem** was one of the first “large scale” optimization problems of the 20<sup>th</sup> century.

---

The U.S. Army wanted to minimize the cost of feeding GIs in the field while still providing a healthy diet.



The goal of the **Diet Problem** is to select a set of foods that will satisfy a set of daily nutritional requirements at minimum cost.

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- The problem is formulated as a **linear program**.
- This "large scale" computation has nine equations in 77 unknowns.

# The **Diet Problem** was first calculated manually.

---

- 1939: George Stigler used a heuristic to make an “educated guess” of \$39.93 per year.
- 1947: Jack Laderman (National Bureau of Standards) used the new simplex method.

*Nine clerks using manual desk calculators took 120 man days to solve for the optimal solution of \$39.69 - only 24 cents off Stigler's estimate!*

---

Excel's “Solver” has LP. We use it to answer our DG Diet question.

# What is Linear Programming?

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- Linear programming (LP, also called linear optimization) is **a method to achieve the best outcome** (such as maximum profit or lowest cost) in a mathematical model whose **requirements** are represented by **linear relationships**.
- Linear programming is a special case of mathematical programming (also known as mathematical optimization).



The **Diet Problem** can be formulated mathematically as a linear programming problem.

---

### Sets

$F$  = set of foods

$N$  = set of nutrients

### Parameters

$a_{ij}$  = amount of nutrient  $j$  in food  $i$ ,  $\forall i \in F, \forall j \in N$

$c_i$  = cost per serving of food  $i$ ,  $\forall i \in F$

$Fmin_i$  = minimum number of required servings of food  $i$ ,  $\forall i \in F$

$Fmax_i$  = maximum allowable number of servings of food  $i$ ,  $\forall i \in F$

$Nmin_j$  = minimum required level of nutrient  $j$ ,  $\forall j \in N$

$Nmax_j$  = maximum allowable level of nutrient  $j$ ,  $\forall j \in N$

# Diet Problem:

## Objective Function & Constraints

---

**Objective Function:** Minimize the total cost of the food

$$\text{Minimize } \sum_{i \in F} c_i x_i$$

**Constraint Set 1:** For each nutrient  $j \in N$ , at least meet the minimum required level.

$$\sum_{i \in F} a_{ij} x_i \geq Nmin_j, \forall j \in N$$

**Constraint Set 2:** For each nutrient  $j \in N$ , do not exceed the maximum allowable level.

$$\sum_{i \in F} a_{ij} x_i \leq Nmax_j, \forall j \in N$$

**Constraint Set 3:** For each food  $i \in F$ , select at least the minimum required number of servings.

$$x_i \geq Fmin_i, \forall i \in F$$

**Constraint Set 4:** For each food  $i \in F$ , do not exceed the maximum allowable number of servings.

$$x_i \leq Fmax_i, \forall i \in F$$

# Query Criteria: Nutrition Label

		<b>Nutrition Facts</b>	
<b>Start Here</b> →		Serving Size 1 cup (228g) Servings Per Container 2	
<b>Check Calories</b>		<b>Amount Per Serving</b>	
		<b>Calories</b> 250	Calories from Fat 110
			<b>% Daily Value*</b>
<b>Limit these Nutrients</b>	<b>Total Fat</b> 12g		18%
	Saturated Fat 3g		15%
	Trans Fat 3g		
	<b>Cholesterol</b> 30mg		10%
	<b>Sodium</b> 470mg		20%
	<b>Potassium</b> 700mg		20%
	<b>Total Carbohydrate</b> 31g		10%
	Dietary Fiber 0g		0%
	Sugars 5g		
<b>Get Enough of these Nutrients</b>	<b>Protein</b> 5g		
	Vitamin A		4%
	Vitamin C		2%
	Calcium		20%
	Iron		4%
<b>Footnote</b>	* Percent Daily Values are based on a 2,000 calorie diet. Your Daily Values may be higher or lower depending on your calorie needs.		
		Calories:	2,000      2,500
	Total Fat	Less than	65g      80g
	Sat Fat	Less than	20g      25g
	Cholesterol	Less than	300mg      300mg
	Sodium	Less than	2,400mg      2,400mg
	Total Carbohydrate		300g      375g
	Dietary Fiber		25g      30g

**Quick Guide to % DV**

• 5% or less is Low

• 20% or more is High

<https://www.nhlbi.nih.gov/health/educational/wecan/eat-right/nutrition-facts.htm>

# Dietary Reference Intakes (DRI)

DRI is the general term for a set of reference values used to plan and assess nutrient intakes of healthy people. These values, which vary by age and gender, include:

---

- **Recommended Dietary Allowance (RDA):** average daily level of intake sufficient to meet the nutrient requirements of nearly all (97%-98%) healthy people.
- **Adequate Intake (AI):** established when evidence is insufficient to develop an RDA and is set at a level assumed to ensure nutritional adequacy.
- **Tolerable Upper Intake Level (UL):** maximum daily intake unlikely to cause adverse health effects.

# DRIs are calculated for each “Life Stage Group”.

---

<b>Infants</b>	<b>Males</b>	<b>Females</b>	<b>Pregnancy</b>
<ul style="list-style-type: none"><li>• 0–6 mo</li><li>• 7–12 mo</li></ul>	<ul style="list-style-type: none"><li>• 9–13 y</li><li>• 14–18 y</li><li>• 19–30 y</li></ul>	<ul style="list-style-type: none"><li>• 9–13 y</li><li>• 14–18 y</li><li>• 19–30 y</li></ul>	<ul style="list-style-type: none"><li>• <math>\leq 18</math> y</li><li>• 19-30y</li><li>• 31-50 y</li></ul>
<b>Children</b>	<ul style="list-style-type: none"><li>• 31-50 y</li><li>• 50-70 y</li><li>• <math>&gt; 70</math> y</li></ul>	<ul style="list-style-type: none"><li>• 31-50 y</li><li>• 50-70 y</li><li>• <math>&gt; 70</math> y</li></ul>	<b>Lactation</b>
<ul style="list-style-type: none"><li>• 1–3 y</li><li>• 4–8 y</li></ul>			<ul style="list-style-type: none"><li>• <math>\leq 18</math> y</li><li>• 19-30y</li><li>• 31–50 y</li></ul>

# Sample LP Model: Output Table



	A	B	C	D	E	F	G	H	I	J	K
6			eggs	wakame	matzos	milk	beans	peanut butter	TOTAL	minvalue	maxvalue
7											
8	<b>DECISION</b>		0.00	0.00	2.77	0.00	5.48	2.30			
9	Fat		5	0	0	2.5	1	15	40.0	40	70
10	Sodium		0.07	0.73	0	0.105	0.39	0.115	2.4	1.5	2.4
11	Carbs		0	3	26	12	20	8	200.0	200	300
12	Protein		6	1	4	8	7	7	65.5	45	157
13	<b>COST</b>		0.29	0.37	0.18	0.24	0.14	0.19	\$ 1.70		
14											
15	Calories								1,422		

# Sample LP Model: Cell Formulas

	A	B	C	D	E	F	G	H	I	J	K
6			eggs	wakame	matzos	milk	beans	peanut butter	TOTAL	minvalue	maxvalue
7											
8	DECISION		0.00	0.00	2.77	0.00	5.48	2.30			
9	Fat		5	0	0	2.5	1	15	40.0	40	70
10	Sodium		0.07	0.73	0	0.105	0.39	0.115	2.4	1.5	2.4
11	Carbs		0	3	26	12	20	8	200.0	200	300
12	Protein		6	1	4	8	7	7	65.5	45	157
13	COST		0.29	0.37	0.18	0.24	0.14	0.19	\$ 1.70		
14											
15	Calories								1,422		

TOTAL



= \$C9\*\$C8+\$D9\*\$D8+\$E9\*\$E8+\$F9\*\$F8+\$G9\*\$G8+\$H9\*\$H8

= \$C10\*\$C8+\$D10\*\$D8+\$E10\*\$E8+\$F10\*\$F8+\$G10\*\$G8+\$H10\*\$H8

= \$C11\*\$C8+\$D11\*\$D8+\$E11\*\$E8+\$F11\*\$F8+\$G11\*\$G8+\$H11\*\$H8

= \$C12\*\$C8+\$D12\*\$D8+\$E12\*\$E8+\$F12\*\$F8+\$G12\*\$G8+\$H12\*\$H8

= \$C13\*\$C8+\$D13\*\$D8+\$E13\*\$E8+\$F13\*\$F8+\$G13\*\$G8+\$H13\*\$H8

= 4\*(\$I11+\$I12)+9\*\$I9

	eggs	wakame	matzos	milk	beans	peanut butter	TOTAL	minvalue	maxvalue
<b>DECISION</b>	<b>0.00</b>	<b>0.00</b>	<b>2.77</b>	<b>0.00</b>	<b>5.48</b>	<b>2.30</b>			
Fat	5	0	0	2.5	1	15	40.0	40	70
Sodium	0.07	0.73	0	0.105	0.39	0.115	2.4	1.5	2.4
Carbs	0	3	26	12	20	8	200.0	200	300
Protein	6	1	4	8	7	7	65.5	45	157
<b>COST</b>	<b>0.29</b>	<b>0.37</b>	<b>0.18</b>	<b>0.24</b>	<b>0.14</b>	<b>0.19</b>	<b>\$ 1.70</b>		
Calories									

Solver Parameters

Set Objective:  ↑

To:  Max  Min  Value Of:

By Changing Variable Cells:  ↑

Subject to the Constraints:

\$I\$10 <= \$K\$10  
 \$I\$10 >= \$J\$10  
 \$I\$11 <= \$K\$11  
 \$I\$11 >= \$J\$11  
 \$I\$12 <= \$K\$12  
 \$I\$12 >= \$J\$12  
 \$I\$9 <= \$K\$9  
 \$I\$9 >= \$J\$9

Make Unconstrained Variables Non-Negative

Select a Solving Method:  Options

Solving Method

Select the GRG Nonlinear engine for Solver Problems that are smooth nonlinear. Select the LP Simplex engine for linear Solver Problems, and select the Evolutionary engine for Solver problems that are non-smooth.

# Sample LP Model:

# Solver Parameters



For \$1.70, your basic needs for macronutrients can be met by eating 4.5 flat breads (matzohs, tortillas, etc.), 5 tablespoons of peanut butter and a can of beans.

---



# 5. Brief plan for answering more detailed questions.

---

## Present

### Database

- Tables Defined and Populated
- Can query on 2-Table Joins

### LP *Excel with Solver*

- Macronutrients (Protein, Fat, Carbohydrates) and Sodium Only

## Future

### Database

- Master 3-Table Joins, producing table for LP

### LP *Excel with Solver*

- Extend to micronutrients on Nutrition Label (Vitamin A, Vitamin C, Iron, and Calcium)
- Add Energy (kCal) range options *Done!*

# 6. DAT-201 Final Database Project: Roles and Responsibilities

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*Aaron Simpson*

- “Diet Problem” Idea
- Construct Database Tables
- Query Database for LP Table
- Build & Run LP

*Paula Shubock*

- Data Acquisition
- Data Cleaning
- Database Schema
- Identify LP Constraints
- Presentation

# Discussion



*“Please upload the following into each group member's folder in your cohort's work directory”*

---

- ✓ A thorough work process log, detailing the queries you ran on your database to extract data for visualization. **Separate logs for Aaron and Paula**
- ✓ A PostgreSQL database, which should be based on a set of flat files (CSVs, Excel). **dbdgdiet**
- ✓ The spreadsheet (or other data file) created after running your queries, to generate the visualization(s). LP file: **lpdietproblem.xlsx**
- ✓ Your visualization(s). **This Presentation, Parts 3 and 4.**
- ✓ A document that includes your question, your data-backed claim(s), citations of all of your data sources, and the description of how each group member contributed. **This Presentation, Parts 1 and 2 (claims and citations), Part 3 (contributions).** Also see logs for more information about data sources.