
ISE 3230

A Balanced Meal in College

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12/06

Motivation



Assumptions



Student in the Ohio State University (O-H-I-O!)



Balanced Nutrition based on personal needs

(Height / Weight / Gender / Age / Meal Type/ Activity Level)



Meal at the **grain bowl station** in the Union Market (priced by weight)



Minimize total **price** of the meal

Generalized Knapsack Problem

c_i = cost of the food i , for $i = 1, 2, \dots, m$

x_i = amount of food i to eat, for $i = 1, 2, \dots, m$

a_{ij} = amount of nutrient i in food j , for $i = 1, 2, \dots, m, j = 1, 2, \dots, n$

p_{ij} = minimum amount of nutrient allowed per day, for $i = 1, 2, \dots, m, j = 1, 2, \dots, n$

P_{ij} = maximum amount of nutrient allowed per day, for $i = 1, 2, \dots, m, j = 1, 2, \dots, n$

Then, our problem can be formulated as:

$$\text{Minimize } \sum_{i=1}^m c_i x_i$$

$$\text{Subject to : } p_i \leq \sum_{j=1}^n a_{ij} x_j \leq P_i$$

$$i = 1, \dots, m$$



Ohio Union Operations - DAILY MENU - Union Market



Back



Item Nutrition



Add Items



Meal Nutrition



Clear My Meal

Item Name	Serving Size	# of Serv
BAKED POTATO BAR		
<input type="checkbox"/> Baked Potato	Order	1 ▾
<input type="checkbox"/> Butter Cup	Each	1 ▾
<input type="checkbox"/> Cheese - Cheddar Shredded	Ounce	1 ▾
GRAIN BOWL		
<input type="checkbox"/> Brown Rice	6 Oz. Serving	1 ▾
<input type="checkbox"/> Chili Roasted Broccoli	Ounce	1 ▾
<input type="checkbox"/> Chipotle Chicken	3 Oz. Serving	1 ▾
<input type="checkbox"/> Chipotle Sweet Potatoes	Ounce	1 ▾
<input type="checkbox"/> Cilantro Chutney	Ounce	1 ▾
<input type="checkbox"/> Corn - Yellow	Ounce	1 ▾
<input type="checkbox"/> Harissa Sauce	Ounce	1 ▾
<input type="checkbox"/> Peruvian Pesto Aioli	Ounce	1 ▾
<input type="checkbox"/> Quinoa	6 Oz. Serving	1 ▾
<input type="checkbox"/> Quinoa Thai Curry Blend With Vegetables	6 Oz. Serving	1 ▾
<input type="checkbox"/> Pickled Red Onion	Ounce	1 ▾
<input type="checkbox"/> Sauce - Tamari Gluten Free	Ounce	1 ▾
<input type="checkbox"/> Seared Salmon	Each	1 ▾
<input type="checkbox"/> Tamari Marinated Kale	Ounce	1 ▾
<input type="checkbox"/> Tikka Cauliflower	Ounce	1 ▾
<input type="checkbox"/> Tofu Sofritas	4 Oz. Serving	1 ▾

I Am Allergic To...

- ☐ Dairy
- ☐ Eggs
- ☐ Fish
- ☐ Gluten
- ☐ Peanuts
- ☐ Shellfish
- ☐ Soy
- ☐ Tree Nuts
- ☐ Wheat

My Diet Preference

- ☐ Vegan
- ☐ Vegan (Order No Cheese)
- ☐ Vegetarian



Clear Filters

Brown Rice



Nutrition Information

1 Servings Per Container

~~Serving Size 1/2 Cup (125g)~~

Amount Per Serving

Calories 230

% Daily Value*

Total Fat 1.5g **2%**

Saturated Fat 0g **0%**

Trans Fat 0g

Cholesterol 0mg **0%**

Sodium 0mg **0%**

Total Carbohydrate 49g **16%**

Dietary Fiber 1g **6%**

Total Sugars 0g

Protein 5g

Calcium 3.06mg **0%**

Iron 3.09mg **15%**

Vitamin C 0mg **0%**

* The % Daily Value (DV) Tells You How Much A Nutrient In A Serving Of Food Contributes To A Daily Diet. 2000 Calories A Day Is Used For General Nutrition Advice.

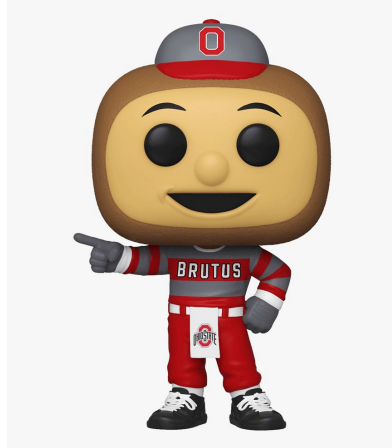
Ingredients: WATER, DRY LONG GRAIN BROWN RICE(PARBOILED LONG GRAIN BROWN RICE)

Category	Food	Size	nutrition information			
			Calories	Fat	Total Carb	Protein
Carb	Brown Rice	Ounce	38.33	0.25	8.17	0.83
	Chipotle Sweet Potatoes	Ounce	24.57	0.03	5.71	0.46
	Quinoa	Ounce	33.33	0.58	5.83	1.33
	Quinoa Thai Churry Blend With Vegetables	Ounce	31.67	1	4.33	1
	Corn - Yellow	Ounce	25	0	6	0
Protein	Chipotle Chicken	Ounce	43.33	1.67	0.33	6
	Seared Salmon	Each	440	34	0	33
	Tofu Sofritas	Ounce	35	2	1.25	3
Veggies	Chili Roasted Broccoli	Ounce	20	1	1	0
	Tamari Marinated Kale	Ounce	10	0	1	0
	Tikka Cauliflower	Ounce	25	2	2	0
	Pickled Red Onion	Ounce	15	0	3	0
Sauce	Sauce - Harissa Sauce	Ounce	30	1	5	0
	Sauce - Peruvian Pesto Aioli	Ounce	25	1	5	0
	Sauce - Cilantro Chutney	Ounce	20	1.5	2	2
	Sauce - Tamari Gluten Free	Ounce	15	0	2	3

Sample result

Buckeyes

- Female
- 19 years old
- 155 cm tall
- 42 kg
- Lightly active
- Meal: dinner



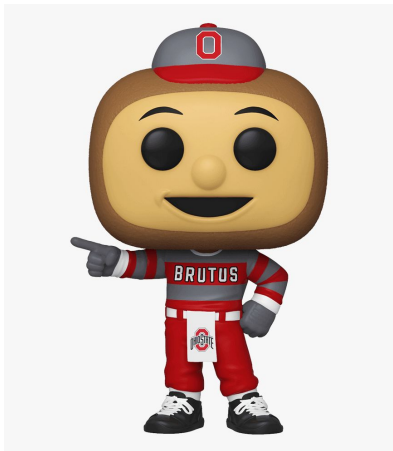
Brutus

- Male
- 22 years old
- 185 cm tall
- 90 kg
- Very active
- Meal: lunch



Imaged by Heritage Auctions, HA.com

Sample result - Buckeyes



Female | 19 years old | 155 cm tall | 42 kg

Lightly active

Meal: dinner

Calories: 450 kcal

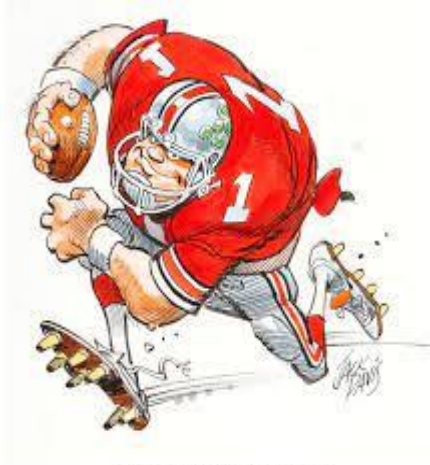
Price (without dining dollar) : \$ 7.63

Price (with dining dollar): \$ 4.96

Recommended meals:

- Brown Rice: 3.97 ounce
- Chipotle Chicken: 4.87 ounce
- Tikka Cauliflower: 2.67 ounce
- Pickled Red Onion: 1.33 ounce

Sample result - Brutus



Imaged by Heritage Auctions, HA.com



Male | 22 years old | 185 cm tall | 90 kg

Very active

Meal: lunch

Calories: 1287 kcal

Price (without dining dollar) : \$ 20.26

Price (with dining dollar): \$ 13.17

Recommended meals:

- Brown Rice: 13.01 ounce
- Chipotle Chicken: 10.74 ounce
- Tofu Sofritas: 6.38 ounce
- Tikka Cauliflower: 4 ounce

If we had more time ...

- Choose the station / restaurant
- Consider sleep / stress / allergy factors
- Consider bulking and cutting requirements
- Plan different meals for a week



References:

Net Nutrition:

<https://dining.osu.edu/NetNutrition/1#>

Equation for Calories:

<https://www.thejakartapost.com/life/2016/09/27/how-to-calculate-your-ideal-calorie-intake.html>

Calories per gram for carbohydrate, protein, and fat:

<https://www.nal.usda.gov/programs/fnic#:~:text=How%20many%20calories%20are%20in,provides%209%20calories%20per%20gram>.

Meal calories percentage:

<https://www.omnicalculator.com/health/meal-calorie#:~:text=25%2D30%25%20of%20daily%20calories,of%20daily%20calories%20for%20dinner>

Harris-Benedict Calculator :

<https://www.omnicalculator.com/health/bmr-harris-benedict-equation>

Activity level multiplier:

<https://www.k-state.edu/paccats/Contents/PA/PDF/Physical%20Activity%20and%20Controlling%20Weight.pdf>