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APPENDIX A
NUTR 2320: Assignment 4
THE Diet Design Project, part 1
100 Points

Instructions: Do not wait until the due date to start this assignment. This assignment could take you 9 hours to complete successfully.

1. Part 1: Determine your energy needs for a high burn (physically active) day and a low burn (physically inactive) using two or three methods: Measured and calculated resting energy expenditure (REE) X activity factor and Estimated Energy Requirement (EER). You will choose one method in which you calculate your high burn and low burn energy needs on which you will base the rest of the project. If you do not have your REE measure, then you can omit this option. **(20 points)**
2. Part 2: Determine your diet prescription for percentage of Calories from carbohydrate, protein, and fat, Calories of carbohydrate, protein, and fat, and grams of carbohydrate, protein, and fat based off your total high burn and low burn Calories and using the worksheets provided. **(30 points)**
3. Part 3: Design an exchange list prescription for your high burn and low burn diet prescription using the Exchange List allocation worksheet provided. **(50 points: 1x high burn, 1 x low burn; 15 points each)**
4. Submit your assignment.
 - a. *Type your work for parts 1, 2, 3 in this file and save it as a PDF or MS word file. Highlight your text or type it in some other color besides black or red. Include your first and last name in your file name. Upload and attach it to your assignment 4 submission in the online class.*
 - b. *Your assignment will be graded using the assignment 4 grading form (see page 12 of this assignment).*

NOTE: SAMPLE WORK IS PROVIDED ON PAGES 12-19

Part 1: Estimating Energy Needs (20 points)

There are several ways to measure or estimate energy expenditure, or determine one's energy needs. The technique used varies depending on the setting: research, clinical setting, or education.

Mifflin-St Jeor Equations: These equations are more recently developed and are believed to be more precise in determining Resting Energy Expenditure (REE) Calories/day under normal physiological conditions. The Equations are gender specific, and take into account height in centimeters, weight in kilograms, and age in years of the individual.

1. Calculate your REE using the Mifflin Equation. (show your work)

For MEN:

$$\text{REE (Calories/day)} = (10 \times W) + (6.25 \times H) - (5 \times A) + 5$$

$$\begin{aligned} &(10 \times 65.9 \text{ kg}) + (6.25 \times 170.69 \text{ cm}) - (5 \times 20) + 5 \\ &= 659 + 1,066.8125 - 100 + 5 \\ &= \mathbf{1,630.81 \text{ Calorie REE}} \end{aligned}$$

For WOMEN:

$$\text{REE (Calories/day)} = (10 \times W) + (6.25 \times H) - (5 \times A) - 161$$

For a sample calculation, please see the sample work on page 12

Energy Levels and REE factors by gender for #2 and 3 on the next page.

1. Sedentary

Male: REE x 1.3 factor Female: REE x 1.3 factor

2. Lightly active

Male: REE x 1.6 factor Female: REE x 1.5 factor

3. Moderately active

Male: REE x 1.7 factor Female: REE x 1.6 factor

4. Very active

Male: REE x 2.1 factor Female: REE x 1.9 factor

5. Extremely active

Male: REE x 2.4 factor Female: REE x 2.2 factor

6. Personalized

Some variation of the above factors

WORKSHEET TO ESTIMATE YOUR ENERGY NEEDS

See the sample work and calculations on page 13

2. Choose a level of activity that represents your high-energy use day and another that represents your low-energy use day (see levels 1-6 on the previous page).

- High burn level (#1-6): **#4** High burn REE factor: **2.1**
- Low burn level (# 1-6): **#1** Low burn REE factor: **1.3**

3. Calculate high burn and low burn Calorie needs. (show your work)

Method 1: My calculated (Mifflin) REE: **1,630.81**

- High burn energy needs using your calculated REE and the REE factor: **3424.70 Calories**
 $1630.81 \times 2.1 = 3424.70 \text{ Calories}$
- Low burn energy needs using your calculated REE and the REE factor: **2120.05 Calories**
 $1630.81 \times 1.3 = 2120.05 \text{ Calories}$

Method 2 (OPTIONAL): My measured (Indirect Calorimetry) REE: **1689**

- High burn energy needs using your measured REE and the REE factor: **3546.9 Calories**
 $1689 \times 2.1 = 3546.9 \text{ Calories}$
- Low burn energy needs using your measured REE and the REE factor: **2195.7 Calories**
 $1689 \times 1.3 = 2195.7 \text{ Calories}$

Method 3: My DRI for Calories (EER) calculated using a high burn Physical Activity Level (PAL) and a low burn PAL. (show your work, use EER PALs, do not use the factors on the previous page)

High Burn EER: $662 - (9.53 \times \text{Age}) + \text{PA} (15.91 \times \text{W(kg)} + 539.6 \times \text{H(m)})$

High Burn EER = $662 - (9.53 \times 20) + 1.48 (15.91 \times 65.9 \text{ kg} + 539.6 \times 1.7069 \text{ m})$
= $662 - 190.6 + 1.48 (1048.469 + 921.04324)$
= $662 - 190.6 + 2914.8781152$
= **3386.28** (round to **3386** High Burn Calories)

Low Burn EER: $662 - (9.53 \times \text{Age}) + \text{PA} (15.91 \times \text{W(kg)} + 539.6 \times \text{H(m)})$

Low Burn EER = $662 - (9.53 \times 20) + 1.13 (15.91 \times 65.9 \text{ kg} + 539.6 \times 1.7069 \text{ m})$
= $662 - 190.6 + 1.11 (1048.469 + 921.04324)$
= $662 - 190.6 + 2186.1585864$
= **2657.56** (round to **2658** Low Burn Calories)

Adult Dietary Reference Intake (DRI) for Energy (Calories) Using the Estimated Energy Requirement (EER) Equations

Males 9-18 y 19 y	$\text{EER} = 88.5 - (61.9 \times \text{Age in Years}) + \text{PA} (26.7 \times \text{Weight in Kg} + 903 \times \text{Height in Meters}) + 25$ PA (Physical Activity) = 1.0 if sedentary; 1.13 if low active; 1.26 if active; 1.42 if very active $\text{EER} = 662 - (9.53 \times \text{Age in Years}) + \text{PA} (15.91 \times \text{Weight in Kg} + 539.6 \times \text{Height in Meters})$ PA (Physical Activity) = 1.0 if sedentary; 1.11 if low active; 1.25 if active; 1.48 if very active		
Females 9-18 y 19 y	$\text{EER} = 135.3 - (30.8 \times \text{Age in Years}) + \text{PA} (10.0 \times \text{Weight in Kg} + 934 \times \text{Height in Meters}) + 25$ PA (Physical Activity) = 1.0 if sedentary; 1.16 if low active; 1.31 if active; 1.56 if very active $\text{EER} = 354 - (6.91 \times \text{Age in Years}) + \text{PA} (9.36 \times \text{Weight in Kg} + 726 \times \text{Height in Meters})$ PA (Physical Activity) = 1.0 if sedentary; 1.12 if low active; 1.27 if active; 1.45 if very active		
Pregnancy 1st trimester 2nd trimester 3rd trimester	Adult EER + 0 Calories Adult EER + 340 Calories Adult EER + 452 Calories	Lactation 1st 6 mo 2nd 6 mo	Adult EER + 330 Calories Adult EER + 400 Calories

Physical Activity Factors

Physical Activity (PA)	Recommendation/Description (Values based on an Average Weight Person)
FACTOR Sedentary Low Active Active Very Active	Only Physical Activities required for independent living Walking 1.5-3 miles per day at 2-4 mph pace Walking 3-10 miles per day at 2-4 mph pace Walking 10 or more miles per day at 2-4 mph pace

4. Decide on the Calorie levels for your high burn and low burn diets (choose Calorie levels from one of the methods). These numbers will be the basis for designing your diets, so choose wisely!

High Burn Calories: 3546.9

Low Burn Calories: 2195.7

Remember that application of the above principles in the real world is conditional on a wide range of energy expenditure. Energy expenditure (due to physical activity variance, or secondarily to stress) is highly variable, thus the calculated dietary intakes for the high-Calorie-burn days, and the low-burn days may contain significant error.

Part 2: MACRONUTRIENT DESIGN (30 points)

Selecting Percentage of Calories from carbohydrate, protein, and fat to determine grams and Calories from of carbohydrate, protein, and fat

Diets Must Minimally Meet the AMDRs

- 45-65% of total Calories from carbohydrate
- 10-35% of Calories from protein
- 20-35% of total Calories from fat

Remember to limit sugars and saturated fats while minimally meeting the DRI for protein and preventing a high protein diet)

Suggestions for making energy distribution choices: In assignment 5 you will design a day's worth of eating based on the total Calories and percentage of calories from carbohydrate, protein and fat designed in assignment 4. In assignment 5 you will be allowed a 50 Calorie buffer, a 3% of Calorie for Fat variance, and a 20 grams carbohydrate and protein buffer from your plan, yet still remain within the AMDRs. Thus, it is wise to set up your diet design carefully and allow yourself a little room for variance. So it is highly suggested that you do not plan carbohydrate, protein, or fat at the end range of the AMDRs. *For example, strive for 60% carbohydrate 15% protein and 25% fat, instead of 65% carbohydrate, 15% protein, and 20% fat.*

Guidelines for Athletes: If you are involved in athletics and need to make sure that glycogen stores are replenished to potential, it is recommended that between ~60% of total Calories should be provided from carbohydrate. This is a high carbohydrate diet. If you want the high carbohydrate diet, you will need sufficient protein for tissue repair (15-20% of calories), so that leaves 20-25% of calories from fat.

Guidelines for Fat Cell Reduction: For individuals who desire fat cell reduction and want to maintain consuming about the same amount of food, finding and eliminating the hidden Calories that come from fat and added sugars in the diet can do this fairly easily. Thus the diet will be moderate in carbohydrate, protein, and fat (such as 50, 25, and 25%, respectively).

Chose one of the following macronutrient distribution options:

1. 60% carbs, 15% protein, and 25% fat
2. 60% carbs, 20% protein, and 20% fat
3. 55% carbs, 20% protein, and 25% fat
4. 50% carbs, 25% protein, and 25% fat
5. 50% carbs, 20% protein, and 30% fat

Other options within the AMDRs but can be problematic with diet design:

6. 45% carbs, 25% protein, and 30% fat
7. 45% carbs, 30% protein, and 25% fat
8. 65% carbs, 15% protein, and 20% fat

List the macronutrient distribution design option 1-8 and percentages you chose for the high burn and low burn days (*can be the same or different*)

High Burn: 3546.9 Calories Option 1- **60% Carbs, 15% Protein, 25% Fat**

Low Burn: 2195.7 Calories Option 2 - **60% Carbs, 20% Protein, 20% Fat**

A. CALCULATE YOUR PROTEIN (Pro) CALORIES AND GRAMS:

Show your mathematical work, Sample provided on page 16

1. Multiply the percent of Calories desired from protein times total Calories needed. This equals how many Calories should come from protein.

High Burn Calculation for Calories from Pro: $3546.9 \times 15\% = 3546.9 \times 0.15 = 532.035 \text{ Calories}$

Low Burn Calculation for Calories from Pro: $2195.7 \times 20\% = 2195.7 \times 0.20 = 439.14 \text{ Calories}$

2. To determine the grams of protein needed: Divide the total Calories from protein by 4 Calories per gram. This equals grams of total protein.

High Burn Calculation for total grams of Pro: $532.035 \text{ Calories} / 4 \text{ Calories/gram} = 133.009 \text{ grams}$

Low Burn Calculation for total grams of Pro: $439.14 \text{ Calories} / 4 \text{ Calories/gram} = 109.785 \text{ grams}$

3. The DRI for protein is 0.8 grams of high quality dietary protein per kilogram of body weight for adult men and women. Calculate your DRI for protein: body weight in pounds divided by 2.2 = body weight in kilograms (Kg). Weight in Kg times 0.8 grams/Kg = **52.72** grams per day DRI for protein. Make sure your grams from protein in part 2 meet or exceed your DRI for protein calculated here.

DRI for Pro: $145 \text{ lbs} / 2.2 = 65.90 \text{ kg} \times 0.8 \text{ grams/Kg} = 52.72 \text{ grams}$

4. For moderate exercise levels 1.2 – 1.5 grams protein/Kg/day is advised. If you are interested in lean body mass gain, 1.6-1.8 grams protein/Kg day is recommended. If you are a distance athlete, 2.0 grams protein/Kg/day is needed. Calculate your personalized estimated need for protein. Make sure your grams from protein in part 2 meet or exceed your personalized estimate for protein calculated here.

Personalized Pro estimate: $65.90 \text{ kg} \times 1.6 \text{ grams/Kg} = 105.44 \text{ grams}$

If your DRI for protein and personalized protein estimate are not met, then choose a different macronutrient distribution design option to meet your needs and redo part A calculations.

B. CALCULATE YOUR CARBOHYDRATE (Carbs) CALORIES AND GRAMS:

Show your mathematical work, Sample provided on page 16

1. Multiply the percent of Calories desired from carbohydrate times total Calories needed. This equals how many Calories should come from carbohydrate.

High Burn Calculation for Calories from Carbs: $3546.9 \times 60\% = 3546.9 \times 0.60 = 2128.14 \text{ Calories}$

Low Burn Calculation for Calories from Carbs: $2195.7 \times 60\% = 2195.7 \times 0.60 = 1317.42 \text{ Calories}$

2. To determine the grams of carbohydrate needed: Divide the total Calories from carbohydrate by 4 Calories per gram. This equals grams of total carbohydrate.

High Burn Calculation for total grams of Carbs: $2128.14 \text{ Calories} / 4 \text{ Calories/gram} = 532.035 \text{ grams}$

Low Burn Calculation for total grams of Carbs: $1317.42 \text{ Calories} / 4 \text{ Calories/gram} = 329.355 \text{ grams}$

C. CALCULATE YOUR FAT CALORIES AND GRAMS:

Show your mathematical work, Sample provided on page 17

1. Multiply the percent of Calories desired from fat times total Calories needed. This equals how many Calories should come from fat.

High Burn Calculation for Calories from Fat: $3546.9 \times 25\% = 3546.9 \times 0.25 = 886.725 \text{ Calories}$

Low Burn Calculation for Calories from Fat: $2195.7 \times 20\% = 2195.7 \times 0.20 = 439.14$ Calories

2. To determine the grams of fat needed: Divide the total Calories from carbohydrate by 9 Calories per gram. This equals grams of total fat.

High Burn Calculation for total grams of Fat: $886.725 \text{ Calories} / 9 \text{ Calories/gram} = 98.525$ grams

Low Burn Calculation for total grams of Fat: $439.14 \text{ Calories} / 9 \text{ Calories/gram} = 48.793$ grams

D. CHECK YOUR WORK

To make sure that you do not have a calculation error, add the Calories from protein, carbohydrate, and fat together for each high burn and low burn plan.

High Burn Calorie Check: Calories from Pro + Carb + Fat = Total Calories
 $532.035 + 2128.14 + 886.725 = 3546.9$ Calories

Low Burn Calorie Check: Calories from Pro + Carb + Fat = Total Calories
 $439.14 + 1317.42 + 439.14 = 2195.7$ Calories

Compare the Calorie check number to your total high and low burn calories. If they do not match. Redo your calculations until they do using the formulas provided.

PART 3 (50 points)

Translating your diet design into MyPlate then Exchange List patterns

Determine the Exchange List Pattern that will fulfill your nutritional needs using MyPlate and the Exchange Lists. **Use the MyPlate and Exchange List appendices.** Note that service equivalents in MyPlate are different from Exchange List exchange amounts. Regardless this give you a rough idea for planning a healthy diet.

1. Determine the closest Calorie level from MyPlate as compared to your high and low burn calorie level using the table below. If you are planning a diet with more than 3,200 Calories then extrapolate the servings from the food groups up proportionately.

MyPlate Food Intake Patterns

Daily Amount of Food from Each Group									
Calorie Level	1,600	1,800	2,000	2,200	2,400	2,600	2,800	3,000	3,200
Milk	3 c	3 c	3 c	3 c	3 c	3 c	3 c	3 c	3 c
Fruits	1.5 c	1.5 c	2 c	2 c	2 c	2 c	2.5 c	2.5 c	2.5 c
Vegetables	2 c	2.5 c	2.5 c	3 c	3 c	3.5 c	3.5 c	4 c	4 c
Grains	5 oz.	6 oz.	6 oz.	7 oz.	8 oz.	9 oz.	10 oz.	10 oz.	10 oz.
Protein	5 oz.	5 oz.	5.5 oz.	6 oz.	6.5 oz.	6.5 oz.	7 oz.	7 oz.	7 oz.
Oils	5 tsp	5 tsp	6 tsp	6 tsp	7 tsp	8 tsp	8 tsp	10 tsp	11 tsp

[[TF]]c = cup, oz. = ounce equivalent, tsp = teaspoon

2. Allocate the total number of exchanges for milk. For most people 3 MyPlate dairy cup equivalents, which are equal to 3 milk exchanges, are planned. If you are lactose intolerant or have a milk allergy prescribe milk alternatives. *There are 12 grams of carbohydrate, 8 grams of protein, and varying amounts of fat per exchange in the milk list. Examples of milk exchanges include: 1 cup milk or milk alternative and 2/3 cup low-fat yogurt.*

3. Prescribe the total number of fruit exchanges. For most people 1.5 to 2.5 MyPlate fruit cup equivalents, which are equal to 3 to 6 fruit exchanges are planned. *There are 15 grams of carbohydrate*

per exchange in the fruit list. Examples of fruit exchanges include: 1 small (4 oz) apple, 1 kiwi, $\frac{1}{2}$ cup canned fruit, 3 dried prunes or dates, 2 tangerines, and $\frac{1}{3}$ to $\frac{1}{2}$ cup juice.

4. Prescribe the total number of nonstarchy vegetable exchanges. For most people 2 to 4 MyPlate vegetable cup equivalents, which are equal to 4 to 8 vegetable exchanges are planned. Remember to eat a variety of vegetables. Starchy vegetables are included in the Starch Exchange list. *There are 5 grams of carbohydrate and 2 grams of protein per exchange in the nonstarchy vegetable list. Examples of nonstarchy vegetable exchanges include: $\frac{1}{2}$ cup cooked vegetables or vegetable juice, 1-cup raw vegetable is one exchange.*

5. Prescribe the remaining carbohydrate. Make a quick summation of the total grams of each energy-producing nutrient. Determine how many more grams of carbohydrate you need in order to fulfill the carbohydrate prescription. Sum the number of grams of carbohydrate prescribed thus far and subtract this number from the number of grams of carbohydrate prescribed in the diet. You will use this data in order to prescribe the number of STARCH exchanges. There are 15 grams of carbohydrate, 3 grams of protein, and trace grams fat per starch exchange. Once you know how many grams of carbohydrate that you have remaining to fulfill for the diet, divide the total grams of carbohydrate by 15 to get the number of exchanges that you need to prescribe for the Starch exchange. At minimum, consider the recommendations made by MyPlate and be sure to prescribe $\frac{1}{2}$ of the starch exchanges as whole grains. *Examples of starch exchanges include: $\frac{1}{4}$ of a bagel, 1 slice (1 oz) bread, 1 x 6 inch tortilla, 1 x 4 inch waffle or pancake, $\frac{1}{2}$ cup most cereals and cooked corn, peas, potato, or yam, $\frac{1}{3}$ cup cooked rice, pasta, or baked beans, 3 cups popcorn, and 3-8 crackers.*

6. Prescribe the remaining protein. Make a quick summation of the total grams of protein if the protein requirement is not fulfilled, then prescribe the number of meat exchanges that you need using the process described above. Meat exchanges provide 0 grams of carbohydrate, 7 grams of protein, and a variable amount of fat. Divide the grams of protein that still need to be provided in the diet by 7 to determine the number of exchanges of meat or meat substitutes to prescribe. At minimum consider the recommendations made by MyPlate. Be sure to limit high animal fat protein sources. *Examples of meat exchanges include: 1 ounce of beef, poultry, pork, lamb, $\frac{1}{2}$ cup tofu, 2 egg whites or oysters, 1 ounce of cheese, lunch meat, or sausage, and 1 tablespoon of peanut butter.*

7. Prescribe the remaining fat. Now it is time to adjust the total Calories of the diet with fat. Make a quick summation of the number of grams of fat allocated thus far, and subtract this number from the total number of grams of fat prescribed for the diet. Each fat exchange provides 5 grams of fat, therefore divide the remaining number of gram of fat by 5 to get the number of fat exchanges to prescribe. Be sensitive to the type of fat that you are adding at this point, so that the fatty acid distribution will meet the dietary criteria stipulated for the assignment. The majority should be monounsaturated fat. There should be enough polyunsaturated fat to meet the essential fatty acid needs. At minimum consider the recommendations made by MyPlate. Limit solid fats from saturated fat. *Examples of fat exchanges include: 1 teaspoon oil, 1 tablespoon sesame seeds, reduced fat-mayonnaise, regular salad dressing, coconut milk, 2 tablespoons avocado, half and half, reduced-fat salad dressing, 4 pecan or walnut halves, 6 almonds, and 10 peanuts.*

HIGH BURN Exchange List Allocation Worksheet
(25 POINTS) **Please complete this form, not your own version of it**

Total HIGH Burn Calories: **3546.9**

Sample provided on page 18

% Calories from CARBS: **60**

Grams CARBS: **532.035**

Calories CARBS: **2128.14**

% Calories from PRO: **15**

Grams PRO: **133.009**

Calories PRO: **532.035**

% Calories from FAT: **25**

Grams FAT: **98.525**

Calories FAT: **886.725**

Exchange	# exchanges	Grams Carbs/EX	Total Carbs	Grams PRO/EX	Total PRO	Grams FAT/EX	Total FAT
Skim Milk		12		8		0	
1% Milk		12		8		3	
2% Milk	---	12	---	8	---	5	---
Whole	3	12	36	8	24	8	24
Fruit	8	15	120	0	0	0	0
Vegetable	8	5	40	2	16	0	0
<i>Subtotal Carbs</i>			196				
Starch	22.5	15	337.5	3	67.5	0	0
<i>Subtotal PRO</i>					107.5		
V. Lean Meat		0		7		0 or 1	
Lean Meat	2	0	0	7	14	3	6
M. Fat Meat	1	0	0	7	7	5	5
H. Fat Meat	1	0	0	7	7	8	8
<i>Subtotal Fat</i>							43
Sat Fat	1	0	0	0	0	5	5
Mono Fat	8	0	0	0	0	5	40
Poly Fat	2	0	0	0	0	5	10
Totals	56.5		533.5		135.5		98

Plan exchanges to be within 3 grams of your carbohydrate, protein, and fat prescription. Round to nearest whole or half exchange

Avoid the use of high fat milk and meat as this will not be conducive to planning a healthy diet or meeting design criteria in assignment 5.

LOW BURN Exchange List Allocation Worksheet
(25 POINTS) **Please complete this form, not your own version of it**

Total LOW Burn Calories: 2195.7

Sample provided on page 19

% Calories from CARBS: **60%** Grams CARBS: **329.355** Calories CARBS: **1317.42**

% Calories from PRO: **20%** Grams PRO: **109.785** Calories PRO: **439.14**

% Calories from FAT: **20%** Grams FAT: **48.793** Calories FAT: **439.14**

Exchange	# exchanges	Grams Carbs/EX	Total Carbs	Grams PRO/EX	Total PRO	Grams FAT/EX	Total FAT
Skim Milk		12		8		0	0
1% Milk	3	12	36	8	24	3	9
2% Milk	---	12	---	8	---	5	---
Whole	0	12	0	8	0	8	0
Fruit	4	15	60	0	0	0	0
Vegetable	7	5	35	2	14	0	0
<i>Subtotal Carbs</i>			131				
Starch	13	15	195	3	39	0	0
<i>Subtotal PRO</i>					77		
V. Lean Meat	2	0	0	7	14	0 or 1	2
Lean Meat	1.5	0	0	7	10.5	3	4.5
M. Fat Meat	1	0	0	7	7	5	5
H. Fat Meat	0	0	0	7	0	8	0
<i>Subtotal Fat</i>							20.5
Sat Fat	1	0	0	0	0	5	5
Mono Fat	3	0	0	0	0	5	15
Poly Fat	1.5	0	0	0	0	5	7.5
Totals	38		326		108.5		48

Plan exchanges to be within 3 grams of your carbohydrate, protein, and fat prescription. Round to nearest whole or half exchange

Avoid the use of high fat milk and meat as this will not be conducive to planning a healthy diet or meeting design criteria in assignment 5.

Exchange List Allocation Worksheet used with permission © 2016 Joan S. Thompson

Grading Rubric Form

Objective/Criteria	Didn't Meet Any Expectations	Didn't Meet Most Expectations	Didn't Meet All Expectations	Didn't Meet All Expectations	Meet All Expectations
Part 1: Energy Needs	(0 points) Numerous Calculation errors, or incomplete calculations and/or didn't show all work.	(5 points) Numerous Calculation errors, or incomplete calculations or didn't show all work.	(10 points) Some Calculation errors, or incomplete calculations or didn't show all work.	(15 points) Some Calculation errors, or incomplete calculations or didn't show all work.	(20 points) Correct and Complete Calculations.
Part 2: Diet Design (Pro, Carbs, Fat)	(0 points) Numerous Calculation errors, or incomplete calculations and/or didn't show all work.	(10 points) Numerous Calculation errors, or incomplete calculations or didn't show all work.	(20 points) Some Calculation errors, or incomplete calculations or didn't show all work.	(25 points) Some Calculation errors, or incomplete calculations or didn't show all work.	(30 points) Correct and Complete Calculations.
Part 3: Exchange Allocation high burn	(0 points) No or extremely poor exchange prescription	(5 points) Not within 3 grams of diet design criteria and/or unbalanced design in several exchange lists	(10 points) Not within 3 grams of diet design criteria or unbalanced design in two or three exchange list	(20 points) Not within 3 grams of diet design criteria or unbalanced design in one or two exchange list	(25 points) Met all criteria
Part 3: Exchange Allocation low burn	(0 points) No or extremely poor exchange prescription	(5 points) Not within 3 grams of diet design criteria and/or unbalanced design in several exchange lists	(10 points) Not within 3 grams of diet design criteria or unbalanced design in two or three exchange list	(20 points) Not within 3 grams of diet design criteria or unbalanced design in one or two exchange list	(25 points) Met all criteria

SAMPLE WORK: AMY

Part 1: Estimating Energy Needs (20 points)

There are several ways to measure or estimate energy expenditure, or determine one's energy needs. The technique used varies depending on the setting: research, clinical setting, or education.

Mifflin-St Jeor Equations: These equations are more recently developed and are believed to be more precise in determining Resting Energy Expenditure (REE) Calories/day under normal physiological conditions. The Equations are gender specific, and take into account the height in centimeters, weight in kilograms, and age in years of the individual.

1. Calculate your REE using the Mifflin Equation. (show your work)

For MEN:

$$\text{REE (Calories/day)} = (10 \times W) + (6.25 \times H) - (5 \times A) + 5$$

For WOMEN:

$$\text{REE (Calories/day)} = (10 \times W) + (6.25 \times H) - (5 \times A) - 161$$

Amy is a female, age 25 who weighs 140 lb and is 5ft 5in tall (65 inches).

[140 lbs ÷ 2.2 = 63.64 Kg and 65 inches x 2.54 = 165 cm]

$$\begin{aligned}\text{Amy's REE} &= (10 \times 63.64) + (6.25 \times 165) - (5 \times 25) - 161 \\ &= 636.36 + 1031 - 125 - 161 = 1,381.36 \text{ Calorie REE}\end{aligned}$$

Energy Levels and REE factors by gender for #2 and 3 on the next page.

1. Sedentary
Male: REE x 1.3 factor Female: REE x 1.3 factor
2. Lightly active
Male: REE x 1.6 factor Female: REE x 1.5 factor
3. Moderately active
Male: REE x 1.7 factor Female: REE x 1.6 factor
4. Very active
Male: REE x 2.1 factor Female: REE x 1.9 factor
5. Extremely active
Male: REE x 2.4 factor Female: REE x 2.2 factor
6. Personalized
Some variation of the above factors

WORKSHEET TO ESTIMATE YOUR ENERGY NEEDS

2. Choose a level of activity that represents your high-energy use day and another that represents your low energy use day (see levels 1-6 on the previous page).

- High burn level (#1-6): 4 High burn REE factor: 1.9
- Low burn level (# 1-6): 2 Low burn REE factor: 1.5

3. Calculate high burn and low burn Calorie needs. (show your work)

Method 1: My calculated (Mifflin) REE: 1381

- High burn energy needs using your calculated REE and the REE factor: _____
 $1381 \times 1.9 = 2624 \text{ Calories}$
- Low burn energy needs using your calculated REE and the REE factor: _____
 $1381 \times 1.5 = 2072 \text{ Calories}$

Method 2 (OPTIONAL): My measured (Indirect Calorimetry) REE: Not Done

- High burn energy needs using your measured REE and the REE factor: _____
- Low burn energy needs using your measured REE and the REE factor: _____

Method 3: My DRI for Calories (EER) calculated using a high burn Physical Activity Level (PAL) and a low burn PAL. (show your work, use EER PALs, do not use the factors on the previous page)

High Burn EER:

$$\text{EER} = 354 - (6.91 \times \text{Age in Years}) + \text{PA} (9.36 \times \text{Weight in Kg} + 726 \times \text{Height in Meters})$$

PA (Physical Activity) = 1.0 if sedentary; 1.12 if low active; 1.27 if active; 1.45 if very active

$$\begin{aligned}\text{EER} &= 354 - (6.91 \times 25) + 1.45(9.36 \times 63.64 + 726 \times 1.65) \\ \text{EER} &= 354 - 172.75 + 1.45(595.67 + 1197.9) \\ \text{EER} &= 354 - 172.75 + 2600.68 = 2781.93 \text{ (round to } \mathbf{2782} \text{ High Burn Calories)}\end{aligned}$$

Low Burn EER:

$$\begin{aligned}\text{EER} &= 354 - 172.75 + 1.12(595.67 + 1197.9) \\ \text{EER} &= 354 - 172.75 + 2008.80 = 2190.05 \text{ (round to } \mathbf{2190} \text{ Low Burn Calories)}\end{aligned}$$

Adult Dietary Reference Intake (DRI) for Energy (Calories) Using the Estimated Energy Requirement (EER) Equations

Males 9-18 y 19 y	EER = 88.5 - (61.9 x Age in Years) + PA (26.7 x Weight in Kg + 903 x Height in Meters) + 25 PA (Physical Activity) = 1.0 if sedentary; 1.13 if low active; 1.26 if active; 1.42 if very active EER = 662 - (9.53 x Age in Years) + PA (15.91 x Weight in Kg + 539.6 x Height in Meters) PA (Physical Activity) = 1.0 if sedentary; 1.11 if low active; 1.25 if active; 1.48 if very active		
Females 9-18 y 19 y	EER = 135.3 - (30.8 x Age in Years) + PA (10.0 x Weight in Kg + 934 x Height in Meters) + 25 PA (Physical Activity) = 1.0 if sedentary; 1.16 if low active; 1.31 if active; 1.56 if very active EER = 354 - (6.91 x Age in Years) + PA (9.36 x Weight in Kg + 726 x Height in Meters) PA (Physical Activity) = 1.0 if sedentary; 1.12 if low active; 1.27 if active; 1.45 if very active		
Pregnancy 1st trimester 2nd trimester 3rd trimester	Adult EER + 0 Calories Adult EER + 340 Calories Adult EER + 452 Calories	Lactation 1st 6 mo 2nd 6 mo	Adult EER + 330 Calories Adult EER + 400 Calories

Physical Activity Factors

FACTOR Sedentary Low Active Active Very Active	Only Physical Activities required for independent living Walking 1.5-3 miles per day at 2-4 mph pace Walking 3-10 miles per day at 2-4 mph pace Walking 10 or more miles per day at 2-4 mph pace

4. Decide on the Calorie levels for your high burn and low burn diets (choose Calorie levels from one of the methods). These numbers will be the basis for designing your diets, so choose wisely!

High Burn Calories: 2624

Low Burn Calories: 2072

Remember that application of the above principles in the real world is conditional on a wide range of energy expenditure. Energy expenditure (due to physical activity variance, or secondarily to stress) is highly variable, thus the calculated dietary intakes for the high-Calorie-burn days, and the low-burn days may contain significant error.

Part 2: MACRONUTRIENT DESIGN (30 points)

Selecting Percentage of Calories from carbohydrate, protein, and fat to determine grams and Calories from of carbohydrate, protein, and fat

Diets Must Minimally Meet the AMDRs

- 45-65% of total Calories from carbohydrate
- 10-35% of Calories from protein
- 20-35% of total Calories from fat

Remember to limit sugars and saturated fats while minimally meeting the DRI for protein and preventing a high protein diet)

Suggestions for making energy distribution choices: In assignment 5 you will design a day's worth of eating based on the total Calories and % of calories from carbohydrate, protein, and fat designed here in assignment 4. In assignment 5 you will be allowed a 50 Calorie buffer, a 3% of Calorie for Fat variance, and a 20 grams carbohydrate and protein buffer from your plan, yet still within the AMDRs. Thus, it is wise to set up your diet design carefully and allow yourself a little room for variance. So it is highly suggested that you do not plan carbohydrate, protein, or fat at the end range of the AMDRs. *For example, strive for 60% carbohydrate 15% protein and 25% fat, instead of 65% carbohydrate, 15% protein, and 20% fat.*

Guidelines for Athletes: If you are involved in athletics and need to make sure that glycogen stores are replenished to potential, it is recommended that between ~60% of total Calories should be provided from carbohydrate. This is a high carbohydrate diet. If you want the high carbohydrate diet, you will need sufficient protein for tissue repair (15-20% of calories), so that leaves 20-25% of calories from fat.

Guidelines for Fat Cell Reduction: For individuals who desire fat cell reduction and want to maintain consuming about the same amount of food, finding and eliminating the hidden Calories that come from fat and added sugars in the diet can do this fairly easily. Thus the diet will be moderate in carbohydrate, protein, and fat (such as 50, 25, and 25%, respectively).

Chose one of the following macronutrient distribution options:

1. 60% carbs, 15% protein, and 25% fat
2. 60% carbs, 20% protein, and 20% fat
3. 55% carbs, 20% protein, and 25% fat
4. 50% carbs, 25% protein, and 25% fat
5. 50% carbs, 20% protein, and 30% fat

Other options within the AMDRs but can be problematic with diet design:

6. 45% carbs, 25% protein, and 30% fat
7. 45% carbs, 30% protein, and 25% fat
8. 65% carbs, 15% protein, and 20% fat

List the macronutrient distribution design option 1-8 and percentages you chose for the high burn and low burn days (can be the same or different)

High Burn: 2624 Calories Option 1 - 60% carbs, 15% protein, and 25% fat

Low Burn: 2072 Calories Option 3 - 55% carbs, 20% protein, and 25% fat

A. CALCULATE YOUR PROTEIN (Pro) CALORIES AND GRAMS:

Show your mathematical work

1. Multiply the percent of Calories desired from protein times total Calories needed. This equals how many Calories should come from protein.

High Burn Calculation for Calories from Pro:

$$2624 \times 0.15 = 393.6 \text{ Calories}$$

Low Burn Calculation for Calories from Pro:

$$2072 \times 0.2 = 414.4 \text{ Calories}$$

2. To determine the grams of protein needed: Divide the total Calories from protein by 4 Calories per gram. This equals grams of total protein.

High Burn Calculation for total grams of Pro:

$$393.6 \text{ Calories} \div 4 \text{ Calories/gram} = 98.4 \text{ grams}$$

Low Burn Calculation for total grams of Pro:

$$414.4 \text{ Calories} \div 4 \text{ Calories/gram} = 103.6 \text{ grams}$$

3. The DRI for protein is 0.8 grams of high quality dietary protein per kilogram of body weight for adult men and women. Calculate your DRI for protein: body weight in pounds divided by 2.2 = body weight in kilograms (Kg). Weight in Kg times 0.8 grams/Kg = ____ grams per day DRI for protein. Make sure your grams from protein in part 2 meet or exceed your DRI for protein calculated here.

$$\text{DRI for Pro: } 140 \text{ lbs} \div 2.2 = 63.64 \text{ Kg} \times 0.8 \text{ grams/Kg} = 50.9$$

4. For moderate exercise levels 1.2 – 1.5 grams protein/Kg/day is advised. If you are interested in lean body mass gain, 1.6-1.8 grams protein/Kg day is recommended. If you are a distance athlete 2.0 grams protein/Kg/day is needed. Calculate your personalized estimated need for protein. Make sure your grams from protein in part 2 meet or exceed your personalized estimate for protein calculated here.

$$\text{Personalized Pro estimate: } 63.64 \text{ Kg} \times 1.5 \text{ grams/Kg} = 95.5$$

If your DRI for protein and personalized protein estimate are not met then choose a different macronutrient distribution design option to meet your needs and redo part A calculations.

B. CALCULATE YOUR CARBOHYDRATE (Carbs) CALORIES AND GRAMS:

Show your mathematical work

1. Multiply the percent of Calories desired from carbohydrate times total Calories needed. This equals how many Calories should come from carbohydrate.

High Burn Calculation for Calories from Carbs:

$$2624 \times 0.6 = 1574 \text{ Calories}$$

Low Burn Calculation for Calories from Carbs:

$$2072 \times 0.55 = 1140 \text{ Calories}$$

2. To determine the grams of carbohydrate needed: Divide the total Calories from carbohydrate by 4 Calories per gram. This equals grams of total carbohydrate.

High Burn Calculation for total grams of Carbs:

$$1574 \text{ Calories} \div 4 \text{ Calories/gram} = 393.5 \text{ grams}$$

Low Burn Calculation for total grams of Carbs:

$$1140 \text{ Calories} \div 4 \text{ Calories/gram} = 285 \text{ grams}$$

C. CALCULATE YOUR FAT CALORIES AND GRAMS:

Show your mathematical work

1. Multiply the percent of Calories desired from fat times total Calories needed. This equals how many Calories should come from fat.

High Burn Calculation for Calories from Fat:

2624 X 0.25 = 656 Calories

Low Burn Calculation for Calories from Fat:

2072 X 0.25 = 518 Calories

2. To determine the grams of fat needed: Divide the total Calories from carbohydrate by 9 Calories per gram. This equals grams of total fat.

High Burn Calculation for total grams of Fat:

656 Calories ÷ 9 Calories/gram = 73 grams

Low Burn Calculation for total grams of Fat:

518 Calories ÷ 9 Calories/gram = 57.5 grams

D. CHECK YOUR WORK

To make sure that you do not have a calculation error, add the calories from protein, carbohydrate, and fat together for each high burn and low burn plan. Compare that number to your total high and low burn calories. If they do not match. Redo your calculations until they do using the formulas provided.

High Burn Calorie Check: $393.4 + 1574 + 656 = 2624$ Calories (same as goal)

Low Burn Calorie Check: $414.4 + 1140 + 518 = 2072$ Calories (same as goal)

HIGH BURN Exchange List Allocation Worksheet
(25 POINTS) **Please complete this form, not your own version of it**

High Burn Total Calories: **2624**

% Calories from CARBS: **60**

Grams CARBS: **393.5**

Calories CARBS: **1574**

% Calories from PRO: **15**

Grams PRO: **98.4**

Calories PRO: **393.6**

% Calories from FAT: **25**

Grams FAT: **73**

Calories FAT: **656**

Exchange	# Exchanges	Grams Carbs/EX	Total Carbs	Grams PRO/EX	Total PRO	Grams FAT/EX	Total FAT
Skim Milk	3	12	36	8	24	0	0
1% Milk		12		8		3	
2% Milk	---	12	---	8	---	5	---
Whole	X	12	X	8	X	8	X
Fruit	4	15	60	0	0	0	0
Vegetable	6	5	30	2	12	0	0
<i>Subtotal Carbs</i>			126		36		0
Starch	18	15	270	3	54	0	
<i>Subtotal PRO</i>					90		
V. Lean Meat		0		7		0 or 1	
Lean Meat	1	0		7	7	3	3
M. Fat Meat	X	0	X	7	X	5	X
H. Fat Meat	X	0	X	7	X	8	X
<i>Subtotal Fat</i>							3
Sat Fat	3	0		0		5	15
Mono Fat	6	0		0		5	30
Poly Fat	5	0		0		5	25
Totals			396		97		73

Plan exchanges to be within 3 grams of your carbohydrate, protein, and fat prescription. Round to nearest whole or half exchange

Avoid the use of high fat milk and meat as this will not be conducive to planning a healthy diet or meeting design criteria in assignment 5.

LOW BURN Exchange List Allocation Worksheet
(25 POINTS) **Please complete this form, not your own version of it**

Low Burn Total Calories: **2072**

% Calories from CARBS: **55**

Grams CARBS: **285**

Calories CARBS: **1140**

% Calories from PRO: **20**

Grams PRO: **103.6**

Calories PRO: **414.4**

% Calories from FAT: **25**

Grams FAT: **57.5**

Calories FAT: **518**

Exchange	# Exchanges	Grams Carbs/EX	Total Carbs	Grams PRO/EX	Total PRO	Grams FAT/EX	Total FAT
Skim Milk	3	12	36	8	24	0	0
1% Milk		12		8		3	
2% Milk	---	12	---	8	---	5	---
Whole	X	12	X	8	X	8	X
Fruit	3	15	45	0	0	0	0
Vegetable	5	5	25	2	10	0	0
<i>Subtotal Carbs</i>			106		36		0
Starch	12	15	180	3	36	0	
<i>Subtotal PRO</i>					72		
V. Lean Meat	2	0		7	14	0 or 1	2
Lean Meat	2.5	0		7	17.5	3	7.5
M. Fat Meat	X	0	X	7	X	5	X
H. Fat Meat	X	0	X	7	X	8	X
M. Fat Meat		0		7		5	
H. Fat Meat		0		7		8	
<i>Subtotal Fat</i>							9.5
Sat Fat	1	0		0		5	5
Mono Fat	5	0		0		5	25
Poly Fat	3.5	0		0		5	17.5
Totals			283.5		103.5		57

Plan exchanges to be within 3 grams of your carbohydrate, protein, and fat prescription. Round to nearest whole or half exchange

Avoid the use of high fat milk and meat as this will not be conducive to planning a healthy diet or meeting design criteria in assignment 5.

Exchange List Allocation Worksheet used with permission © 2016 Joan S. Thompson