MA 150 Notes §8.3

Recall:

- The constant calorie expenditure model (CCEM) is given by

$$W(t) = W(t-1) + \frac{I_0}{3500} - \frac{E_0}{3500}.$$

- The variable calorie expenditure model (VCEM) is given by

$$W(t) = W(t-1) - \frac{\lambda_0 \cdot 4.536}{3500} \cdot W(t-1) + \frac{I_0}{3500} - \frac{\lambda_0}{3500} \cdot [15.875 \cdot H - 5 \cdot A + 166 \cdot S - 161].$$

- The VCEM is an affine model with equlibrium value given by

$$W^* = 0.2205 \cdot \frac{I_0}{\lambda_0} - 3.5 \cdot H + 1.102 \cdot A - 36.596 \cdot S + 35.494.$$

1 Health Metrics

Though our models so far have focused on body weight, we should be more concerned with overall health. Today we take a look at some simple ways of assessing our overall health status that are more reliable than just thinking about body weight.

1.1 Body Mass Index (BMI)

The *body mass index*, or BMI, is a health metric that takes into account both a person's weight and their _____. It is widely used because of its simplicity and its ability to give a quick assessment of overall health.

$$BMI = 703.07 \cdot \frac{W}{H^2}.$$

Example 1: Calculate Dr. Barton's BMI and assess his health status based on the result.

- $W =$ _____.
- $H =$ _____.

BMI	Health Status Category
Below 18.5	Underweight
Between 18.5 and 24.9	Normal
Between 25.0 and 29.9	Overweight
Above 29.9	Obese

Table 8.2: NIH ranges for interpreting BMI values.

1.2 Waist to Height Ratio (WHR)

A shortcoming of the BMI is that it doesn't distinguish between "good" body weight, i.e. _____, and "bad" body weight, i.e. _____.

For example, a 5'9" tall body builder who weighs 200 pounds would have the same BMI (29.5, so nearly obese) as a sedentary office worker of the same height and weight. However, we expect that the body builder is at a healthy weight because it will likely be mostly muscle. The office worker on the other hand likely carries a lot more fat. BMI can't distinguish between these two cases!

The *waist-to-height ratio* has been found to be a more accurate predictor of overall health status than BMI. Because WHR measures a person's "shape" it provides an indirect measure for how much body fat vs. lean muscle a person is carrying.

$$WHR = \frac{Wa}{H}.$$

- $Wa =$ _____.
- $H =$ _____.

Example 2: Calculate Dr. Barton's WHR and assess his health status based on the result.

Waist to Height Ratio	Health Status Category
Below 0.40	Underweight
Between 0.40 and 0.50	Healthy
Between 0.50 and 0.60	Overweight
Above 0.60	Obese

Table 8.3: Ranges for interpreting WHR values.

1.3 Body Fat Percentage:

WHR is an improvement over BMI because it is an indirect measure of how much body fat a person has. We can potentially improve on WHR by estimating our *body fat percentage* directly. Body fat percentage is the _____. (The remaining percentage is referred to as our percentage of lean body mass.)

A home body fat scale is a simple, relatively inexpensive way to monitor one's body fat percentage, but we can also use equations that have been developed by many different researchers for this purpose. Some involve taking measurements with a measuring tape at various points on the body. The equations due to Jackson make use only of a person's sex, age, weight, and height:

$$\text{(Men) body fat } \% = 0.14 \cdot A + 37.31 \cdot \ln(BMI) - 103.94.$$

$$\text{(Women) body fat } \% = 0.14 \cdot A + 39.96 \cdot \ln(BMI) - 102.01.$$

Example 3: Estimate Dr. Barton's body fat % and assess his health status based on the result.

	Women	Men
Essential Fat	10-13%	2-5%
Athletes	14-20%	6-13%
Fitness	21-24%	14-17%
Acceptable	25-31%	18-24%
Obesity	32% or over	25% or over

Table 8.4: American Council on Exercise body fat percentage guidelines.