clear all;%clc;

load mint\_body\_dataset.mat

%1: gender 2: age(years) 3:weight(lbs) 4:height(inches)

for k = 1 : 13

%display(k)

LBtoKG = 0.453592;

INCHtoCM = 2.5441;

%---------------------

% measurement\_system = 'US' or 'metric'

measurement\_system = 'US';

iw\_method = 'formula'; % 'chart'/'formula'/'medical'

BF\_method = 1; % 1/2/3

LBW\_method = 1; % 1/2

BMR\_method = 1; % 1/2/3/4

% age

age = mint\_body\_data{2}(k);

% gender = 'M' or 'F'

gender = mint\_body\_data{1}(k);

% weight[lbs]

weight = mint\_body\_data{3}(k);

if strcmp(measurement\_system,'metric')==1

weight = weight \* LBtoKG;

end

% height[inches]

height = mint\_body\_data{4}(k);

if strcmp(measurement\_system,'metric')==1

height = height \* INCHtoCM;

end

% hip[inches]

hip = 36;

if strcmp(measurement\_system,'metric')==1

hip = hip \* INCHtoCM;

end

% waist[inches]

waist = 30;

if strcmp(measurement\_system,'metric')==1

waist = waist \* INCHtoCM;

end

% neck[inches]

neck = 12;

if strcmp(measurement\_system,'metric')==1

neck = neck \* INCHtoCM;

end

%% Body measurement

% Calculation

%--------------------------------------------

% Body Mass Index (BMI)

switch measurement\_system

case 'metric'

%BMI = mass[kg] / (height[m])^2

BMI = weight / ((height/100)^2);

case 'US'

%BMI = (mass[lb] / (height[in])^2) x 703.06957964

BMI = (weight / (height^2)) \* 703.06957964;

end

if BMI < 16

BMI\_diagnose = 'Severely underweight';

BMI\_Health\_risk = 'Risk of developing problems such as nutritional deficiency and osteoporosis';

elseif BMI < 18.5

BMI\_diagnose = 'Underweight';

BMI\_Health\_risk = 'Risk of developing problems such as nutritional deficiency and osteoporosis';

elseif BMI < 25

BMI\_diagnose = 'Normal';

BMI\_Health\_risk = 'Low Risk';

elseif BMI < 30

BMI\_diagnose = 'Overweight';

BMI\_Health\_risk = 'Moderate risk of developing heart disease, high blood pressure, stroke, diabetes';

elseif BMI < 35

BMI\_diagnose = 'Obese';

BMI\_Health\_risk = 'High risk of developing heart disease, high blood pressure, stroke, diabetes';

else

BMI\_diagnose = 'Very Obese';

BMI\_Health\_risk = 'High risk of developing heart disease, high blood pressure, stroke, diabetes';

end

%fprintf('BMI = %f\t%s\t(%s)\n',BMI,BMI\_diagnose,BMI\_Health\_risk);

%--------------------------------------------

% BMI prime

BMIprime = BMI/25;

%--------------------------------------------

% Ideal Weight

% Check idea weight calculation method

switch iw\_method

% Calculate idea weight based on height weight chart

case 'chart'

load iwchart.mat

% iwchart : inch male(minlbs maxlbs) female(minlbs maxlbs)

switch measurement\_system

case 'US'

ind = find(iwchart(:,1) == height);

if gender == 'M'

iw\_min = iwchart(ind,2);

iw\_max = iwchart(ind,3);

elseif gender == 'F'

iw\_min = iwchart(ind,4);

iw\_max = iwchart(ind,5);

end

case 'metric'

ind = find(iwchart(:,1) == round(height/INCHtoCM));

if gender == 'M'

iw\_min = iwchart(ind,2) \* LBtoKG;

iw\_max = iwchart(ind,3) \* LBtoKG;

elseif gender == 'F'

iw\_min = iwchart(ind,4) \* LBtoKG;

iw\_max = iwchart(ind,5) \* LBtoKG;

end

end

% Calculate idea weight based on formula

case 'formula'

switch measurement\_system

case 'US'

if gender == 'M'

% [Devine74]Men: Ideal Body Weight (in kilograms) = 50 kg + 2.3 kg per inch over 5 feet.

iw = (50 + 2.3 \* (height-60))/LBtoKG;

elseif gender == 'F'

% [Robinson83]Women: Ideal Body Weight (in kilograms) = 49 kg + 1.7 kg for each inch over 5 feet

iw = (49 + 1.7 \* (height-60))/LBtoKG;

end

case 'metric'

if gender == 'M'

% [Devine74]Men: Ideal Body Weight (in kilograms) = 50 + 2.3 kg per inch over 5 feet.

iw = 50 + 2.3 \* (height/INCHtoCM-60);

elseif gender == 'F'

% [Robinson83]Women: Ideal Body Weight (in kilograms) = 49 kg + 1.7 kg for each inch over 5 feet

iw = 49 + 1.7 \* (height/INCHtoCM-60);

end

end

% idea weight based on medical recommendation (BMI = 19-25)

case 'medical'

switch measurement\_system

case 'US'

%mass[lb] = BMI / (height[in])^2 / 703.06957946

iw\_min = 19 \* height^2 / 703.0695794;

iw\_max = 25 \* height^2 / 703.06957946;

case 'metric'

%mass[kg] = BMI / (height[m])^2

iw\_min = 19 \* (height/100)^2;

iw\_max = 25 \* (height/100)^2;

end

end

%--------------------------------------------

% Waist to Hip Ratio (WHR)

WHR = waist/hip;

if gender == 'M'

if age < 30

if WHR < 0.83

WHR\_Obesity\_Risk = 'Low';

elseif WHR < 0.89

WHR\_Obesity\_Risk = 'Moderate';

elseif WHR < 0.94

WHR\_Obesity\_Risk = 'High';

else

WHR\_Obesity\_Risk = 'Very High';

end

elseif age < 40

if WHR < 0.84

WHR\_Obesity\_Risk = 'Low';

elseif WHR < 0.82

WHR\_Obesity\_Risk = 'Moderate';

elseif WHR < 0.96

WHR\_Obesity\_Risk = 'High';

else

WHR\_Obesity\_Risk = 'Very High';

end

elseif age < 50

if WHR < 0.88

WHR\_Obesity\_Risk = 'Low';

elseif WHR < 0.96

WHR\_Obesity\_Risk = 'Moderate';

elseif WHR < 1.00

WHR\_Obesity\_Risk = 'High';

else

WHR\_Obesity\_Risk = 'Very High';

end

elseif age < 60

if WHR < 0.90

WHR\_Obesity\_Risk = 'Low';

elseif WHR < 0.97

WHR\_Obesity\_Risk = 'Moderate';

elseif WHR < 1.02

WHR\_Obesity\_Risk = 'High';

else

WHR\_Obesity\_Risk = 'Very High';

end

else

if WHR < 0.91

WHR\_Obesity\_Risk = 'Low';

elseif WHR < 0.99

WHR\_Obesity\_Risk = 'Moderate';

elseif WHR < 1.03

WHR\_Obesity\_Risk = 'High';

else

WHR\_Obesity\_Risk = 'Very High';

end

end

if WHR < 0.9

WHR\_Abdominal\_Obesity = 'No';

else

WHR\_Abdominal\_Obesity = 'Yes';

end

elseif gender == 'F'

if age < 30

if WHR < 0.71

WHR\_Obesity\_Risk = 'Low';

elseif WHR < 0.78

WHR\_Obesity\_Risk = 'Moderate';

elseif WHR < 0.82

WHR\_Obesity\_Risk = 'High';

else

WHR\_Obesity\_Risk = 'Very High';

end

elseif age < 40

if WHR < 0.72

WHR\_Obesity\_Risk = 'Low';

elseif WHR < 0.79

WHR\_Obesity\_Risk = 'Moderate';

elseif WHR < 0.84

WHR\_Obesity\_Risk = 'High';

else

WHR\_Obesity\_Risk = 'Very High';

end

elseif age < 50

if WHR < 0.73

WHR\_Obesity\_Risk = 'Low';

elseif WHR < 0.80

WHR\_Obesity\_Risk = 'Moderate';

elseif WHR < 0.87

WHR\_Obesity\_Risk = 'High';

else

WHR\_Obesity\_Risk = 'Very High';

end

elseif age < 60

if WHR < 0.74

WHR\_Obesity\_Risk = 'Low';

elseif WHR < 0.82

WHR\_Obesity\_Risk = 'Moderate';

elseif WHR < 0.88

WHR\_Obesity\_Risk = 'High';

else

WHR\_Obesity\_Risk = 'Very High';

end

else

if WHR < 0.76

WHR\_Obesity\_Risk = 'Low';

elseif WHR < 0.84

WHR\_Obesity\_Risk = 'Moderate';

elseif WHR < 0.90

WHR\_Obesity\_Risk = 'High';

else

WHR\_Obesity\_Risk = 'Very High';

end

end

if WHR < 0.85

WHR\_Abdominal\_Obesity = 'No';

else

WHR\_Abdominal\_Obesity = 'Yes';

end

end

%--------------------------------------------

% Body Fat Percentage

% Check BF% chart selected

switch BF\_method

case 1

% Calculate BF% method 1 : BMI [Deurenberg91]

% Child body fat % = (1.51 × BMI) ? (0.70 × Age) ? (3.6 × sex) + 1.4

% Adult body fat % = (1.20 × BMI) + (0.23 × Age) ? (10.8 × sex) ? 5.4

% where sex is 1 for males and 0 for females.

%Deurenberg formula1 #1: Adult Body Fat % = (1.20 x BMI) + (0.23 x Age) - (10.8 x gender) - 5.4

%Deurenberg formula2 #2: Adult Body Fat % = (1.29 x BMI) + (0.20 x Age) - (11.4 x gender) - 8.0

%Gallagher formula3: Adult Body Fat % = (1.46 x BMI) + (0.14 x Age) - (11.6 x gender) - 10

%Jackson-Pollock formula4,5: Adult Body Fat % = (1.61 x BMI) + (0.13 x Age) - (12.1 x gender) - 13.9

%Heritage study: Adult Body Fat % = (1.39 x BMI) + (0.16 x Age) - (10.34 x gender) - 9

%Gallagher2000 Body Fat % = 64.5 - 848 \*(1/BMI) + 0.079 \* age - 16.4 \* sex + 0.05 \* sex \* age + 39.0 \* sex \*(1/BMI), sex = 1 for male and 0 for female

if age < 13

BF = (1.51 \* BMI) - (0.70 \* age) - (3.6 \* (gender=='M')) + 1.4;

else

%BF = (1.20 \* BMI) + (0.23 \* age) - (10.8 \* (gender=='M')) - 5.4;

BF = (1.29 \* BMI) + (0.20 \* age) - (11.4 \* (gender=='M')) - 8.0;

%BF = (1.46 \* BMI) + (0.14 \* age) - (11.6 \* (gender=='M')) - 10;

%BF = (1.61 \* BMI) + (0.13 \* age) - (12.1 \* (gender=='M')) - 13.9;

%BF = (1.39 \* BMI) + (0.16 \* age) - (10.34 \* (gender=='M')) - 9;

%BF = 64.5 - 848 \*(1/BMI) + 0.079 \* age - 16.4 \* (gender=='M') + 0.05 \* (gender=='M') \* age + 39.0 \* (gender=='M') \*(1/BMI);

end

case 2

% Calculate BF% method 2 : CUN-BAE [Gómez-Ambrosi12]

% BF% = –44.988 + (0.503 x age) + (10.689 x sex) + (3.172 x BMI)

% – (0.026 x BMI^2) + (0.181 x BMI x sex) – (0.02 x BMI x age)

% – (0.005 x BMI^2 x sex) + (0.00021 x BMI^2 x age)

% where male = 0 and female = 1 for sex, and age in years,

BF = -44.988 + (0.503 \* age) + (10.689 \* (gender=='F')) + (3.172 \* BMI)...

- (0.026 \* BMI^2) + (0.181 \* BMI \* (gender=='F')) - (0.02 \* BMI \* age)...

- (0.005 \* BMI^2 \* (gender=='F')) + (0.00021 \* BMI^2 \* age);

% CHECKED THIS METHOD

case 3

% Calculate BF% method 3 : US Navy

switch measurement\_system

case 'US'

% Men Percentage of Fat = (86.01 x LOG10((waist) - (neck))) - (70.041 x LOG10(height)) + 36.76

% Women Percentage of Fat = (163.205 x LOG10((waist) + (hip) - (neck))) - (97.684 x LOG10(height)) - 78.387

if gender == 'M'

BF = (86.01 \* log10((waist) - (neck))) - (70.041 \* log10(height)) + 36.76;

elseif gender == 'F'

BF = (163.205 \* log10((waist) + (hip) - (neck))) - (97.684 \* log10(height)) - 78.387;

end

case 'metric'

% Men Percentage of Fat = 495 / (1.0324 - 0.19077 x (LOG10(waist - neck)) + 0.15456 x (LOG10(height))) - 450

% Women Percentage of Fat = 495 / (1.29579 - 0.35004 x (LOG10(waist + hip - neck)) + 0.22100 x (LOG10(height))) - 450

% Men %Fat = 86.010\*LOG10(waist - neck) - 70.041\*LOG10(height) + 30.30

% Women %Fat = 163.205\*LOG10(waist + hip - neck) - 97.684\*LOG10(height) - 104.912

if gender == 'M'

%BF = 495 / (1.0324 - 0.19077 \* (log10(waist - neck)) + 0.15456 \* (log10(height))) - 450;

%BF = 86.010 \* log10(waist - neck) - 70.041 \* log10(height) + 30.30;

BF = (86.01 \* log10((waist) - (neck))) - (70.041 \* log10(height)) + 36.76;

elseif gender == 'F'

%BF = 495 / (1.29579 - 0.35004 \* (log10(waist + hip - neck)) + 0.22100 \* (log10(height))) - 450;

%BF = 163.205 \* log10(waist + hip - neck) - 97.684 \* log10(height) - 104.912;

BF = (163.205 \* log10((waist/INCHtoCM) + (hip/INCHtoCM) - (neck/INCHtoCM))) - (97.684 \* log10(height/INCHtoCM)) - 78.387;

end

end

% NEED NECK INFO

end

%--------------------------------------------

% Body adiposity index (BAI)

% BAI = (100\*Hip[m] / (Height[m] x sqrt(Height[m]))) – 18

switch measurement\_system

case 'US'

BAI = (hip\*INCHtoCM / (height\*INCHtoCM/100 \* sqrt(height\*INCHtoCM/100))) - 18;

case 'metric'

BAI = ((hip) / ((height/100)\*sqrt(height/100))) - 18;

end

%--------------------------------------------

% Calculate Lean Body Weight (LBW)

switch LBW\_method

case 1

% Lean Body Weight (men) = (1.10 x Weight(kg)) - 128 x( Weight^2/(100 x Height(m))^2)

% Lean Body Weight (women) = (1.07 x Weight(kg)) - 148 x( Weight^2/(100 x Height(m))^2)

switch measurement\_system

case 'US'

if gender == 'M'

LBW = ((1.10 \* weight \* LBtoKG) - 128 \* ((weight \* LBtoKG)^2 / (height \* INCHtoCM)^2))/LBtoKG;

if age >= 25

LBW = LBW - 0.3 / LBtoKG \*(age-25);

end

elseif gender == 'F'

LBW = ((1.07 \* weight \* LBtoKG) - 148 \* ((weight \* LBtoKG)^2 / (height \* INCHtoCM)^2))/LBtoKG;

if age >= 25

LBW = LBW - 0.125 / LBtoKG \*(age-25);

end

end

case 'metric'

if gender == 'M'

LBW = (1.10 \* weight) - 128 \* (weight^2 / height^2);

if age >= 25

LBW = LBW - 0.3\*(age-25);

end

elseif gender == 'F'

LBW = (1.07 \* weight) - 148 \* (weight^2 / height^2);

if age >= 25

LBW = LBW - 0.125\*(age-25);

end

end

end

case 2

%For men over the age of 16: lean body mass in kilograms = (0.32810 \* (body weight in kilograms)) + (0.33929 \* (height in centimeters)) - 29.5336

%For women over the age of 30: lean body mass in kilograms = (0.29569 \* (body weight in kilograms)) + (0.41813 \* (height in centimeters)) - 43.2933

switch measurement\_system

case 'US'

if gender == 'M'

LBW = ((0.32810 \* weight \* LBtoKG) + (0.33929 \* height \* INCHtoCM) - 29.5336)/LBtoKG;

elseif gender == 'F'

LBW = ((0.29569 \* weight \* LBtoKG) + (0.41813 \* height \* INCHtoCM) - 43.2933)/LBtoKG;

end

case 'metric'

if gender == 'M'

LBW = (0.32810 \* weight) + (0.33929 \* height) - 29.5336;

elseif gender == 'F'

LBW = (0.29569 \* weight) + (0.41813 \* height) - 43.2933;

end

end

end

%--------------------------------------------

% Checking BF% and LBW formulae

weight\_cal = BF/100 \* weight + LBW;

%--------------------------------------------

% Check BMR calculation method

switch BMR\_method

case 1

% Calculate BMR method 1 (Roza Shizgal)

% For men: BMR = 88.362 + (13.397 x weight in kg) + (4.799 x height in cm) - (5.677 x age in years)

% For women: BMR = 447.593 + (9.247 x weight in kg) + (3.098 x height in cm) - (4.330 x age in years)

switch measurement\_system

case 'US'

if gender == 'M'

BMR = 88.362 + (13.397 \* weight \* LBtoKG) + (4.799 \* height \* INCHtoCM) - (5.677 \* age);

elseif gender == 'F'

BMR = 447.593 + (9.247 \* weight \* LBtoKG) + (3.098 \* height \* INCHtoCM) - (4.330 \* age);

end

case 'metric'

if gender == 'M'

BMR = 88.362 + (13.397 \* weight) + (4.799 \* height) - (5.677 \* age);

elseif gender == 'F'

BMR = 447.593 + (9.247 \* weight) + (3.098 \* height) - (4.330 \* age);

end

end

case 2

% Calculate BMR method 2 (Mifflin90)

% For men: BMR = 5 + (10 x weight in kg) + (6.25 x height in cm) – (5.0 x age in years)

% For women: BMR = -161 + (10 x weight in kg) + (6.25 x height in cm) – (5.0 x age in years)

switch measurement\_system

case 'US'

if gender == 'M'

BMR = 5 + (10 \* weight \* LBtoKG) + (6.25 \* height \* INCHtoCM) - (5.0 \* age);

elseif gender == 'F'

BMR = -161 + (10 \* weight \* LBtoKG) + (6.25 \* height \* INCHtoCM) - (5.0 \* age);

end

case 'metric'

if gender == 'M'

BMR = 5 + (10 \* weight) + (6.25 \* height) - (5.0 \* age);

elseif gender == 'F'

BMR = -161 + (10 \* weight) + (6.25 \* height) - (5.0 \* age);

end

end

case 3

% Calculate BMR method 3 (Katch-McArdle)

% BRM = 370 + 21.6 x LBM

% where: LBM = (1-%BF) x weight in kg

switch measurement\_system

case 'US'

BMR = 370 + 21.6 \* LBW \* LBtoKG;

case 'metric'

BMR = 370 + 21.6 \* LBW;

end

case 4

% Calculate BMR method 4 (Cunningham)

% RRM = 500 + 22 x LBM

switch measurement\_system

case 'US'

BMR = 500 + 22 \* LBW \* LBtoKG;

case 'metric'

BMR = 500 + 22 \* LBW;

end

end

%--------------------------------------------

% Calculate Calories needs per day

activity\_factor = [1.2 1.375 1.55 1.725 1.9];

calories\_needs = BMR \* activity\_factor;

%--------------------------------------------

% Calculate ideal BMR vs age chart

%--------------------------------------------

% Calculate current BMR and compare to ideal chart to get metabolic age

diff\_w = weight - iw;

metabolic\_age = age - 0.143 \* (abs(diff\_w))^(1/3) + 0.236 \* diff\_w;

%fprintf('BMI\tBMIprime\tIW\tBF\tBAI\tLBW\tweight\_cal\tBMR\n');

fprintf('%f\t%f\t%f\t%f\t%f\t%f\t%f\t%f\t%f\n',BMI, BMIprime,iw, BF, BAI, LBW,weight\_cal, BMR, metabolic\_age);

end

%%