CS 514
Applied Artificial Intelligence
Project 1

FITNESS STAR

A PERSONAL FITNESS ASSISTANT EXPERT SYSTEM

INDEX

Note: *Suitable links have been provided for additional information wherever necessary in RULES and DESCRIPTION.*

Abstract:

Fitness Star is a rule based expert system built on JESS that is designed to take certain health related parameters from the user and infer certain vital parameters and makes recommendations to the user of the system. The system advices user his workout and food intake plans based on the person's age, gender, weight, and height and resting heart rate. The system is also capable of diagnosing chances of diabetes and other coronary heart conditions based on blood pressure levels, sugar levels and sleep patterns.

Features:

1. The system can calculate parameters like Body Mass Index and Basal Metabolic Rate of the individual.
2. The system calculates Body Fat percentage and Lean Body Mass.
3. The system can classify the individual into different obesity fitness levels.
4. The system also computes the current daily food intake in calories and recommends to increase or decrease food intake depending on certain vital parameters.
5. The system also calculates the number of calories to be burnt per day for individuals who are above the normal weight.
6. The system also gives you of a rough estimate of number of days it will take to reach the desired fitness weight, subject to the user pursues the recommendations of the system.
7. The system is also capable to identifying stress based on hypertension symptoms and sleep patterns.
8. Based on obesity indices and stress levels the system also estimates risk of Coronary heart diseases.
9. The system also infers chances of diabetes.
10. In case the system finds users with extreme symptoms, the system recommends the user to consult a physician immediately.
11. The system exits by displaying a different motivational quote in the end.

Rules and descriptions:

#	Rule Name	Description	References and detailed explanations
1	`calculateBMI`	Calculates the BMI based on height and weight	BMI Wiki
2	`checkBMIRating`	Assigns a BMI rating.	BMI Wiki
3	`assignFatLvlDesc`	Assigns an additional obesity comment.	BMI Wiki
4	`calcBodyFatPercent`	Calculates the percentage of fat in the body	Calculating Fat Percentage
5	`calcLeanBodyMass`	Calculate the lean body mass of the individual	Lean Body Mass Wiki
6	`weightLossGainPlan`	Plan and estimate parameters like weight to be gained or lost.	Using the BMI formula with the desired BMI.
7	`calculateBMR`	Calculates Basal Metabolic Rate of an individual.	BMR formula
8	`calcCalIntakeToMaint`	Calculate the current daily average calorie intake (Daily calorie needs to maintain current weight) based on Harris Benedict Formula	Harris Benedict Equation
9	`calcCalIntakeBurnQty`	Calculate the number of calories to intake so as to lose or gain weight.	U.S. Army fitness manuals recommends reducing intake by 15% to assist weight loss.
10	`createWorkoutPlan`	Calculates the total number of calories to be burnt to reach target weight and calculate the number of days to reach out the desired weight, subject to the user pursuing the plan vigorously.	Assumption the person will run at 6 mph(moderate) or 10 mph(intense) and will only run up to a maximum of 90 minutes advised by American College of Sports Medicine
11	`calcCalIntakeGainQty`	Calculate the new intake calories for under-weight individuals to gain the desired weight.	U.S. Army fitness manuals recommends increasing the intake by 500 calories daily to assist weight gain.
12	`computeTrgtDaysWgtGain`	Calculates the number of days to achieve the desired weight for underweight individuals.	

13	assessDiabeticCondition	Diagnoses whether an individual has any symptoms of diabetes.	Sugar levels and diabetes
14	checkBldPressLvls	Checks and assigns suitable hypertension levels to the individual.	Understanding blood pressure readings
15	checkStrsLvls	Checks if the individual is stressed based on hyper tension levels and sleep patterns.	
16	chckCHDRisk	Check for any coronary heart disease symptoms based on stress levels and hyper tension	
17	adjustForObesity	Take into account obesity and magnify it if necessary.	
18	calcWaterQty	Calculate the ideal amount of water intake depending on personal parameters for a healthy life style.	Calculating amount of water intake every day
19	findTargetHR	Compute the target heart rate to be achieved during the workout sessions based on person's age, average heart rate and workout intensity.	Calculating your target heart rate
20	chckConsultingReq	In case of extreme scenarios recommend for immediate physician consulting.	Emergency scenarios
*The below rules reside in the **output.clp** file and are only used to direct output to terminal has no processing significance.*			
21	dispOutputWelcome	Displays a welcome banner and personal information.	
22	disImmediateDiagnosisDiab	Displays any diagnosis related to diabetes.	
23	disImmediateDiagnosisHeartCondn	Displays any diagnosis related to coronary heart conditions.	
24	fitnessOutput	Displays all outputs related to fitness parameters, recommendations for calorie intake etc.	
25	workoutOutput	Displays all workout parameters in case the person is over-weight.	

Usage Manual:

Instructions:

Copy the files health.clp, input.clp and output.clp to the BIN folder under the JESS directory.

Open JESS and execute the below commands:

```
(batch health.clp)

(batch input.clp)

(batch output.clp)
```

In case the grader wants to change inputs and test new inputs please only make changes to the input.clp file. Also, make sure there is only one active case in each run i.e. the input.clp file will have only one assert and one run statement at a time.

Sample runs:

Run #1

The contents of input.clp file:

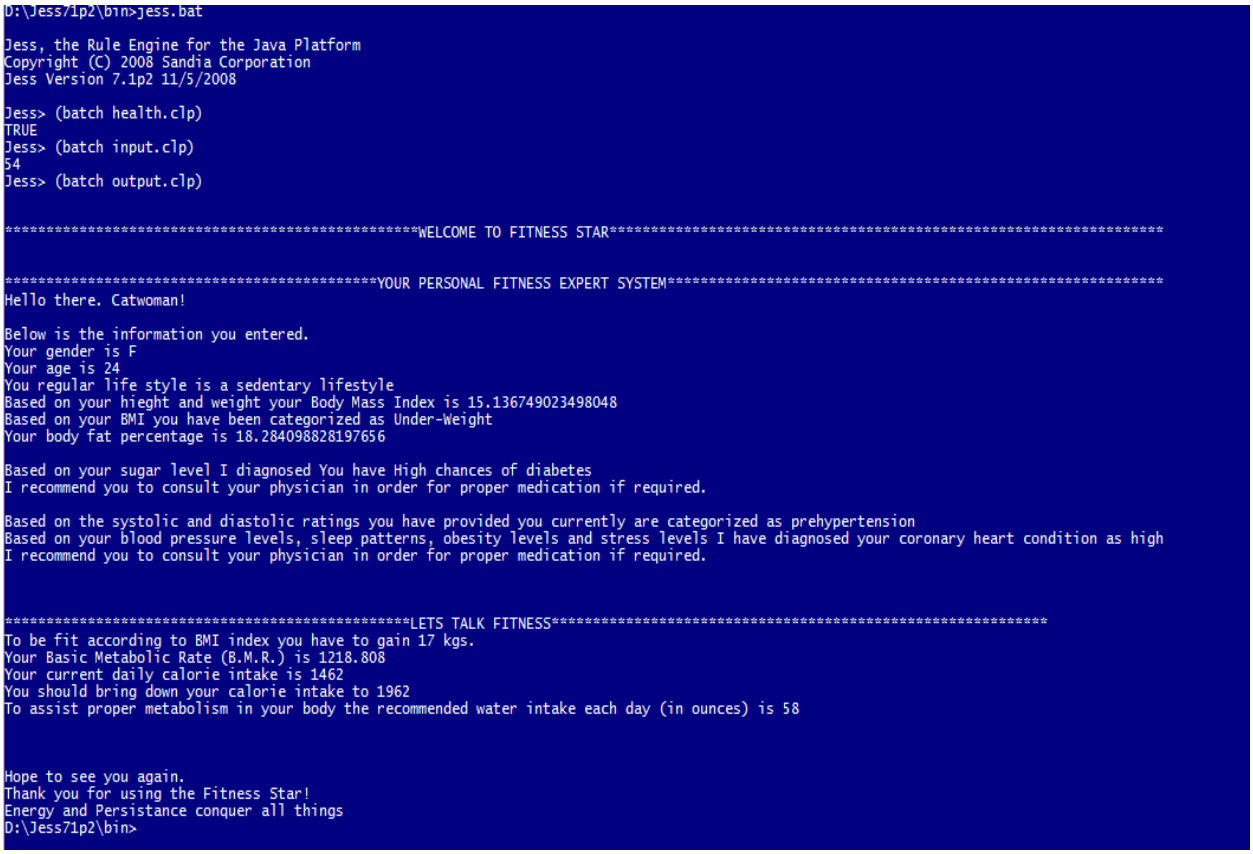
```
(assert (person(personName Ironman)(sex M)(activityType light)(sugarLevel
100.6)(workoutType moderate)(age 24)(height 2.0)(weight
95)(bloodPressureSystolic 118)(bloodPressureDiastolic 81)(currentSleepHours
2)(avgHR 125)))

(run)
```

```
D:\Jess71p2\bin>jess.bat

Jess, the Rule Engine for the Java Platform
Copyright (C) 2008 Sandia Corporation
Jess Version 7.1p2 11/5/2008

Jess> (batch health.clp)
TRUE
Jess> (batch input.clp)
29
Jess> (batch output.clp)


**************************************************WELCOME TO FITNESS STAR**************************************************


*********************************************YOUR PERSONAL FITNESS EXPERT SYSTEM*********************************************
Hello there. Ironman!

Below is the information you entered.
Your gender is M
Your age is 24
You regular life style is a light lifestyle
Based on your hieght and weight your Body Mass Index is 23.75
Based on your BMI you have been categorized as Normal Range
Your body fat percentage is 17.820000000000004

Based on your sugar level I diagnosed You have High chances of diabetes
I recommend you to consult your physician in order for proper medication if required.

Based on the systolic and diastolic ratings you have provided you currently are categorized as normal
Based on your blood pressure levels, sleep patterns, obesity levels and stress levels I have diagnosed your coronary heart condition as less
I recommend you to consult your physician in order for proper medication if required.



*********************************************LETS TALK FITNESS**********************************************
I think you are already fit!


Hope to see you again.
Thank you for using the Fitness Star!
Keep calm and Keep working out!
D:\Jess71p2\bin>
```

Run #2

The contents of input.clp file:

```
(assert (person(personName Catwoman)(sex F)(activityType
sedentary)(sugarLevel 100.6)(workoutType moderate)(age 24)(height
1.6256)(weight 40)(bloodPressureSystolic 125)(bloodPressureDiastolic
90)(currentSleepHours 5)(avgHR 125)))

(run)
```



Run #3

The contents of input.clp file:

```
(assert (person(personName Batman)(sex M)(activityType intense)(sugarLevel
120.0)(workoutType moderate)(age 24)(height 1.6256)(weight
90)(bloodPressureSystolic 140)(bloodPressureDiastolic 101)(currentSleepHours
9)(avgHR 100))) (run)
```

```
D:\Jess71p2\bin>jess.bat

Jess, the Rule Engine for the Java Platform
Copyright (C) 2008 Sandia Corporation
Jess Version 7.1p2 11/5/2008

Jess> (batch health.clp)
TRUE
Jess> (batch input.clp)
53
Jess> (batch output.clp)


**********************************************WELCOME TO FITNESS STAR**********************************************


*****************************************YOUR PERSONAL FITNESS EXPERT SYSTEM*****************************************
Hello there. Batman!

Below is the information you entered.
Your gender is M
Your age is 24
You regular life style is a intense lifestyle
Based on your hieght and weight your Body Mass Index is 34.05768530287061
Based on your BMI you have been categorized as Obese Class I
Your body fat percentage is 30.18922236344473

Based on your sugar level I diagnosed You have High chances of diabetes
I recommend you to consult your physician in order for proper medication if required.

Based on the systolic and diastolic ratings you have provided you currently are categorized as stage1
Based on your blood pressure levels, sleep patterns, obesity levels and stress levels I have diagnosed your coronary heart condition as high
I recommend you to consult your physician in order for proper medication if required.



*********************************************LETS TALK FITNESS*********************************************
To be fit according to BMI index you have to lose 32 kgs.
Your Basic Metabolic Rate (B.M.R.) is 1948.6000000000001
Your current daily calorie intake is 3702
You should bring down your calorie intake to 3146
To assist proper metabolism in your body the recommended water intake each day (in ounces) is 132

Your daily target should be a workout (running) for 90 minutes.
If you hit the target everyday I deduced you could burn 1408 calories every day.
You should aim for a target heart rate of 167.2beats per minute
If you are deligent in following what I recommend I am sure you will fit in 175 days


Hope to see you again.
Thank you for using the Fitness Star!
Keep calm and Keep working out!

D:\Jess71p2\bin>
```

Test cases:

Please use only one test case at a time in the input.clp file

```
(assert (person(personName Robin)(sex M)(activityType sedentary)(sugarLevel
65.6)(workoutType moderate)(age 24)(height 1.7272)(weight
76)(bloodPressureSystolic 125)(bloodPressureDiastolic 85)(currentSleepHours
8)(avgHR 125)))
```

```
(assert (person(personName Batman)(sex M)(activityType intense)(sugarLevel
120.0)(workoutType moderate)(age 24)(height 1.6256)(weight
90)(bloodPressureSystolic 140)(bloodPressureDiastolic 101)(currentSleepHours
9)(avgHR 100)))
```

```
(assert (person(personName Catwoman)(sex F)(activityType
sedentary)(sugarLevel 100.6)(workoutType moderate)(age 24)(height
1.6256)(weight 40)(bloodPressureSystolic 125)(bloodPressureDiastolic
90)(currentSleepHours 5)(avgHR 125)))
```

```
(assert (person(personName Ironman)(sex M)(activityType light)(sugarLevel
100.6)(workoutType moderate)(age 24)(height 2.0)(weight
95)(bloodPressureSystolic 118)(bloodPressureDiastolic 81)(currentSleepHours
2)(avgHR 125)))
```