

# HEART DISEASE RISK PREDICTION SYSTEM

(Predicts risk for heart disease in the next 10 years based  
on user health data)

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

## **ABSTRACT**

Heart Disease Prediction System is a rule based amateur 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 determines whether user is at risk for developing a heart disease in the next 10 years based on the person's age, gender, weight, family history, cholesterol, diabetes, physical inactivity, stress, blood pressure, smoking habits and unhealthy diet.

## **FEATURES**

1. The system can classify the individual into different risk groups based on age and gender.
2. The system, after classifying individuals based on age and gender, further calculates the risk percentage of a heart disease based on their health factors after taking input from user.
3. After finding the risk percentage of the user, the system further sorts them into 3 groups:
  - a. Low Risk
  - b. Average Risk
  - c. High Risk
4. The system recommends further action to be taken according to the risk level.
5. In case the system finds users with high risk, the system recommends the user to consult a physician immediately.

## RULES AND DESCRIPTION

There are 5 templates described in the code

- ```
(deftemplate patient
  (slot family_history (default 0))
  (slot age (default 0))
  (slot gender (default m))
  (slot smoking (default 0))
  (slot high_blood_pressure (default 0))
  (slot physical_inactivity (default 0))
  (slot diabetes (default 0))
  (slot cholesterol (default 0))
  (slot overweight (default 0))
  (slot stress (default 0))
  (slot unhealthy_diet (default 0)))
```
- ```
(deftemplate rating (slot score))
```
- ```
(deftemplate recommendation (slot rating) (slot explanation))
```
- ```
(deftemplate question (slot text) (slot type) (slot ident))
```
- ```
(deftemplate answer (slot ident) (slot text))
```

There are 25 rules in the program, which are further classified into 5 modules according to their function.

| Rule Name                                                                                                                                                                                                                                            | Module                                     | Description                                                        |
|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|--------------------------------------------|--------------------------------------------------------------------|
| <pre>defrule ask::ask- question-by-id</pre>                                                                                                                                                                                                          | <pre>defmodule ask</pre>                   | Rule to assert the answers given by the user to the question asked |
| <pre>defrule welcome-user</pre>                                                                                                                                                                                                                      | <pre>defmodule application-startup</pre>   | Rule for the application that prints the Welcome message           |
| <pre>1. defrule request-   family_history 2. defrule request-age 3. defrule request-   gender 4. defrule request-   smoking 5. defrule request-   high_blood_pressure 6. defrule request-   physical_inactivity 7. defrule request-   diabetes</pre> | <pre>defmodule request- user-details</pre> | Rules to request various user details                              |

|                                                                                                                                                                                                                                                                                                                                                                                                      |                                             |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                        |
|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|---------------------------------------------|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| 8. <code>defrule request-cholesterol</code><br>9. <code>defrule request-overweight</code><br>10. <code>defrule request-stress</code><br>11. <code>defrule request-unhealthy_diet</code>                                                                                                                                                                                                              |                                             |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                        |
| <code>(defrule assert-patient-fact</code>                                                                                                                                                                                                                                                                                                                                                            | <code>defmodule request-user-details</code> | Rule to assert the answers based on the different questions                                                                                                                                                                                                                                                                                                                                                                                                                                                            |
| 1. <code>defrule risk-group1</code><br>2. <code>defrule risk-group2</code><br>3. <code>defrule risk-group3</code><br>4. <code>defrule risk-group4</code><br>5. <code>defrule risk-group5</code><br>6. <code>defrule risk-group6</code><br>7. <code>defrule risk-group7</code><br>8. <code>defrule risk-group8</code><br>9. <code>defrule risk-group9</code><br>10. <code>defrule risk-group10</code> | <code>defmodule risk-recommendation</code>  | <p>Rules that determine what is the risk for heart disease in the next 10 years depending on the values entered and the various combinations of these values in the answers.</p> <p>The risk groups are divided based on age and gender group combinations. The actual risk is further calculated based on the risk possessed by a healthy individual (source: <a href="#">a healthy person's risk of heart disease based on age and gender</a>) and the increase in risk based on the values entered by the user.</p> |
| <code>defrule print-result</code>                                                                                                                                                                                                                                                                                                                                                                    | <code>defmodule result</code>               | Rules to print out the result of the evaluation                                                                                                                                                                                                                                                                                                                                                                                                                                                                        |

## USAGE MANUAL

### JESS:

1. Copy the predict\_heart\_disease.clp file into the bin folder inside Jess directory.
2. Open JESS and execute the following command: (batch "predict\_heart\_disease.clp").

### ECLIPSE:

1. Create a new Java project in Eclipse.
2. Copy the file predict\_heart\_disease.clp to the *src* folder.
3. Run the file using the Eclipse *run* menu.

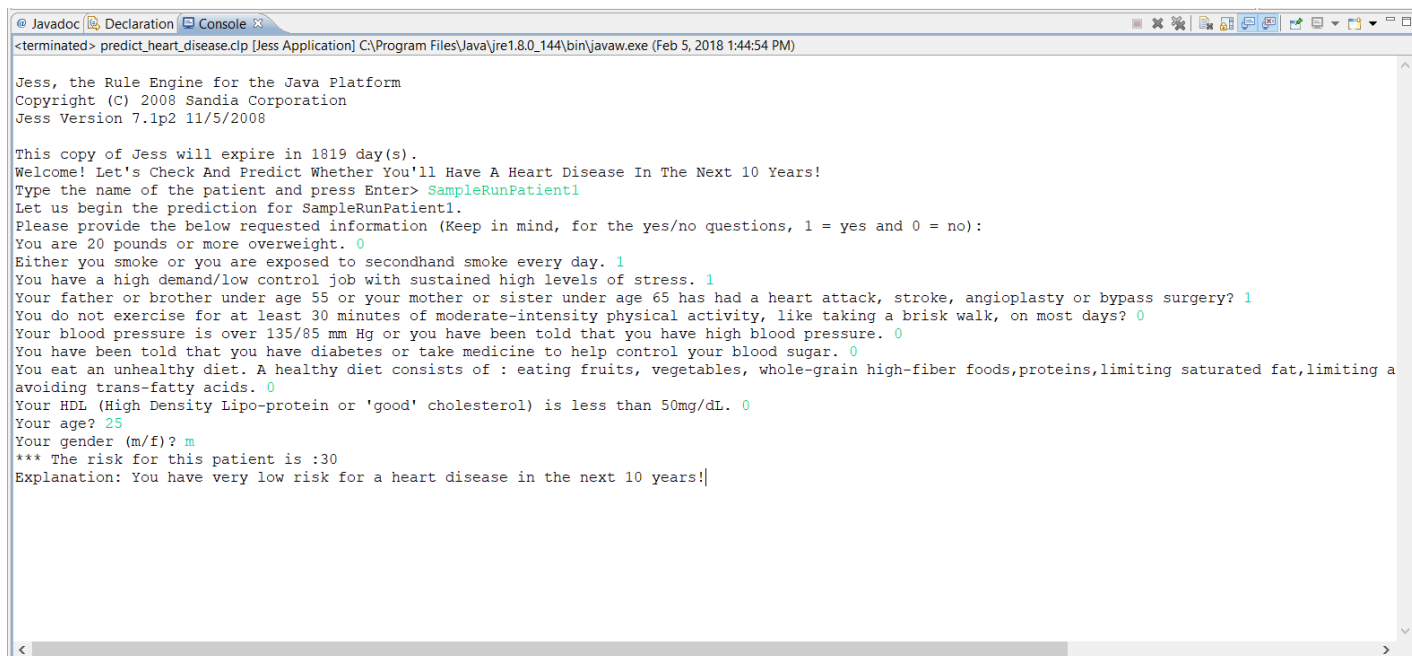
# SAMPLE RUNS

## RUN #1

According to below screenshot, the user gives the following input after the program runs:

```
Patient: SampleRunPatient1
(family_history 1)
(age 25)
(gender m)
(smoking 1)
(high_blood_pressure 0)
(physical_inactivity 0)
(diabetes 0)
(cholesterol 0)
(overweight 0)
(stress 1)
(unhealthy_diet 0)
```

### Output for SampleRunPatient1:



```
<terminated> predict_heart_disease.clp [Jess Application] C:\Program Files\Java\jre1.8.0_144\bin\javaw.exe (Feb 5, 2018 1:44:54 PM)

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

This copy of Jess will expire in 1819 day(s).
Welcome! Let's Check And Predict Whether You'll Have A Heart Disease In The Next 10 Years!
Type the name of the patient and press Enter> SampleRunPatient1
Let us begin the prediction for SampleRunPatient1.
Please provide the below requested information (Keep in mind, for the yes/no questions, 1 = yes and 0 = no):
You are 20 pounds or more overweight. 0
Either you smoke or you are exposed to secondhand smoke every day. 1
You have a high demand/low control job with sustained high levels of stress. 1
Your father or brother under age 55 or your mother or sister under age 65 has had a heart attack, stroke, angioplasty or bypass surgery? 1
You do not exercise for at least 30 minutes of moderate-intensity physical activity, like taking a brisk walk, on most days? 0
Your blood pressure is over 135/85 mm Hg or you have been told that you have high blood pressure. 0
You have been told that you have diabetes or take medicine to help control your blood sugar. 0
You eat an unhealthy diet. A healthy diet consists of : eating fruits, vegetables, whole-grain high-fiber foods,proteins,limiting saturated fat,limiting a
avoiding trans-fatty acids. 0
Your HDL (High Density Lipo-protein or 'good' cholesterol) is less than 50mg/dL. 0
Your age? 25
Your gender (m/f)? m
*** The risk for this patient is :30
Explanation: You have very low risk for a heart disease in the next 10 years!|
```



SampleRunPatient1.PNG

## RUN #2

According to below screenshot, the user gives the following input after the program runs:

```
Patient: SampleRunPatient2
(family_history 0)
(age 60)
(gender f)
(smoking 1)
(high_blood_pressure 0)
(physical_inactivity 1)
(diabetes 1)
(cholesterol 0)
(overweight 1)
(stress 1)
(unhealthy_diet 1)
```

### Output for SampleRunPatient1:



SampleRunPatient2.PNG