CS 760: Machine Learning - Fall 2020

Homework 4: Decision Trees

Due : 10/29/2020

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October 28, 2020

All the code involved is in this GitHub repository.
https://github.com/z-zijie/2020Fall/tree/master/COMP760/Homework4
All the code is in this python file.
https://github.com/z-zijie/2020Fall/blob/master/COMP760/Homework4/code.py

Problem 1

- **Pclass:**
  $1 \rightarrow [1, 0, 0]$;
  $2 \rightarrow [0, 1, 0]$;
  $3 \rightarrow [0, 0, 1]$.
- **Sex:**
  $0 \rightarrow [1, 0]$;
  $1 \rightarrow [0, 1]$.
- **Age:** Binning in [0, 20.25, 40.5, 60.75, 81] then convert to **One-Hot**.
- **Siblings/Spouses Aboard:** Convert to One-Hot like **Sex**.
- **Parents/Children Aboard:** Convert to One-Hot like **Sex**.
- **Fare:** Binning in [0,10,20,30,40,50,70,115,160,205,250,295,340,385,430,475,520] then convert to **One-Hot**.

Explanation:

1. Pclass, Sex, Siblings/Spouses Aboard and Parents/Children Aboard are **CATEGORICAL FEATURES**, so we can directly encode them One-Hot.
2. Age and Fare are **NUMERICAL FEATURES**, we should binning them first. It is worth noticing that the distribution of *Fare* is **skewed distribution**, we can't binning it uniformly.

Problem 2

Please check the relevant code in the file.

Problem 3

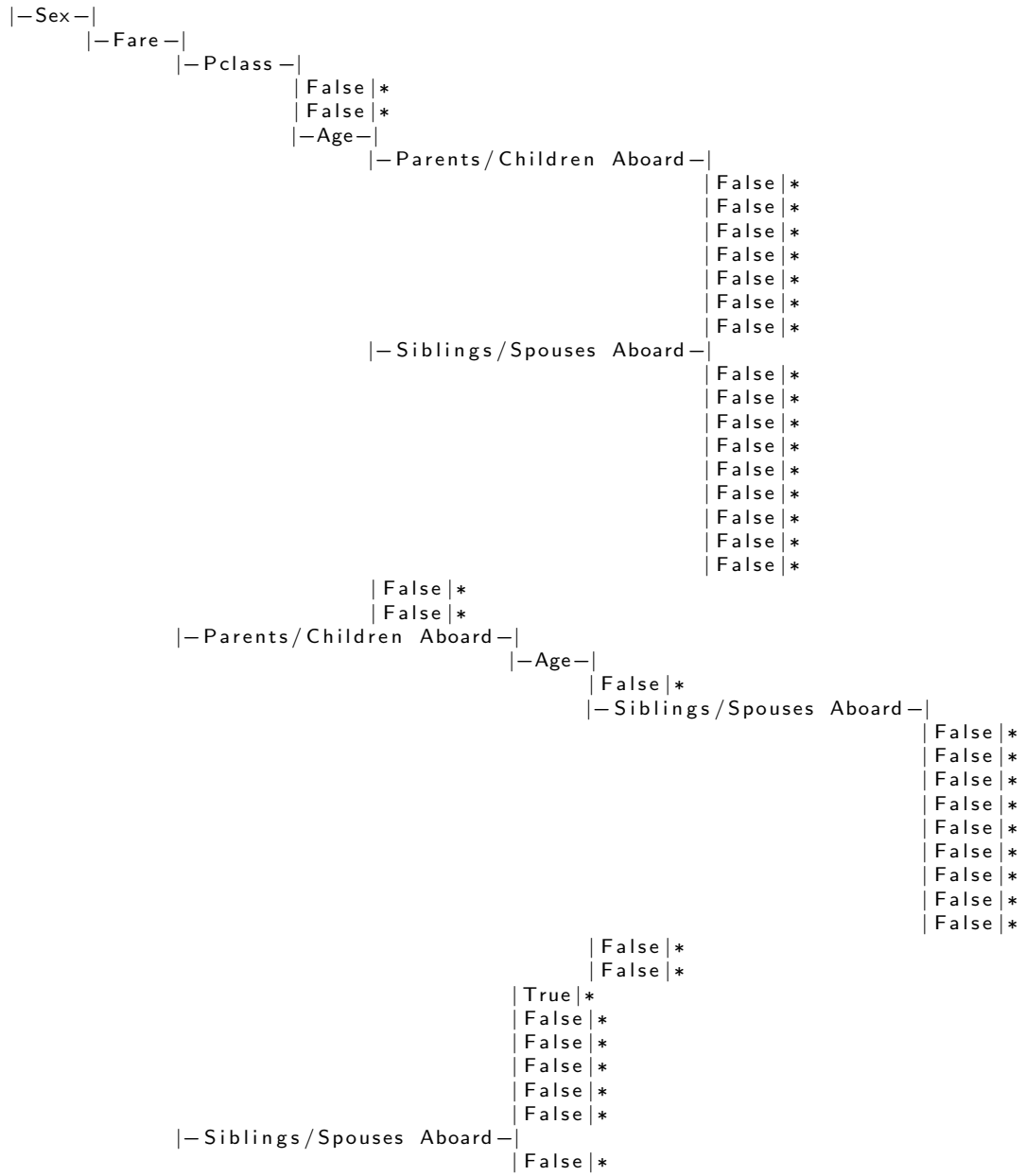
Please check the relevant code in the file.

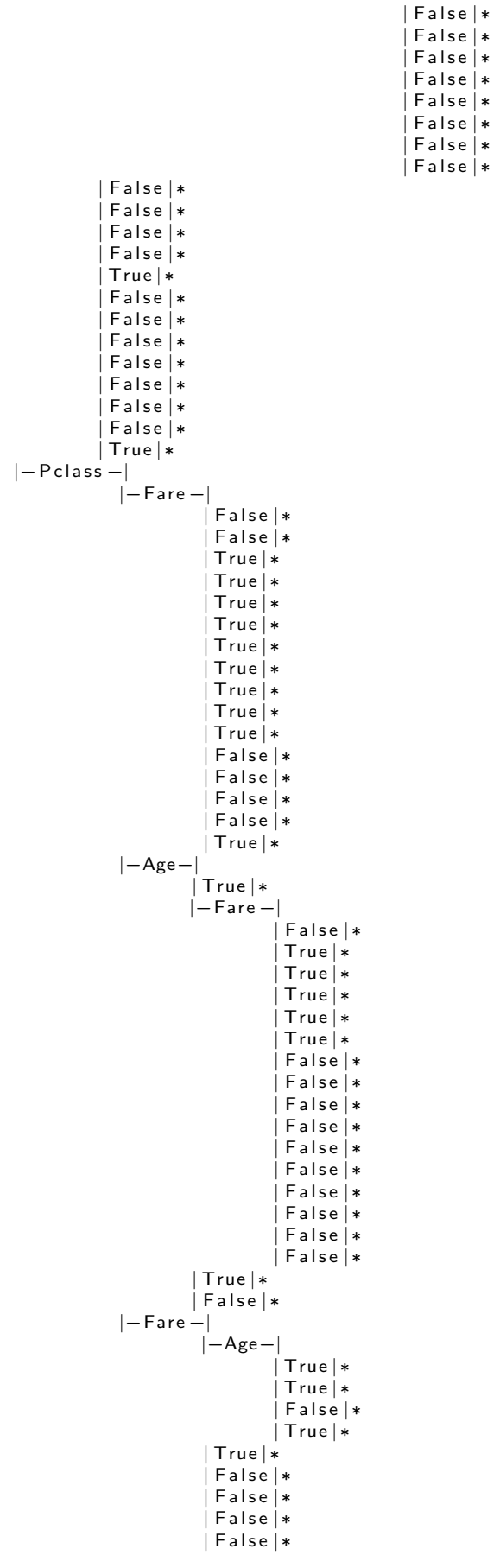
Stopping criteria are

1. **If the entropy of the response y in the current subset of data is close to zero.**
2. **If the current subset of data contains too few samples. (less than 5% of the total data)**
3. **If the depth of the Tree greater than the number of features.**

Problem 4

Please check the relevant code and output in the file.

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Problem 5

Please check the relevant code in the file.

Accuracy = 0.8128523111612176

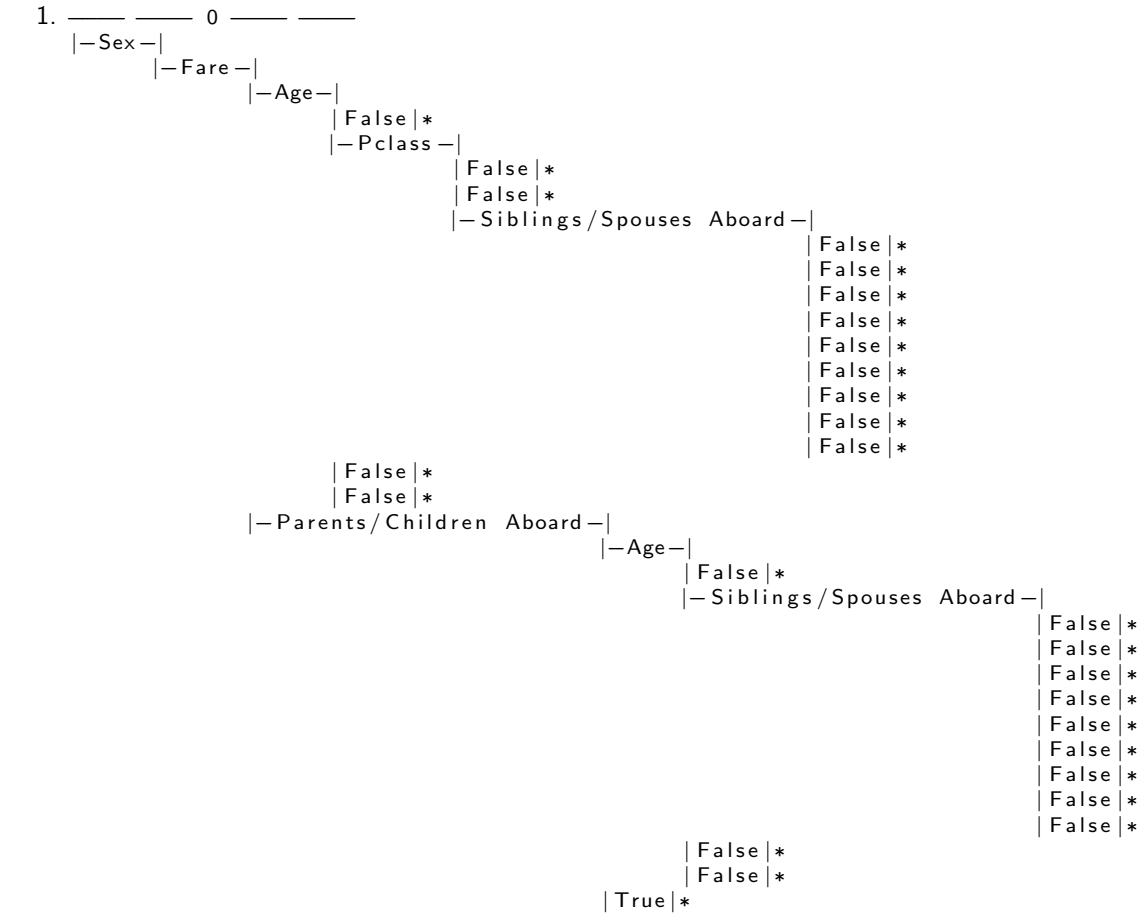
Problem 6

Please check the relevant code in the file.

My own feature vector **x = [1, 1, 22, 1, 0, 71.2833]**
Predicted result = **YES**.

Problem 7

Please check the relevant code and output in the file.



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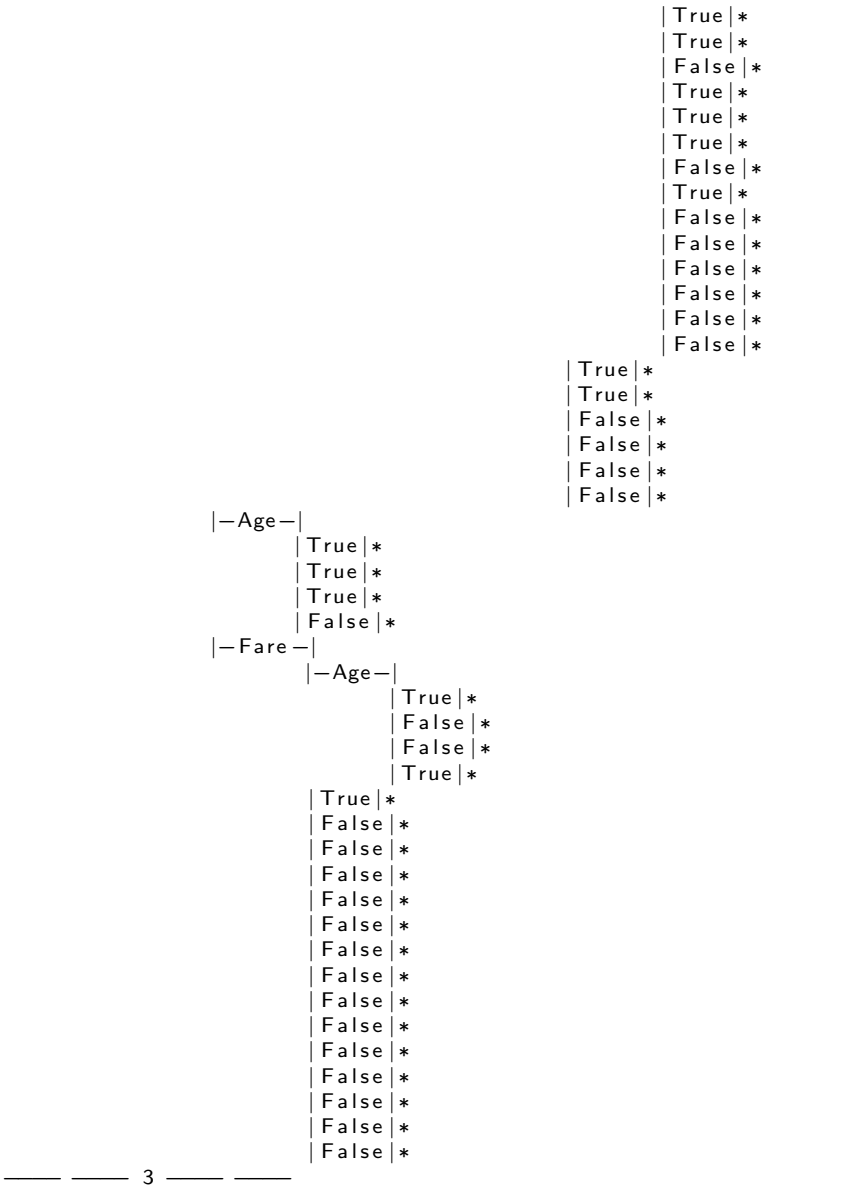
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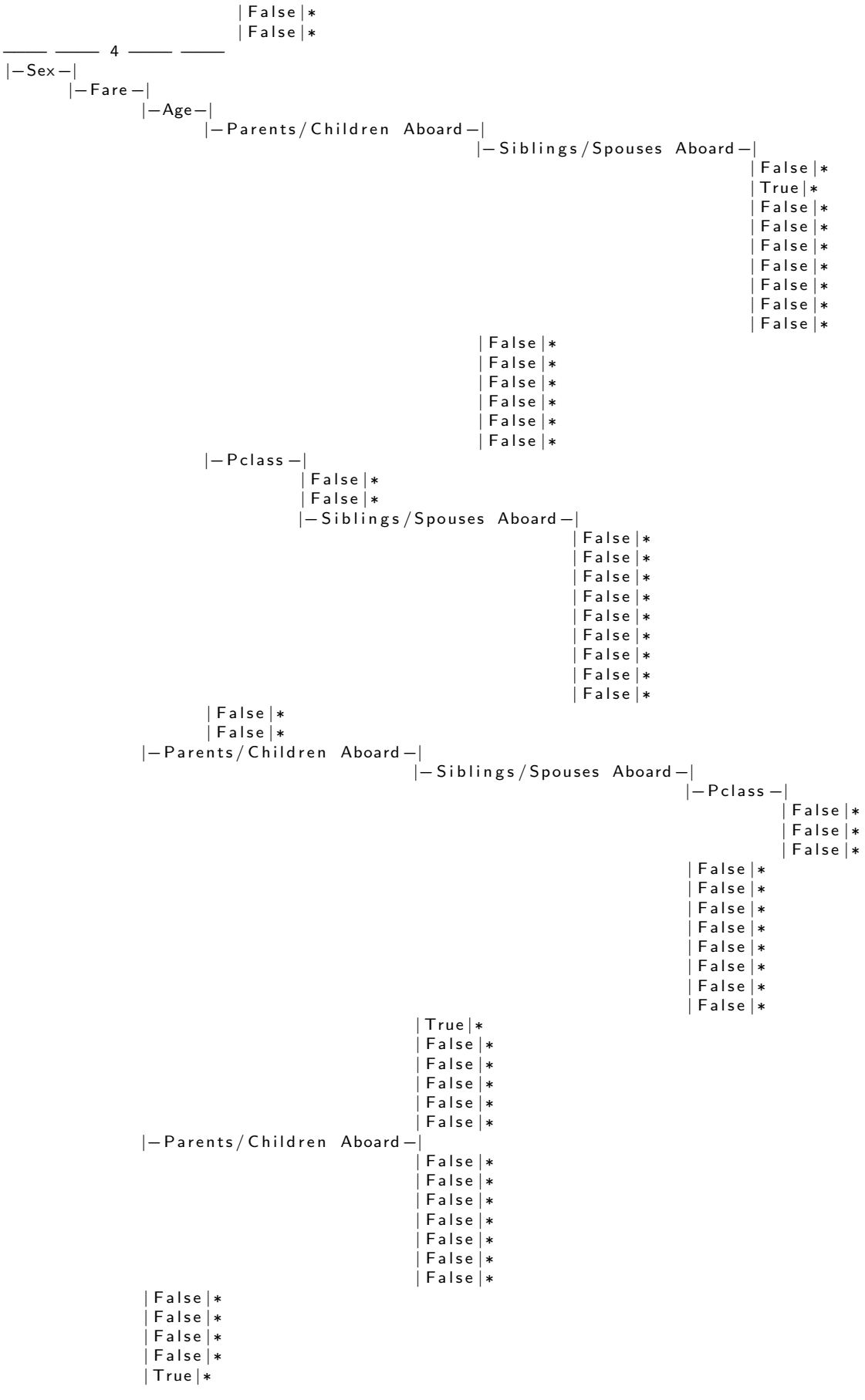
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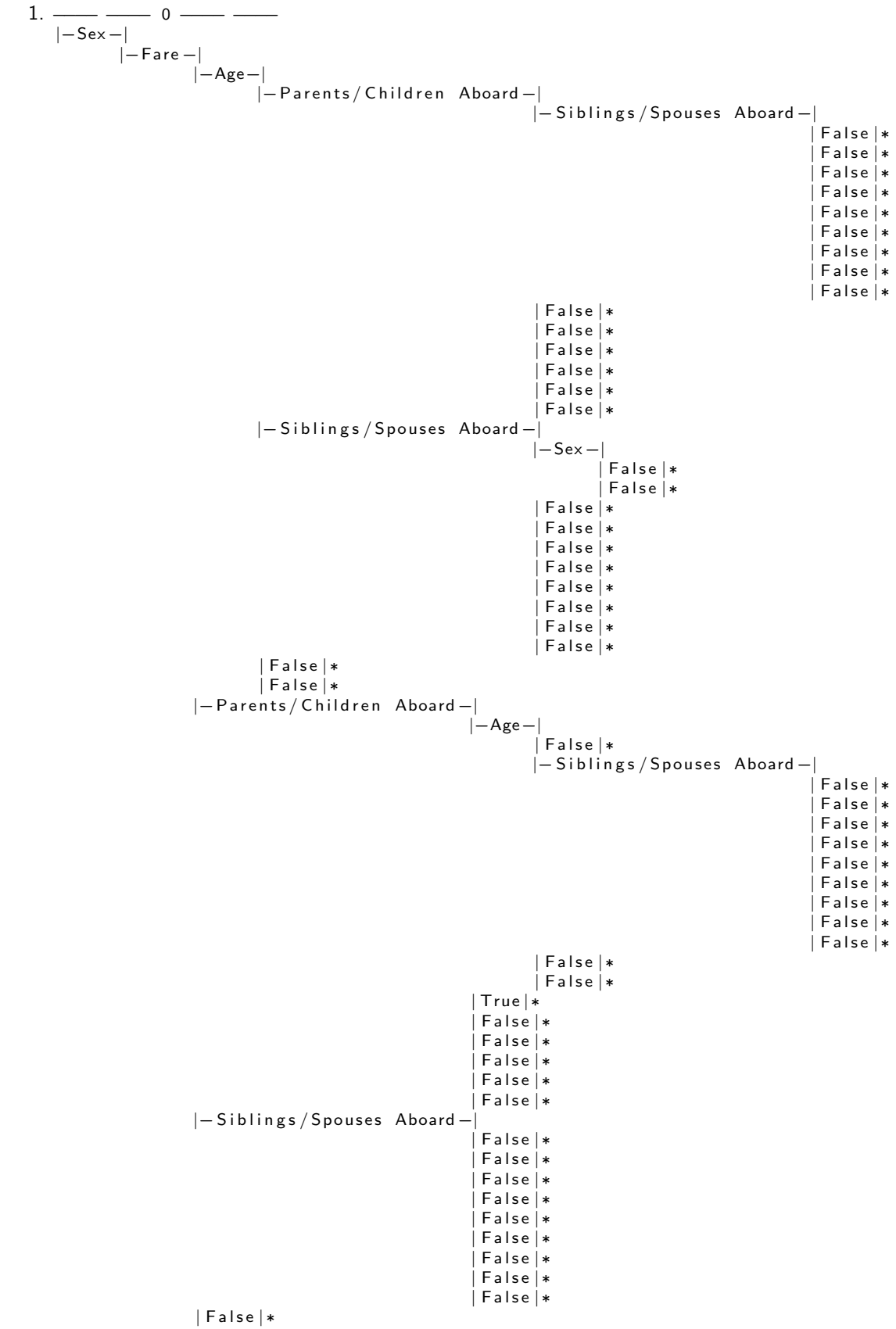
```

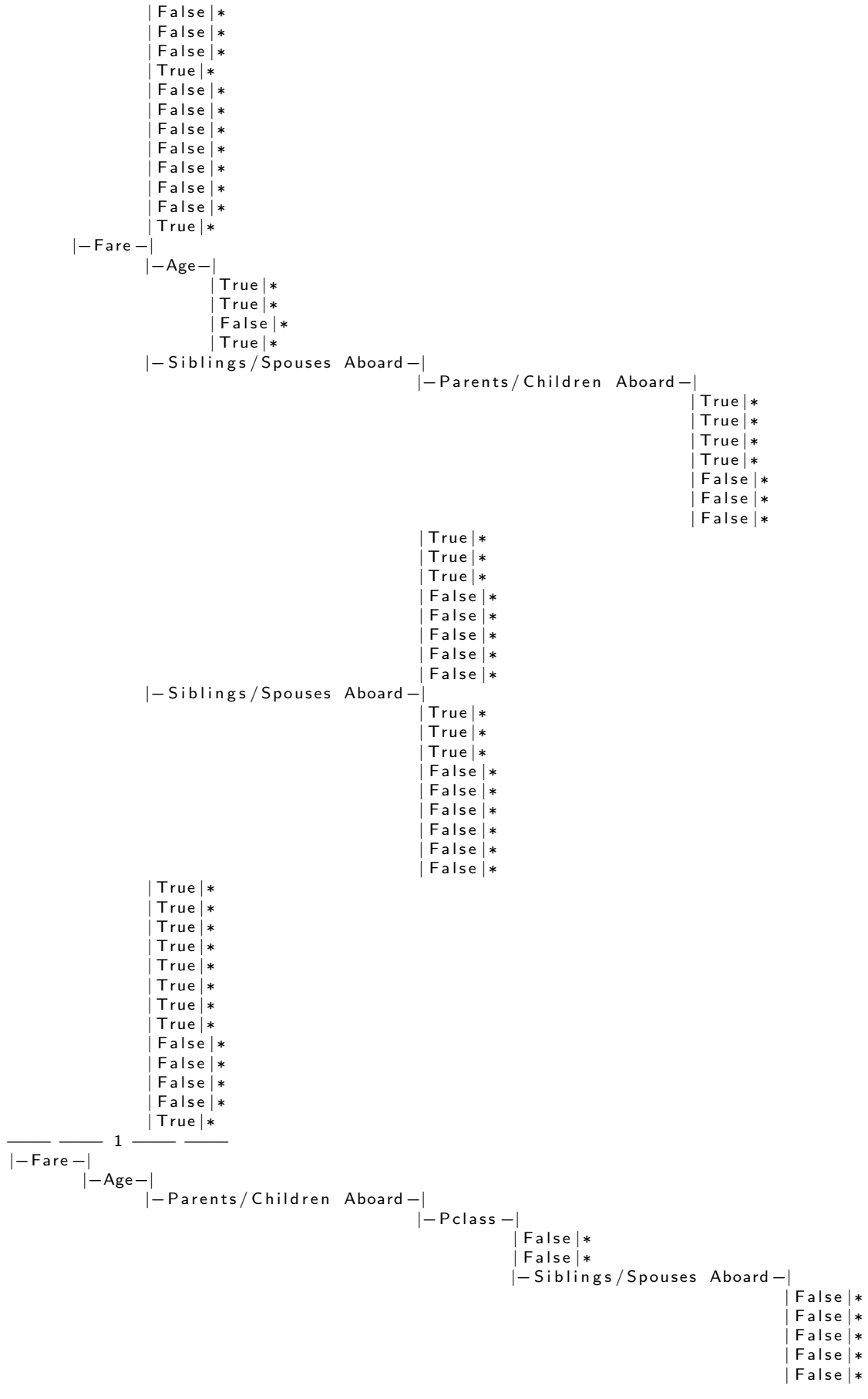
2. **Accuracy = 0.8027057497181511**

3. My own feature vector **x = [1, 1, 22, 1, 0, 71.2833]**
   Predicted result = **YES**.

Problem 8

Please check the relevant code and output in the file.




False
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Siblings/Spouses Aboard
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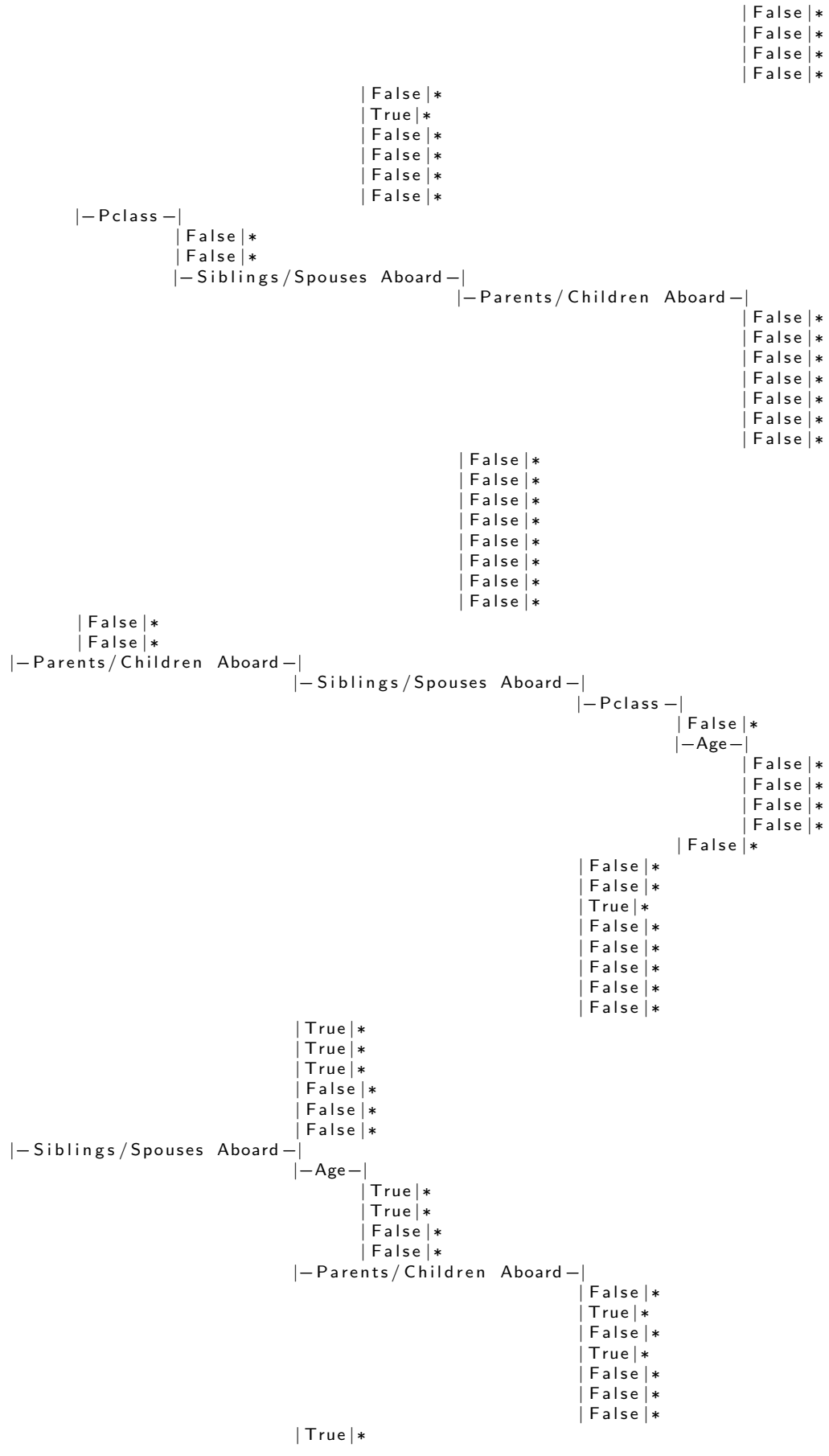
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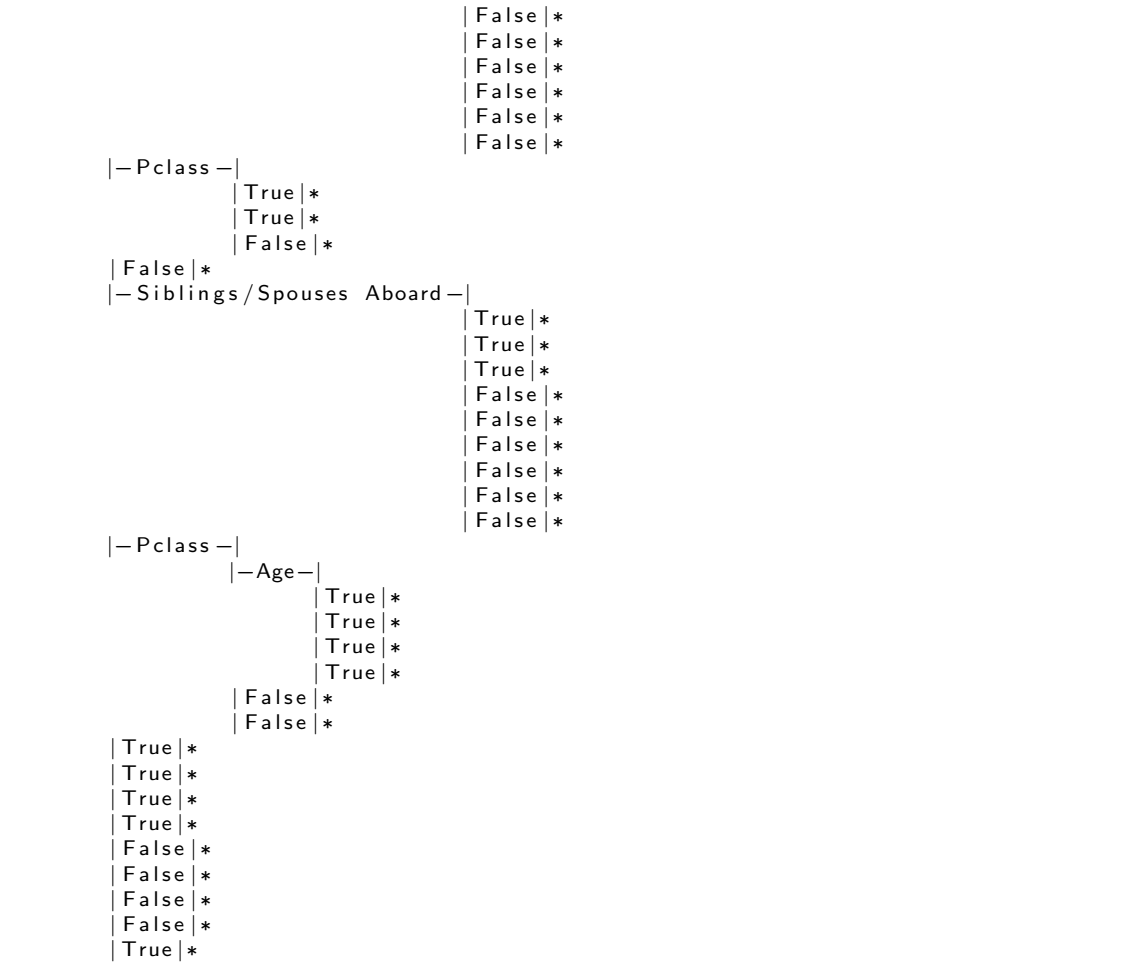
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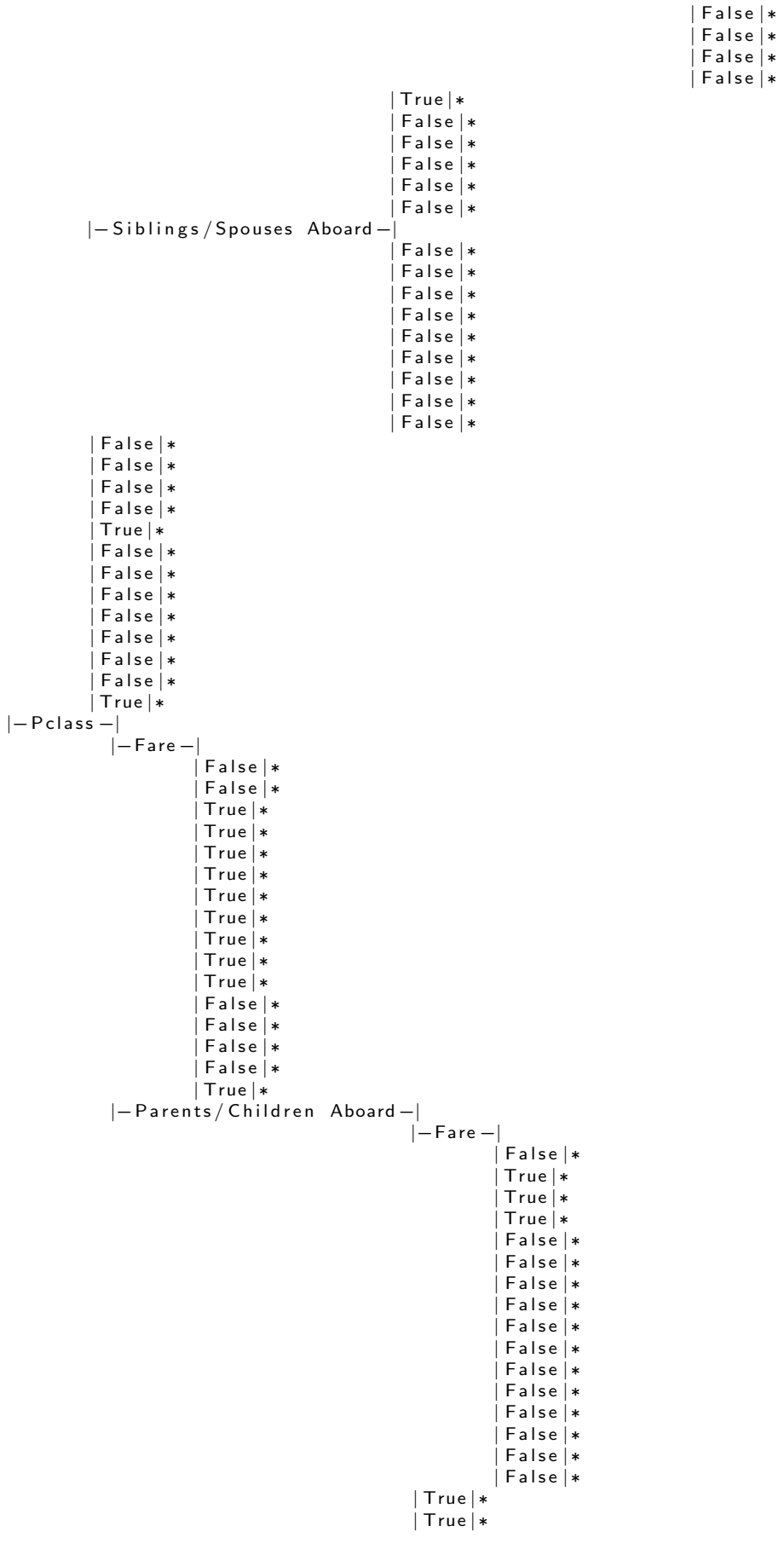
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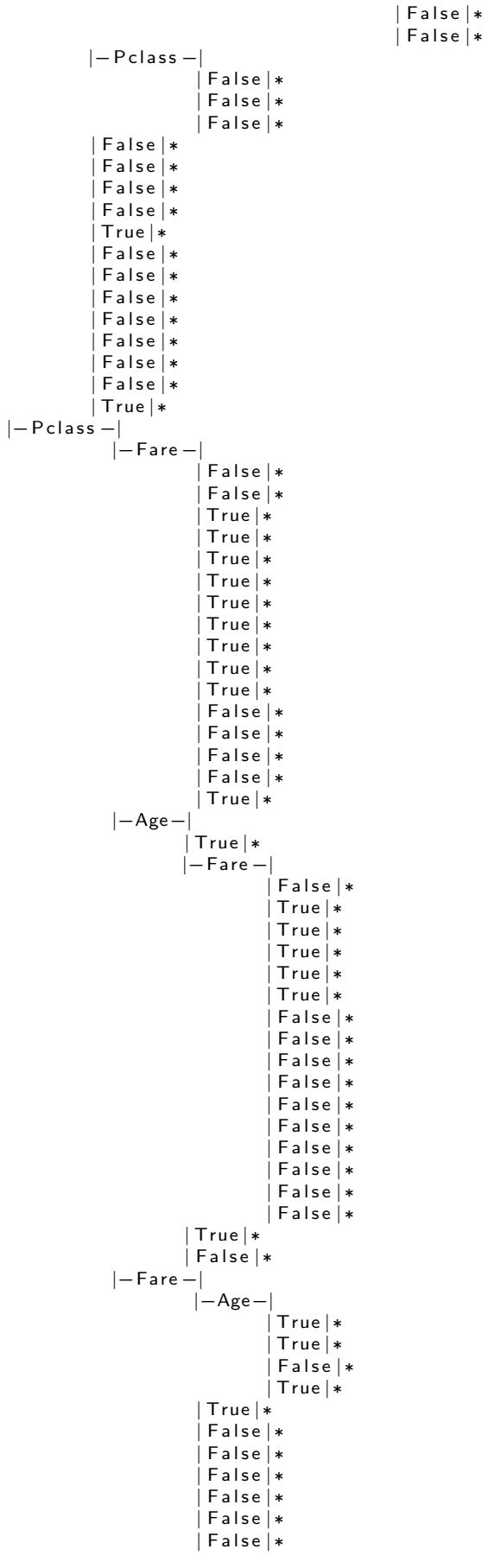
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|False|*
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|False|*
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|False|*
|False|*
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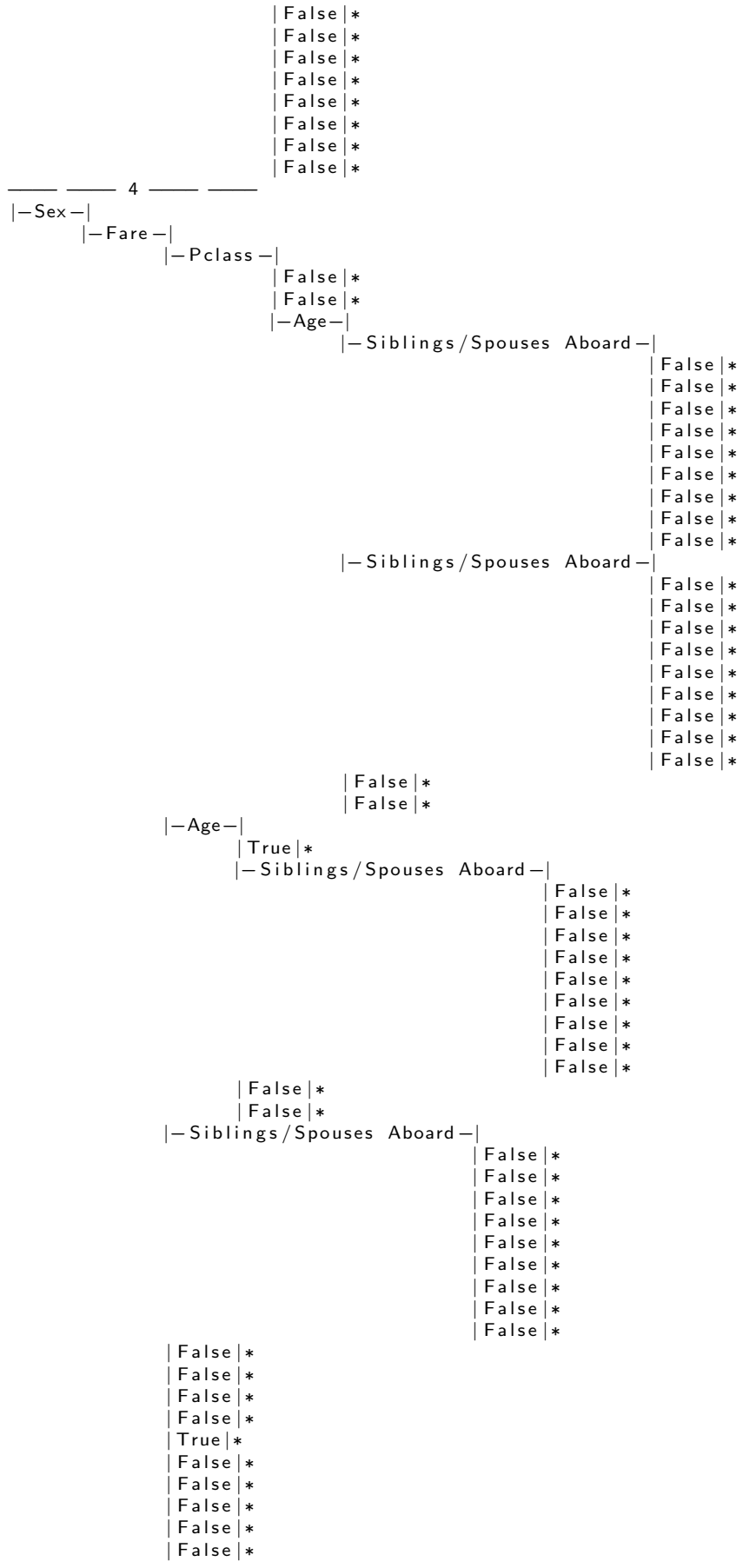
|False|*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|False|*
|False|*
|False|*
|False|*
|False|*
4
|-Sex-|
|-Fare-|
|-Pclass-|
|False|*
|False|*
|-Age-|
|-Siblings/Spouses Aboard-|
|False|*
|False|*
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|False|*
|False|*
|False|*
|False|*
|False|*
|-Siblings/Spouses Aboard-|
|False|*
|False|*
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|False|*
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|False|*
|False|*
|False|*
|False|*
|-Age-|
|True|*
|-Siblings/Spouses Aboard-|
|False|*
|False|*
|False|*
|False|*
|False|*
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|-Siblings/Spouses Aboard-|
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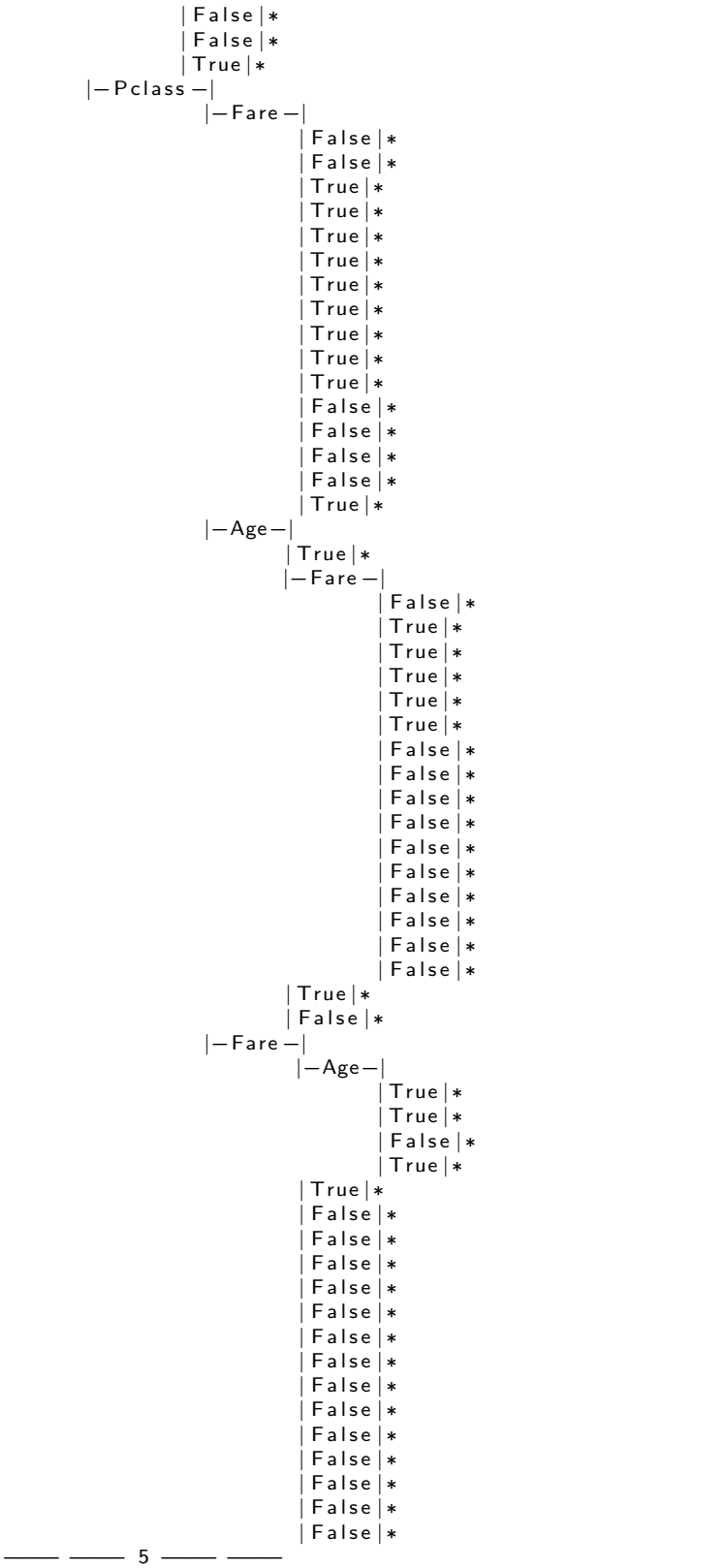
|False|*
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|False|*
|False|*
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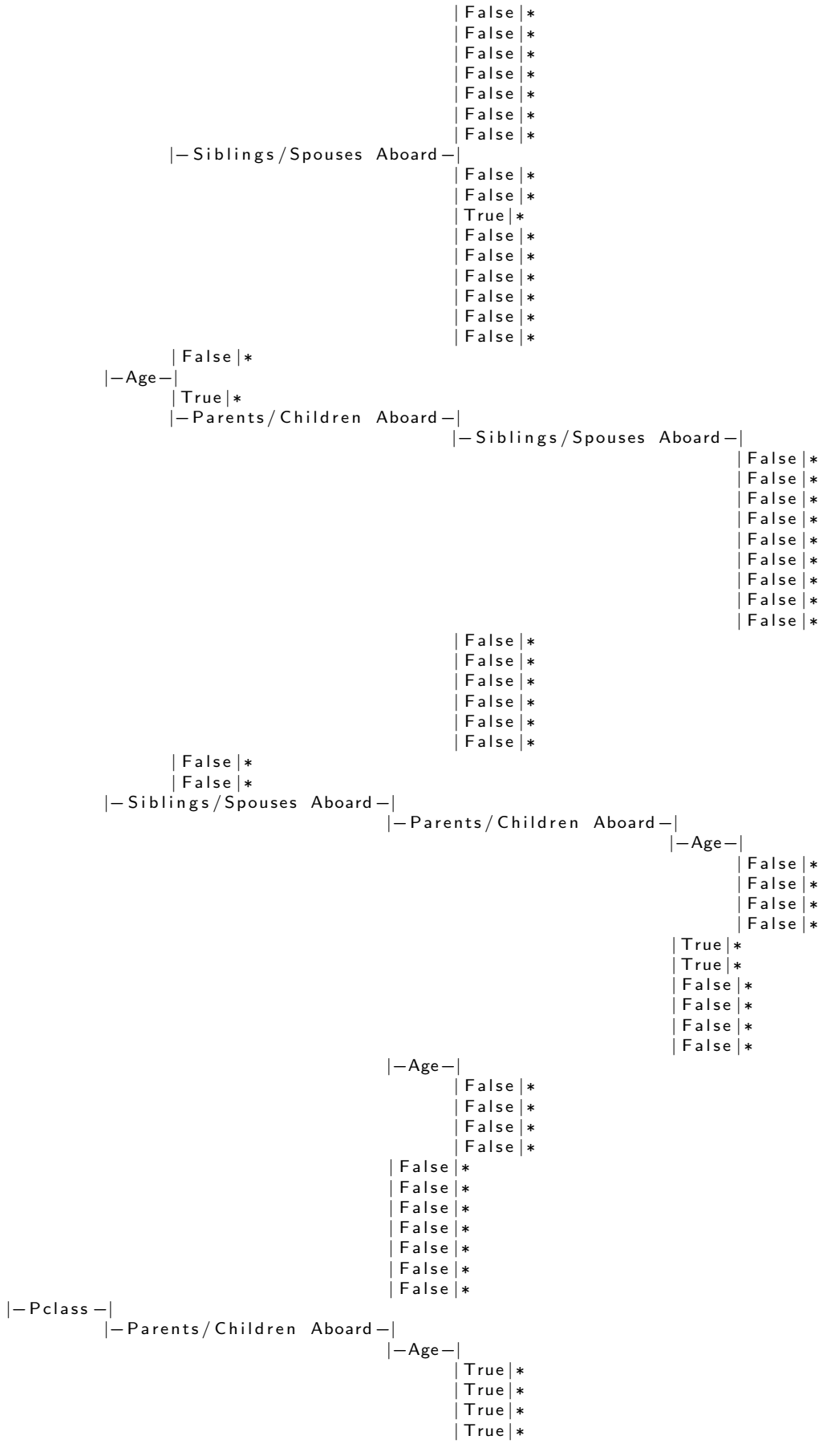
|False|*
|False|*
5
|−Sex−|
|−Pclass−|
|−Age−|
|True|*
|−Siblings/Spouses Aboard−|
|False|*
|True|*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|False|*
|False|*
|False|*
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|False|*
|-Siblings/Spouses Aboard-|
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|False|*
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|True|*
|-Parents/Children Aboard-|
|-Siblings/Spouses Aboard-|
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|-Parents/Children Aboard-|
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|-Pclass-|
|-Parents/Children Aboard-|
|-Age-|
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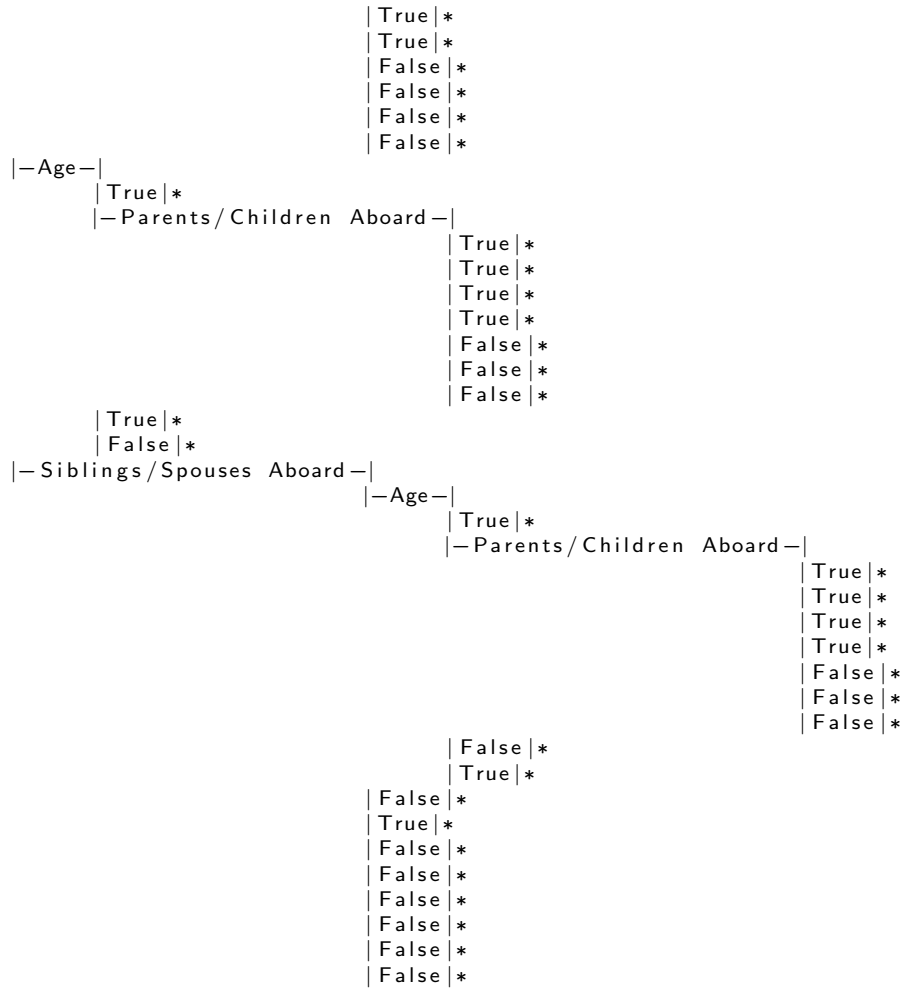
|True|*
|True|*
|True|*



2. **Accuracy = 0.8218714768883878**

3. My own feature vector **x = [1, 1, 22, 1, 0, 71.2833]**
   Predicted result = **YES**.

Problem 9