CS-141 Introduction to Programming
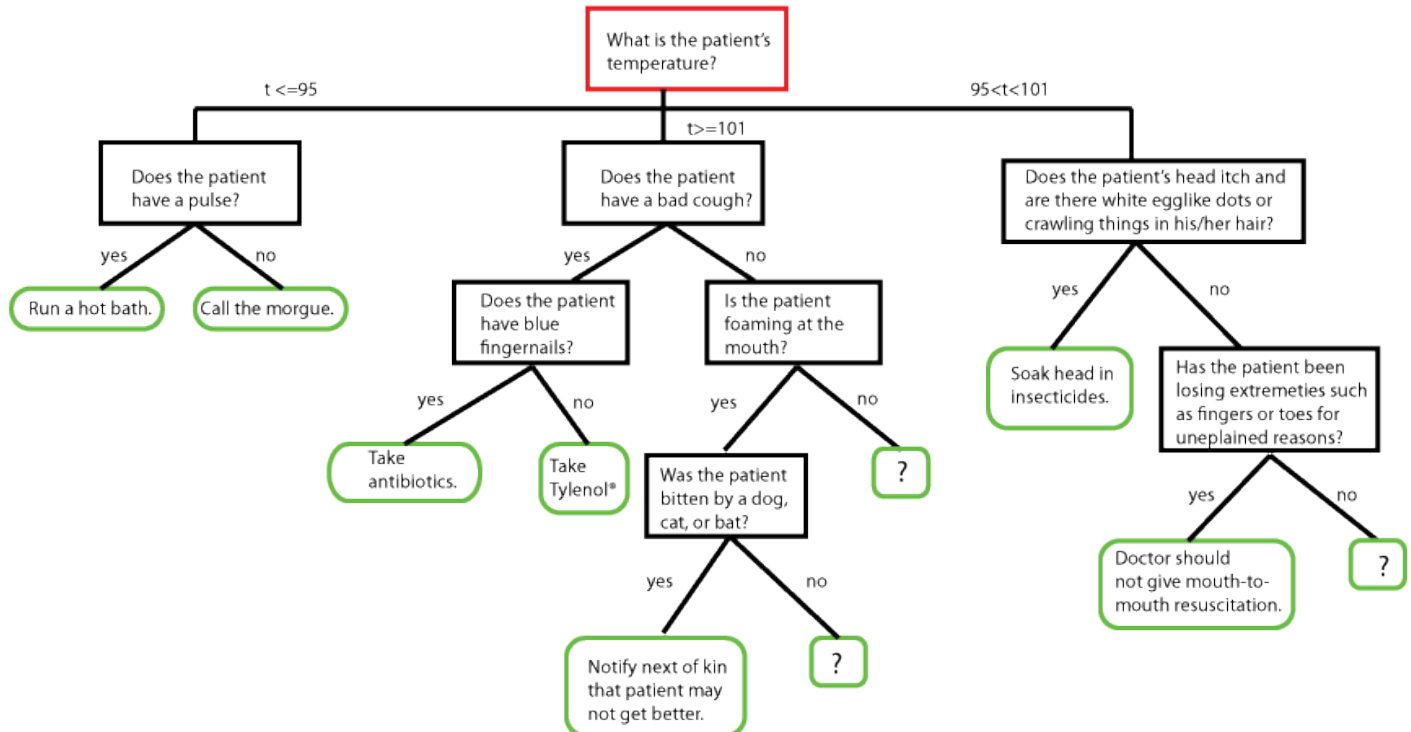## Writing an Expert System

Learning Objectives: Students will learn how to use nested if-else statements to implement a decision tree (the Expert System) in Java .

Example

In class, you saw how to implement a medical diagnosis "expert system". It used a series of questions to arrive at a diagnosis. The structure of the rules can be displayed in a underline decision tree:

Decision Tree for the program *Doctor, Doctor!*

What is the patient's temperature?

- t <=95
  - Does the patient have a pulse?
    - yes → Run a hot bath.
    - no → Call the morgue.
- t>=101
  - Does the patient have a bad cough?
    - yes → Does the patient have blue fingernails?
      - yes → Take antibiotics.
      - no → Take Tylenol®
    - no → Is the patient foaming at the mouth?
      - yes → Was the patient bitten by a dog, cat, or bat?
        - yes → Notify next of kin that patient may not get better.
        - no → ?
      - no → ?
- 95<t<101
  - Does the patient's head itch and are there white egglike dots or crawling things in his/her hair?
    - yes → Soak head in insecticides.
    - no → Has the patient been losing extremeties such as fingers or toes for uneplained reasons?
      - yes → Doctor should not give mouth-to-mouth resuscitation.
      - no → ?

Each box is called a underline node. The top red node is called the underline root node; it is where the diagnosis begins. The green nodes at the bottom are called underline leaf nodes; they are where the final diagnosis can be found. Note that there are some missing leaves in the written rules. These are specified by "?" in the above tree. In these cases, it is assumed the doctor does not have a diagnosis; the program should let the user know this.

Your assignment is as follows:

1. Pick a topic you know something about.
2. Carefully and neatly draw a decision tree. At a minimum, your decision tree should have at least two levels and 5 leaf nodes. For example, two possible structures are shown below:
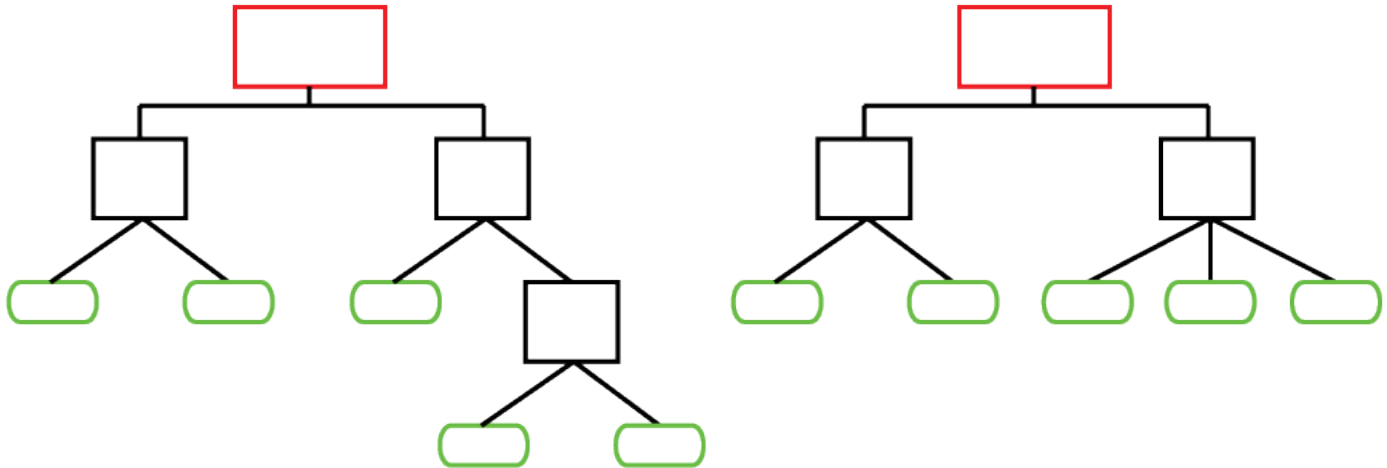
3. Every decision should eventually lead to a response, i.e. there should be no missing leaf nodes (e.g. as in the "?" above). Also, try to be consistent in the structure, for example, in the tree Medical Diagnosis example above, the "yes" always appears on the left branch and the "no" on the right. This will make coding a bit easier.
4. Use your decision tree to guide the writing of your code. Don't implement everything at once. Start with the top most if-else statement (i.e. the one right below the root) and compile & test before continuing. Maintaining proper indentation will significantly increase the readability of your code and decrease how much time you spend having to debug.
5. When done, you should test your code by running it once for each possible "path" from the root to a leaf node.

Pick a partner in the class to work with:

1. Exchange copies of your decision trees.
2. Write your name on their decision tree paper indicating that you are the "Tester".
3. Run their code at least once for each possible output (leaf node). To run their code, they can either give you a copy of their code on a thumb drive, or you can swap seats and run their code on their computer. Each time you run their code, check off the corresponding leaf in their decision tree. This will help you keep track of what you have tested.
4. Based on the results of running their program, answer the questions on the next page.
5. When you are done, staple together all of the following: both copies of the decision tree, both sets of answers to the questions, and paper copies of the code (your instructor may also ask for you to submit an electronic copy of your code.)

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Testing an Expert System

Your name: _____

Your partner's name (i.e. the name of the code's author): _____

The program's area of expertise: _____

1. Did your partner's program correctly implement their decision tree? If not, what went wrong?

2. Was their program understandable and easy to use? If not, what advice would you give your partner for improving their program?

3. Is there anything that you particularly liked about their program?