UNIVERSITY of WISCONSIN-MADISON
Computer Sciences Department

CS 202
Introduction to Computation

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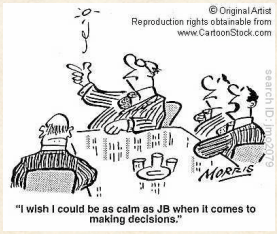
Fall 2010

Lecture 6: How can computation… help you make decisions?



TV Series Recommendation

Imagine: You're bored and need a recommendation for a TV series to start watching

You could ask your friends, do lots of research and make a decision for yourself

… or …

You could try my TV Series Recommendation program…

How does this program work?

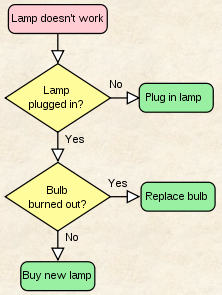
Flowcharts and Decision Trees: Informal

Flowchart:

- Visual representation of steps of algorithm
- Summarizes how algorithm behaves given specific answers

Decision Tree:

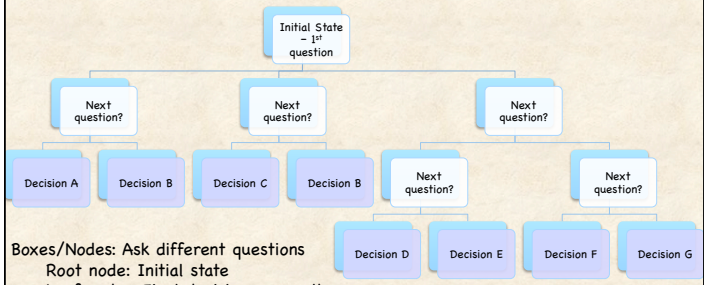
- Flowchart with no actions, just questions
- Shows final decision based on previous answers



Boxes: Represent states (or actions)

Arrows (or edges): Show transitions (or decisions) between states

Decision Trees

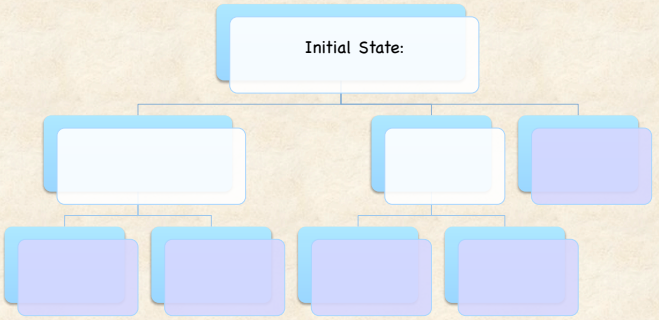


Boxes/Nodes: Ask different questions
- Root node: Initial state
- Leaf nodes: Final decision or result

Edges/Arrow: Represents different answers
- Arrive at later "internal" nodes depending upon previous answers

Different branches can have different # possible answers, depth

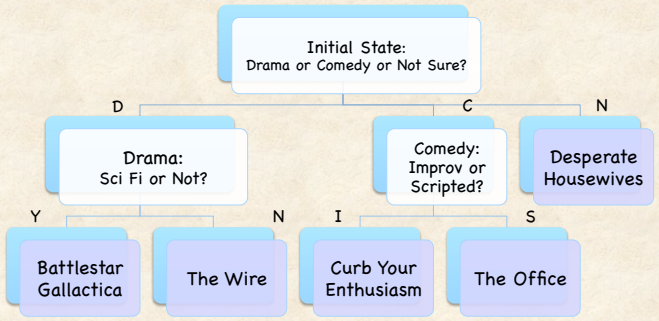
Can we recreate TV decision tree?



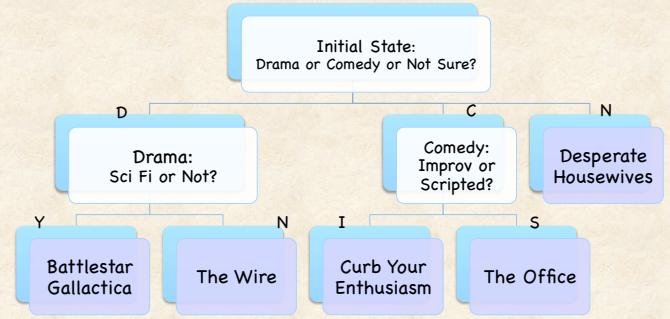
Boxes/nodes:
- Name each something descriptive
- Specify question

Lines/edges:
- Specify answer to move to state

Can we recreate TV decision tree?



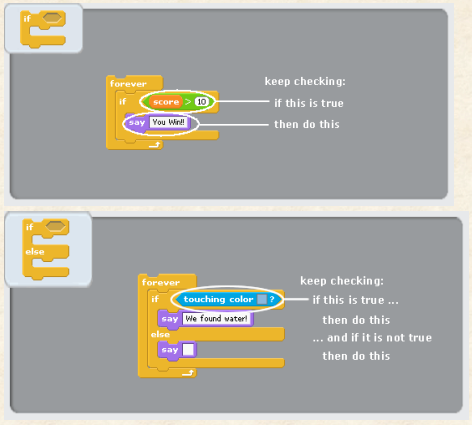
How to Implement Decision Tree?



When in initial state:
- If answer is D, go to state Drama
- If answer is C, go to state Comedy
- If answer is N, go to state Desperate

When in state Drama:
- **If answer is Y, go to state Battlestar**
- **If answer is N, go to state Wire**

Essential Control Constructs



Implement the Decision Tree?

Draw Corresponding Decision Tree?

Design your own Design Tree?

Challenge: Construct a decision tree with only yes/no questions leading to one tv show
Find the smallest number of questions to choose between 8 movies

Some questions are much better than others!

Poor Questions: Need to ask a lot

1) Do you like musicals? 2) Vampires? 3) Shows in real time? 4) Superheros?

5) Mysterious Islands? 6) Patrick Dempsey? 7) Misanthropic medical genuises?

Very poor if thousands of tv shows to pick from!

Good Questions: Need to ask only very few!

1) Some great yes/no question...
2) Some great yes/no question...
3) Some great yes/no question...

Goal: Find questions that divide choices into two equal-sized groups

Other Decision Tree Examples

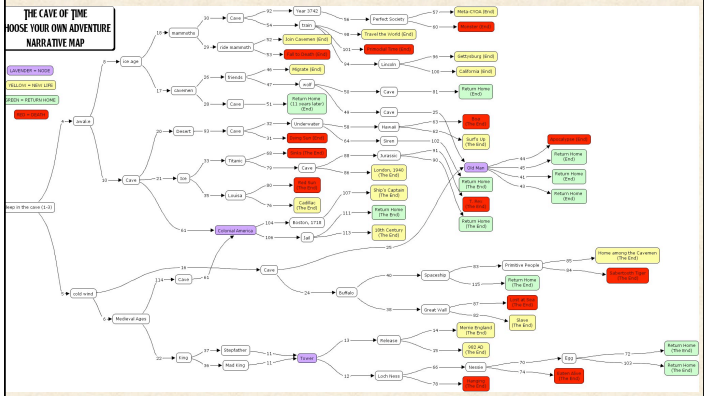
Decision trees represent many activities

Choose Your Own Adventure

In paperback book:

- Pages in book represent different states (Nodes)
- Turn to different page for different decisions (Edges)

Cave of Time Decision Tree



Decision Trees: Straight-forward to Specify

Easy to implement in many frameworks

Basic format:

- State X:
  - if (decision A) goto state Y
  - if (decision B) goto state Z

Structure web pages to form tree

- Current page is current state
- Click on different links to bring you to different pages

Example:
http://editthis.info/choose_your_own_adventure/Paladin.

Programming Concepts

General advice

- Divide high-level functionality into logical units (e.g., scenes)
- Use descriptive names (messages)
- Specify initial state (what program looks like when started)
- Incrementally test code as you go
- Make "non-fragile" code

Control flow

- Scripts must be activated to run
  - When flag clicked; When receive message
- Execution within script proceeds sequentially
- forever, repeat, repeat until, if <expr> then <action1> else <action2>

Data Types: Strings (list of characters, words)

- Ask questions: User types string stored in variable "answer"
- String manipulation: letter <x> of <string>

Today's Summary

Today's Topics

- What is a decision tree?
- How to implement decision trees in Scratch?
  - if (condition1) broadcast <message1>; else broadcast <message2>

Announcements

- Homework 2 due before class…
- Homework 3 available today
  - Construct decision tree for interactive story
  - Extend story with a few new scenes