

Lecture 12. Logic Modeling

Learning Objectives

- Use Structured English as a tool for representing steps in logical processes in data flow diagrams
- Use decision tables and decision trees to represent the logic of choice in conditional statements
- Select among Structured English, decision tables, and decision trees for representing processing logic

Logic Modeling

- Data flow diagrams do not show the logic inside the processes
- Logic modeling involves representing internal structure and functionality of processes depicted on a DFD
- Logic modeling can also be used to show when processes on a DFD occur

Logic Modeling

- Deliverables and Outcomes
 - Structured English
 - Decision Tables
 - Decision Trees
 - State-transition diagrams
 - Sequence diagrams
 - Activity diagrams

1. Structured English

Modeling Logic with Structured English

- Structured English is a language and syntax, based on the relative strengths of structured programming and natural English, for specifying the underlying logic of elementary processes of information processes (on DFDs).
- No specific standards

Modeling Logic with Structured English

- Uses a subset of English
 - Action verbs
 - Noun phrases
 - No adjectives or adverbs
- Similar to programming language
 - If conditions
 - Case statements
 - Pseudocode

Problems with Natural English

- Many of us do not write well, and we also tend not to question our writing abilities.
- Many of us are too educated.
- Some of us write everything like it was a program.
- Too often, we allow the jargon and acronyms of computing to dominate our language.
- English statements frequently have an excessive or confusing scope.
- We overuse compound sentences.
- Too many words have multiple definitions.
- Too many statements use imprecise adjectives.
- Conditional instructions can be imprecise.
- Compound conditions tend to show up in natural English.

Structured English Example

For each CUSTOMER NUMBER in the data store CUSTOMERS:

- a. For each LOAN in the data store LOANS that matches the above CUSTOMER NUMBER
 1. Keep a running total of NUMBER OF LOANS for the CUSTOMER NUMBER
 2. Keep a running total of the ORIGINAL LOAN PRINCIPAL for the CUSTOMER NUMBER
 3. Keep a running total of CURRENT LOAN BALANCE for the CUSTOMER NUMBER
 4. Keep a running total of AMOUNTS PAST DUE for the CUSTOMER NUMBER
- b. If the TOTAL AMOUNTS PAST DUE for the CUSTOMER NUMBER is greater than \$100.00 then:
 1. Write the CUSTOMER NUMBER and all their data attributes as described in the data flow LOANS AT RISK.
 Else
 1. Exclude the CUSTOMER NUMBER and data from the data flow LOANS AT RISK.

2. Decision Table

Policies and Decision Tables

- A policy is a set of rules that governs some process of the business.
- A decision table is a tabular form of presentation that specifies a set of *conditions* and their corresponding *actions* (as required to implement a policy).

Modeling Logic with Decision Tables

- A matrix representation of the logic of a decision
- Specifies the possible conditions and the resulting actions
- Best used for complicated decision logic

Modeling Logic with Decision Tables

- Consists of three parts
 - Condition stubs
 - Lists condition relevant to decision
 - Action stubs
 - Actions that result from a given set of conditions
 - Rules
 - Specify which actions are to be followed for a given set of conditions

Modeling Logic with Decision Tables

- Indifferent Condition (Table Compression)
 - Condition whose value does not affect which action is taken for two or more rules
- Standard procedure for creating decision tables
 - Name the condition and values each condition can assume
 - Name all possible actions that can occur
 - List all rules
 - Define the actions for each rule
 - Simplify the table → table compression

A Simple Decision Table

	Conditions/ Courses of Action	Rules					
		1	2	3	4	5	6
Condition Stubs	Employee type	S	H	S	H	S	H
	Hours worked	<40	<40	40	40	>40	>40
Action Stubs	Pay base salary	X		X		X	
	Calculate hourly wage		X		X		X
	Calculate overtime						X
	Produce Absence Report		X				

Decision Table (Extended)

- Steps:
 - Identify
 - Conditions
 - Criteria: What and How many?
 - Actions
 - Rules
 - Figure out total number of rules
 - Draw a 2D grid

Decision Table Compression

- Steps:
 - Start from extended table
 - Identify *indifferent* rules:
 - Does not change the action if one or more conditions are changed
 - Replace that condition by a dash “ – ”
 - Merge two identical rules
 - It is better to do this one condition a time

3. Decision Trees

Modeling Logic with Decision Trees

- A graphical representation of a decision situation
- Decision situation points are connected together by arcs and terminate in ovals
- Two main components
 - Decision points represented by nodes
 - Actions represented by ovals

Decision Tree Representation

