

## Decision Table Explanation and Examples

### *Decision Tables*

A decision table is used where the process must produce some output or take some actions based on complex decisions. If the decisions are based on several different variables (input data elements), and if those variables can take on many different values, then the logic expressed by structured English or pre/post condition is likely to be so complex that the user won't understand it.

A decision table is created by listing all the relevant conditions (variables or inputs) and all the relevant actions on the left side of the table. In many applications, it is easy (and preferable) to express the variables as binary (true/false) variables, but decision tables can also be built from multivalued variables. Every possible combination of values of the variables is listed in a separate column. Each column is typically called a rule. A rule describes the action, or actions, that should be carried out for a specific combination of values of the variables. At least one action needs to be specified for each rule (for each vertical column in the decision table), or the behavior of the system for that situation will be unspecified.

#### [Insert discussion of table](#)

	1	2	3	4	5	6	7	8
Age > 21	Y	Y	Y	Y	N	N	N	N
Sex	M	M	F	F	M	M	F	F
Weight > 150	Y	N	Y	N	Y	N	Y	N
Medication 1	X				X			X
Medication 2		X			X			
Medication 3			X			X		X
No medication				X			X	X

You must discuss each rule with the user to ensure that you have identified the correct action, or actions, for each combination of variables. It is quite common, when doing this, to find that the user has never thought about certain combinations of variables or that they have never occurred in his or her experience. The advantage of the decision table approach is that you can concentrate on one rule at a time. Another advantage is that the decision table approach does not imply any particular form of implementation. Decision tables are often referred to as a nonprocedural system modeling tool.

#### Steps to Create a Decision Table:

1. Identify all the conditions, or variables, in the specification. Identify all the values that each variable can take on.
2. Calculate the number of combinations of conditions. If all the conditions are binary, then there are  $2^N$  combinations of  $N$  variables.

3. Identify each possible action that is called for in the specification.
4. Create an "empty" decision table by listing all the conditions and actions along the left side and numbering the combinations of conditions along the top of the table.
5. List all the combinations of conditions, one for each vertical column in the table.
6. Examine each vertical column (known as a rule) and identify the appropriate action (s) to be taken.
7. Identify any omissions, contradictions, or ambiguities in the specification (rules in the decision table for which the specification does not indicate that actions should be taken).
8. Discuss the omissions, contradictions, and ambiguities with the user.
9. Combine rules where all possible values of one variable result in the same action (don't care value).

#### Example #1: Calculating Commissions

Write a decision table for the following narrative specification, and indicate any omissions, ambiguities, or contradictions that you find:

The Swell Store employs a number of salespeople to sell a variety of items. Most of these salespeople earn their income from a commission, paid on the items they sell, but a few are salary-plus-commission employees; that is, they receive a fixed salary, regardless of the quantity or type of items they sell, plus a commission on certain items. The Swell Store sells several different lines of merchandise, some of which are known as standard items (a can of tomato soup, for example) because they are widespread and do not require any creative sales techniques; in addition, there are bonus items that are highly profitable but difficult to sell (a gold-plated, diamond-studded Cadillac, perhaps). The standard and bonus items generally represent the low and high ends of the price spectrum, sandwiching a greater number of items in the middle of the spectrum.

Customers, also, are categorized. Some are known as regulars, because they do business so often that no creative selling is required. Most of the customers, however, do a small amount of business at the Swell Store, and are likely to walk in right off the street, buy something, and then disappear forever.

The management's commission policy is as follows: If a non-salaried employee sells an item that is neither standard nor bonus to someone other than a regular customer, he receives a 10 percent commission, unless the item costs more than \$10,000, in which case the commission is 5 percent. For all salespeople, if a standard item is sold, or if any item is sold to a regular customer, no commission is given. If a salaried salesperson sells a bonus item, he receives a 5 percent commission, unless the item sells for more than \$1,000, in which case he receives a flat \$25 commission. If a non-salaried salesman sells a bonus item to someone other than a regular customer, he receives a 10% commission, unless the item sells for more than \$1,000, in which case he receives a flat commission of \$75.

Answer: Commission Table for Swell Store Sales Force

	1	2	3	4	5	6	7	8
Employee Type (S, N)*	N	N	-	-	S	S	N	N
Item Type (S, G, B)*	G	G	S	-	B	B	B	B
Customer (R, W)*	W	W	-	R	-	-	W	W
Cost > \$1,000 (Y/N)	-	-	-	-	N	Y	N	Y
Cost > \$10,000 (Y/N)	N	Y	-	-	-	-	-	-
10%	x						x	
5%		x			x			
None			x	x				
\$25						x		
\$75								x

\*Employee type - Salaried, Non-salaried

\*Item type - Standard, General, Bonus

\*Customer - Regular, Walk-in

Ambiguities: Only two item types are described (Bonus and Standard), but a third category is referenced (General).

Omissions: Salaried employees selling General items are not included in rules.

Salaried employees selling Bonus items should only get commission on Walk-in customers, but this condition is not stated.

Example #2: Check acceptance policy

Create a decision table for a check acceptance policy. The conditions are:

- Check amount is less than \$100
- Customer has a driver's license
- Customer has a check guarantee card
- Check is a two-party check
- Customer is a "preferred customer"

The check can be accepted if:

- Customer has a check guarantee card and a driver's license
- Check is less than \$100 and the customer shows a driver's license or a check guarantee card
- Customer is a "preferred customer" and check amount is less than \$100
- Customer is a "preferred customer" and check is a two-party check

Answer:

	1	2	3	4	5
Check amount < \$100	-	Y	Y	Y	-
Customer has driver's license	Y	Y	-	-	-
Customer has a check guarantee card	Y	-	Y	-	-
Check is a two-party check	-	-	-	-	Y
Customer is a "preferred customer"	-	-	-	Y	Y
Check accepted	x	x	x	x	x

### Example #3: Class selection

You are trying to decide what to take among several available classes for next quarter. Some of the classes are about interesting subjects. Others don't sound all that exciting, but some of them are required for your degree. You also have (or have heard) some strong opinions about the teachers. You want to rank the classes as High, Medium, Low, or Forget-it to help you put together your schedule.

If the subject is interesting, is a requirement, and has a good teacher, it will definitely be rated high. As a matter of fact, even if it isn't required (an elective), you will still rate it high. On the other hand, if it is not interesting, doesn't meet a requirement, and has a bad teacher, forget it. If it is an interesting subject and is a required course, you will deal with a bad teacher if you have to and rate it medium. Also, if it is required with a good teacher, you will have to take it sometime, even if it is boring, so rate this as medium. You are not too excited about non-required courses taught by bad teachers, even if the subject is very interesting, or boring non-required courses, even if the teacher has a good reputation. Rate these combinations as low. If a boring, required course is being offered with a teacher you can't stand, you rate it low. You will have to take it sometime (otherwise, you would forget it), but you can always hope someone else will teach it in the future.

1. What is the maximum number of rules in this table?
2. Can any rules be eliminated or consolidated (if so, which)?
3. Complete a Class Ranking decision table for this problem.

Subject interesting  
Required course  
Good teacher