

Decision Tables

Introduction:

If you recall, one of the major challenges for a Systems Analyst is to effectively communicate the system requirements to a diverse audience. Quite often this entails taking facts harvested from stakeholders and presenting them in a readable form, with enough detail to facilitate testing and other downstream activities.

Supplemental specifications and use cases, along with their supporting artifacts (data definition, messages, UI prototype, etc.) can be an effective way to communicate the non-functional and functional requirements. We have also seen how Structured English can be used to describe business rules. However, when business rules get complicated, Structured English begins to break down. In its place, the Analyst can describe complicated business logic by way of decision tables and/or decision trees.

An Example:

Consider the following example¹, which describes the calculation of shipping charges.

Acme Outdoor World has just announced that it will offer free shipping for all orders over \$250.00². Shipping charges for all other orders will be prorated.

For orders less than \$250.00, the shipping charge will be calculated as follows:

If the number of items is 3 or less:

Delivery Day	Shipping Charge
Next Day	\$35.00
2 nd day	\$15.00
Standard	\$10.00

If the number of items is 4 or more:

Delivery Day	Shipping Charge, N = number of items
Next Day	N * \$7.50
2 nd day	N * \$3.50
Standard	N * \$2.50

For orders over \$250.00, the shipping charge will be calculated as follows:

¹ Adapted from Satzinger, Jackson, Burd, "Systems Analysis and Design in a Changing World" Course Technology, 2002.

² Applies to standard shipping for 4 or more items totaling \$250.00 or more.

If the number of items is 3 or less:

Delivery Day	Shipping Charge
Next Day	\$25.00
2 nd day	\$10.00
Standard	N * \$1.50

If the number of items is 4 or more:

Delivery Day	Shipping Charge, N = number of items
Next Day	N * \$6.00
2 nd day	N * \$2.50
Standard	FREE

Structured English Equivalent:

If purchase amt. > \$250.00

 If number of items < 4 then

 If delivery date is next day then

 Delivery charge = \$25.00

 Else if delivery date is 2nd day then

 Delivery charge is \$10.00

 Else if delivery date is standard then

 Delivery charge is \$1.50 per item.

 End If

Else

 If delivery date is next day then

 Delivery charge is \$6.00 per item

 Else if delivery date is 2nd day then

 Delivery charge is \$2.50 per item

 Else

 Delivery is free of charge

 End If

End If

Else

If number of items < 4 then

If delivery date is next day then

Delivery charge = \$35.00

Else if delivery date is 2nd day then

Delivery charge is \$15.00

Else if delivery date is standard then

Delivery charge is \$10.00

End If

Else

If delivery date is next day then

Delivery charge is \$7.5 per item

Else if delivery date is 2nd day then

Delivery charge is \$3.50 per item

Else

Delivery is \$2.50 per item

End If

End If

Decision Table Equivalent:

Table 1: Calculating Shipping Charges

Purchase Amount	Over \$250.00						Less Than \$250.00					
	3 or less			4 or more			3 or less			4 or more		
Number of Items	Next	2 nd day	Std.	Next	2 nd day	Std.	Next	2 nd day	Std.	Next	2 nd day	Std.
Shipping Charge (\$)	25	10	N * \$1.50	N * \$6.00	N * \$2.50	FREE	35	15	10	N * \$7.50	N * \$3.50	N * \$2.50

How to Construct a Decision Table:

- 1) Identify the Conditionals (Purchase Amount, Number of Items, etc.) and put each of them in a separate row in the leftmost column.
- 2) Identify the Actions (Shipping Charge) and put each of them in the leftmost column beneath the Conditionals.
- 3) Identify the Rules and match them to the Conditionals. Each rule is given a separate column.
- 4) If necessary, reorder the table so that the Conditionals with the fewest rules are above the Conditionals with more rules.
- 5) Fill in the Shipping Charges.
- 6) Label the table. A goof heuristic is to match the name of the table to the action (s)

7) Validate the table with the Stakeholders.

Another Example:

Assume that a given Payroll system uses one of several calculations to pay its employees³, as expressed in the decision table presented below:

Table 2: Calculating Employee Pay

Condition / Action	Rule					
	1	2	3	4	5	6
Employee Type	S	H	S	H	S	H
Hours Worked	<40	<40	40	40	>40	>40
Use base salary	X		X		X	
Calculate hourly wage		X		X		X
Calculate overtime						X
Produce Absence Report		X				

Notes:

1. The format of this table is slightly different than the previous example, but the concepts and techniques for constructing the table remain the same.
2. Note that this table has more than one action, and for readability, I created a blank row to separate the conditions from the actions.
3. Analyze this table and ask yourself: “does it matter how many hours a salaried employee works”?

Modified Payroll Table

The answer to the question posed above is No, it doesn't matter how many hours a salaried employee works because all of the actions are the same: Use base pay. In effect, rules 1, 3 and 5 are said to be indifferent. Indifferent rules can be simplified, as shown in the modified table below.

Table 2: Calculating Employee Pay (Optimized)

Condition / Action	1	2	3	4
	Employee Type	S	H	H
Hours Worked	-----	<40	40	>40
Use base salary	X			
Calculate hourly wage		X	X	X

³ Adapted from Hoffer, George and Valacich, “Modern Systems Analysis and Design”, 3rd Edition, Prentice Hall, 2002.

Calculate overtime				X
Produce Absence Report		X		

Question: Can this table be further reduced?

Conclusion

One of the major themes stressed throughout this course is that a Systems Analyst needs to communicate with people, not machines. To be effective, the Systems Analyst needs to use any number of techniques (or combination thereof) such that the system's requirements are effectively communicated to members of the business and engineering community. For non-functional requirements, we have learned about supplemental specifications and for functional requirements, we have seen use cases and their supporting artifacts. When the logic begins to get complicated, structured English breaks down. Fortunately, there are other techniques the Systems Analyst can draw upon, such as decision tables. Decision tables work equally well with functional and non-functional requirements. They also help to identify redundant logic, which can be simplified by the use of indifferent conditions.