

Process Specification Tools

Structured English, Decision Table &
Decision tree

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- The logic of the system cannot be documented by using DFD or data dictionary.
- DFD just shows the framework of the system, input, process and output.
- Data dictionary contains the details of processes but both do not contain the logic used to convert inputs into outputs.
- To describe the logic of any process, there are three-process specifications tools are used.
 - Structured English,
 - Decision table and
 - Decision tree.

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Structured English

- Structured English is a language and syntax based on the structured programming and natural English for specifying the underlying logic of processes on process model.
- Structured English is not pseudo-code.
- It does not contain declaration, initialization, linking and such technical programming issues.
- Unlike Decision Tables and Decision Trees, which show, only branching logic, Structured English contains complete step-by-step statements.

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Structured English Constructs

Structured English uses the three logic constructs to describe a process:

- Sequence structures
- Decision structures/conditional structures
- Iteration structures/repetition structures

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Sequence structures

- This includes a block of statements where no branching occurs and all the statements are executed from top to bottom sequentially.
- In other words, there are set of actions without existence of conditions.
- Typically, several sequence instructions are used together to describe a process.
- Each sentence uses the action verbs such as GET, SET, FIND, RECORD, CREATE, READ, UPDATE, DELETE, CALCULATE, WRITE, SORT, MERGER, or anything else understandable to the users.

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example:

```
READ hours_worked
READ hours_rate
CALCULATE gross_pay = hours_worked * hours_wage
WRITE gross_pay
```

This simple example shows the sequence of four steps. None of the step contains a decision or any condition. In sequence structure, steps are always carried out, one after the other.

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Decision structure

Decision or conditional structure are used when action is to be taken on the basis of some condition.

The condition should be accessed and then the decision is to be made and set of actions for that decision should be carried out.

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Types of Decision structure

- The **IF-THEN-ELSE** construct specifies that one set of statements should be executed if a specified condition is true, and different set of statement should be executed if the specified condition is false.
- The **CASE** construct is used when there are more than two sets of statements to choose from. These statements are also consists of the sequential statements. The CASE construct is a substitute of an IF-THEN-ELSE IF-THEN-ELSE IF-THEN... construct

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Example:

A bank will grant loan under the following conditions:

- If a customer has an account with the bank and had no loan outstanding, loan will be granted.
- If a customer has an account with the bank but some amount is outstanding from previous loans then loan will be granted if special approval is needed.
- Reject all loan applications in all other cases.

IF customer has a Bank Account THEN

IF Customer has no dues from previous account THEN

Allow loan facility

ELSE

IF Management Approval is obtained THEN

Allow loan facility

ELSE

Reject

ENDIF

ENDIF

ELSE

Reject

ENDIF

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Iteration structures

An Iteration or repetition structure specifies that a set of statements should be repeated based on some specified condition.

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Types of Iteration Structures

- The **DO-WHILE** construct indicates that certain statements are repeated zero, one or more times based on the value of the specified condition.
- These statements are executed till the condition is true. If the condition is false, control is transferred to the statement following outside of DO-WHILE construct.

DO WHILE *condition*

Statement(s) * These statement will be executed
till the condition is true

END DO

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- The **REPEAT-UNTIL** construct indicates that certain statements are repeated one or more times based on the value of the specified condition.
- In REPEAT-UNTIL condition is checked in the last and all the statements under this construct must execute at least once even the condition is false, unlike the DO-WHILE construct.

REPEAT

Statement(s) * These statements will be executed
at least once as the
* condition is specified in the last

UNTIL *condition*

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Guidelines for Writing Structured English

- Express all logic in terms of sequential, repetition, and condition statements.
- Ensure statements are not ambiguous.
- Indent statements to show the logical hierarchy.
- Place each sequence statement on a separate line. When the statement requires more than one line, the next line is indented.
- Capitalize keywords.
- Group blocks of statements together and give them a name that describes their function. Block names are capitalized. Blocks end with an EXIT item.
- Underline words or phrases defined in a data dictionary. Underlining has the advantage of uncovering words or phrases that are still undefined.
- Mark comment lines with an asterisk.
- Use parentheses to clarify AND/OR meanings and condition statements.

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Keywords

Keywords are reserved words that have special meaning. They are predefined identifier and cannot be used to denote other entities or variables. Following are the keywords that can be used in structure English.

- **START, BEGIN, END, STOP, DO WHILE, FOR, UNTIL, DO UNTIL, REPEAT, END WHILE, END UNTIL, END REPEAT, IF, IF THEN, ELSE, IF ELSE, END IF, THEN, ELSE THEN, ELSE IF, SO, CASE, EQUAL, LT, LE, GT, GE, NOT, TRUE, FALSE, AND, OR, XOR, GET, WRITE, PUT, UPDATE, CLOSE, OPEN, CREATE, DELETE, EXIT, FILE, READ, EOF, EOT**

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DECISION TABLES

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DECISION TABLES

- A decision table shows a logical structure, with all possible combinations of conditions and corresponding actions.
- Decision table is a table of rows & columns that shows conditions and actions.

The decision Table is made up of four sections:

- Condition Statements
- Condition Entries
- Action Statement
- Action Entries

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Condition and actions	Decision Rules
Condition Statement	Condition Entries
Action Statements	Action Entries

- The **Condition Statement** identifies the relevant conditions.
- **Condition Entries** tell which value, if any, applies for a particular condition.
- **Action Statement** lists the set of all steps that can be taken when a certain condition occurs.
- **Action Entries** shows what specific actions in a set to take, when selected conditions or combinations conditions are true.

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Benefits of Decision Tables

- **Eliminate Redundancy:** - Decision Tables are likely to get too large if allowed to grow in an uncontrolled way. Removing redundant entries help to manage table size. Redundancy occurs when:
 1. Two decision rules are identical
 2. The actions for two rules are identical.
- **Removing Contradictions:** - Decision rules contradict each other when two or more rules have the same set of conditions and the actions are different. This could occur when either there is an error in constructing the table or when the analysts receive discrepant information from different individuals about how decisions are made.

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- **Impossible Situations:** - In the table below, Rule 1 is not possible as a person who is earning more than Rs. 50,000 per year cannot earn less than Rs. 2000 per month at the same time.

Condition and Actions	Rules			
	1	2	3	4
Salary > 50,000 per year	Y	Y	N	N
Salary < 2000 per month	Y	N	Y	N
Action 1 Action 2				

Impossible situation

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Types of table Entries

There are four types of table forms:

1. Limited – Entry Form
2. Extended – Entry Form
3. Mixed – Entry Form
4. ELSE form

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Limited – Entry Form

Limited –Entry form is a basic table structure consists only of ‘Y’, ‘N’, and blank entries. It is the most commonly used formats.

Grade 10 – 19	DA = 20 % of basic salary HRA = 600
Grade 20 – 29	DA = 20 % of basic HRA = 400
Grade 30 – 39	DA = nil HRA = 40% of basic
Grade 40 & above	DA = nil HRA = 50 % of basic

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Conditions and Actions	Rules				
	1	2	3	4	5
Grade b/w 10 – 19	Y	N	N	N	–
Grade b/w 20 – 29	N	Y	N	N	–
Grade b/w 30 – 39	N	N	Y	N	–
Grade b/w 30 – 39	N	N	N	Y	–
DA 20 % of Basic, HRA = 600	X				
DA 20 % of Basic, HRA = 400		X			
DA =0, HRA =40 % of Basic			X		
DA =0, HRA =50 % of Basic				X	
No Calculation					X

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Extended – Entry Form

The Extended – Entry form replaces Y and N with action entries telling the reader how to decide. Here the condition and action statements themselves are not complete; therefore the entries contain more than one Yes and No.

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E.g.: If an Employee exists, and if he is in marketing department (“MKT”) he is eligible for commission. The commission is based on the total sales made for the month and is calculated as follows:

If sales \geq 10000 then commission is 20 %

If sales \geq 5000 and $<$ 10000 then commission is 10 %

If sales $<$ 5000, commission is 0

Condition and Actions	Rules				
	1	2	3	4	5
Department	MKT	MKT	ADM	MKT	–
Total Sales	10,000	2000	–	5000	–
Commission Applicable	20 %	0	n.a	10 %	n.a

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Mixed – Entry Form

This form consists of combined features of limited and extended – entry forms.

- For all employee in the grade 10 – 19 and those in marketing department commission is calculated as follows:
 If sales \geq 10000 then commission is 20 %.
 If sales \geq 5000 and $<$ 10000 then commission is 10 %.
 If sales $<$ 5000, commission is 0
 If the person is in any other department then he is not entitled for commission.
- Second condition is to check if the employee is supposed to pay income tax. This is done as follows:
 If the employee's salary \geq 50,000 – Tax applicable.
 If salary $<$ 50,000 – Tax not applicable.

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Conditions and Actions	Rules				
	1	2	3	4	5
Department	MKT	MKT	FIN	FIN	MKT
Grade 10 – 19	Y	Y	Y	Y	Y
Salary \geq 50000 p.a.	Y	N	Y	N	N
Salary $<$ 50000 p.a.	–	Y	N	Y	Y
Total Sales	20000	10000	–	–	3000
Commission applicable	20 %	10 %	n.a	n.a	0
Income Tax applicable	X	–	X	–	–
Income Tax exempted	–	X	–	X	X

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ELSE Form

This form aims at omitting repetition by using ELSE rules. To build an ELSE form decision table

- Specify the rules with conditions entries to cover all sets of actions except for one.
- This will be the rule to follow when none of the other explicit conditions are true.
- This rule is the final column on the right, the ELSE column.
- If none of the other conditions are true, then the ELSE decision rule is followed.

The ELSE rule eliminates the need to repeat conditions that lead to the same actions.

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The Employees of marketing department are given commissions according to the total sales done. The commission is given as follows:

If sales \geq 10000 then 20 % commission

If sales \geq 8000 and sales $<$ 10000 then 15 % commission

If sales \geq 5000 and sales $<$ 8000 then 10 % commission else

If sales $<$ 5000 then 2 % commission

Conditions and Actions	Rules			
	1	2	3	4
Sales \geq 10000	N	Y	N	E
Sales \geq 8000 and $<$ 10000	Y	-	N	L
Sales \geq 5000 and 8000	N	-	Y	S
				E
Commission	15 %	20 %	10 %	2 %

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DECISION TREES

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Decision Tree

- A Decision Tree is a graphically representation of conditions and actions sequentially thus showing the order of conditions.
- This method shows the relationship of each condition and its permissible actions.
- Decision trees show the logic structure in a horizontal form that resembles a tree with the root at the left and the braches to the right.
- Decision trees and decision tables provide the same results but decision tree show the result graphically while decision table show the result in tabular form.

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- The following figure shows a decision tree where the sequence of decisions is from left to right.
- The root is on the left, starting point of the decision sequence, the branching moves towards the right. The particular branch to be followed depends upon the condition that exists and the decision to be made.
- Movement is from left to right.
- Each node of the tree represents a condition.
- The right side of the tree lists the actions to be taken, depending upon the sequence of conditions that have been followed.

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<p>Grade 10 – 19 DA = 20 % of basic salary HRA = Nil</p> <p>Grade 20 – 29 DA = 20 % of basic HRA = 400</p> <p>Grade 30 – 39 DA = Nil HRA = 40 % of basic</p> <p>Grade 40 & above DA = Nil HRA = 50 % of basic</p>	
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Benefits of using Decision Trees

- One of the benefits of using decision tree is that analysts are forced to formally identify the actual decisions that must be made.
- Converting decision trees into If-Else structure is very easy when many conditions have to be checked for.
- Decision trees forces analyst to consider the sequence of condition.

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