SCSD2613
System Analysis and Design

UTM
UNIVERSITI TEKNOLOGI MALAYSIA

PART IV
The Analysis Process #2:
Process Specifications and Structured Decisions

update: August 2019 (sharinhh)

OBJECTIVES

i. Understand the purpose of process specifications.
ii. Recognize the difference between structured and semi structured decisions.
iii. Use structured English, decision tables, and decision trees to analyze, describe, and document structured decisions.
iv. Choose an appropriate decision analysis method for analyzing structured decisions and creating process specifications.

LOGIC OF DECISION

- Documenting and analyzing logic:
  - Structured English
  - Decision tables
  - Decision trees
- Logic and structured decisions are distinguishable from semi-structured decisions
- Structured decision analysis methods promote completeness, accuracy, and communication

MAJOR TOPICS

PROCESS SPECIFICATION	• Goals • Process Specification Format
STRUCTURED ENGLISH	• Writing Structured English • Data Dictionary and Process Specification
DECISION TABLE	• Developing Decision Table
DECISION TREE	• Drawing Decision Tree

MAJOR TOPICS

PROCESS SPECIFICATION

- Goals
- Business Rules
- Process Specification Format

PROCESS SPECIFICATIONS

- Sometimes called minispecs
- Created for primitive processes as well as for some higher level processes on a data flow diagram
- Created for class methods in object-oriented design and for the steps in a use case.
- Goals of producing Process Specification:
  1. Reduce process ambiguity
  2. Obtain a precise description of what is accomplished
  3. Validate the system design

PROCESS SPECIFICATIONS

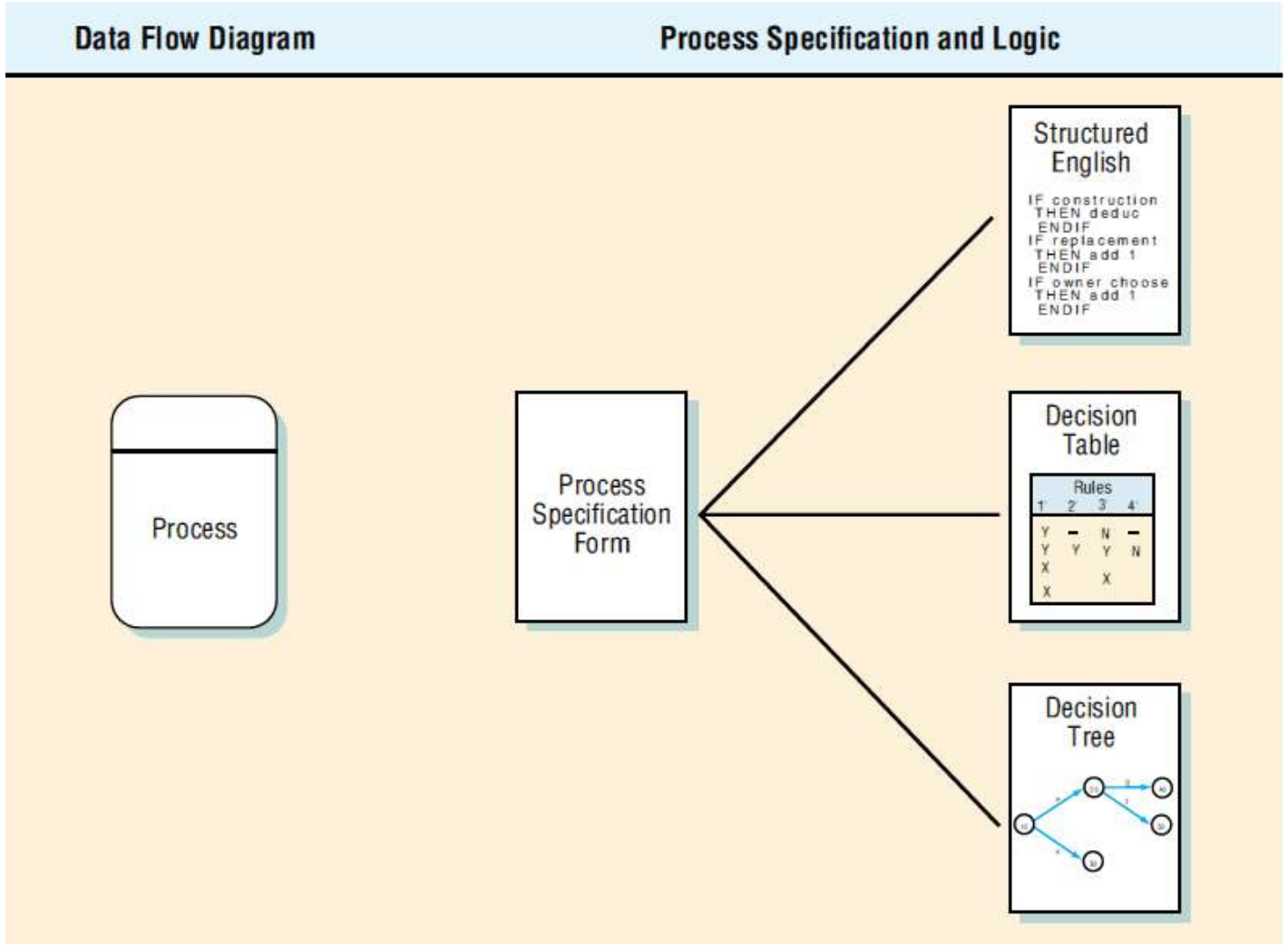
- However, it is **NOT** created for:

Processes that represent physical input and/or output

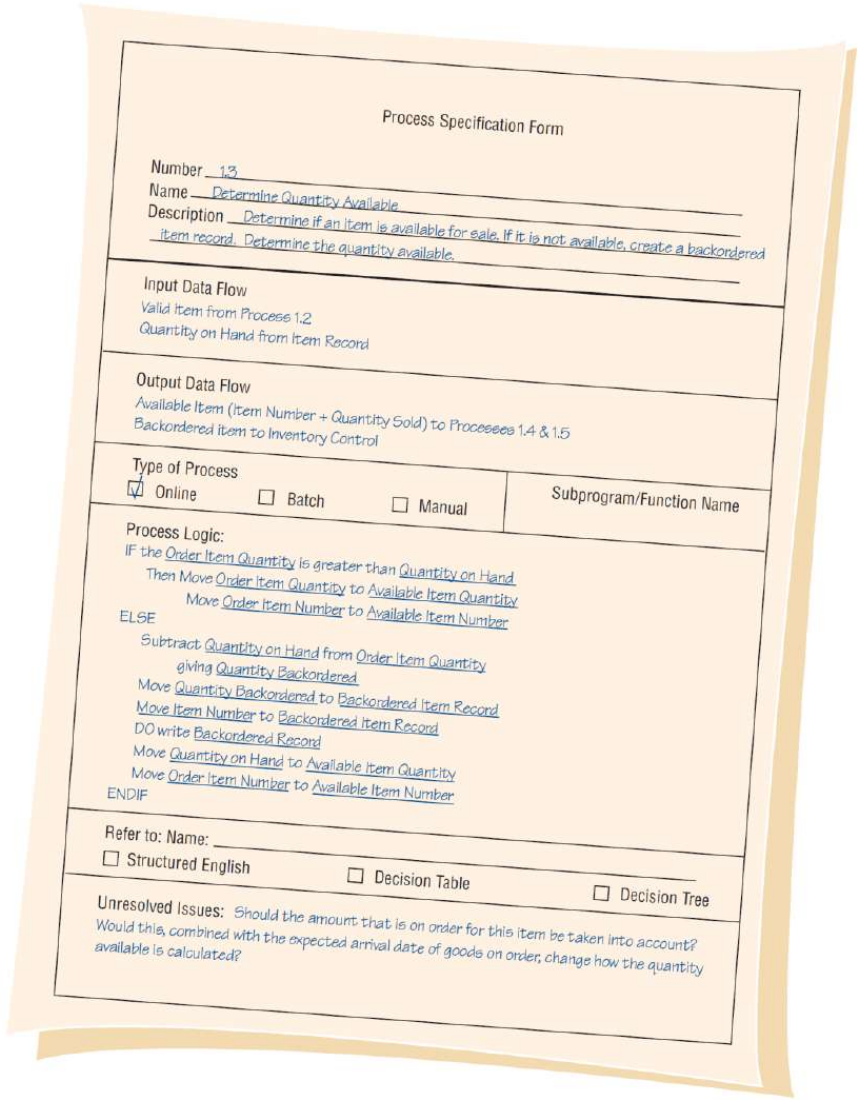
Processes that represent simple data validation

Processes that use prewritten code

HOW PROCESS SPECIFICATION RELATE TO DFD



PROCESS SPEFICATION FORMAT



Process Specification Form

Number 1.3
Name Determine Quantity Available
Description Determine if an item is available for sale. If it is not available, create a backordered item record. Determine the quantity available.

Input Data Flow
Valid Item from Process 1.2
Quantity on Hand from Item Record

Output Data Flow
Available Item (Item Number + Quantity Sold) to Processes 1.4 & 1.5
Backordered item to Inventory Control

Type of Process
☑ Online ☐ Batch ☐ Manual

Subprogram/Function Name

Process Logic:
IF the Order Item Quantity is greater than Quantity on Hand
Then Move Order Item Quantity to Available Item Quantity
Move Order Item Number to Available Item Number
ELSE
Subtract Quantity on Hand from Order Item Quantity
giving Quantity Backordered
Move Quantity Backordered to Backordered Item Record
Move Item Number to Backordered Item Record
DO write Backordered Record
Move Quantity on Hand to Available Item Quantity
Move Order Item Number to Available Item Number
ENDIF

Refer to: Name:
☐ Structured English ☐ Decision Table ☐ Decision Tree

Unresolved Issues: Should the amount that is on order for this item be taken into account? Would this, combined with the expected arrival date of goods on order, change how the quantity available is calculated?

1. The process number
2. The process name
3. Description of what the process accomplishes
4. A list of input data flow
5. Output data flows
6. Type of process
7. Uses prewritten code
8. Process logic description
9. Logic method reference
10. List any unresolved issues

PROCESS SPEFICATION FORMAT

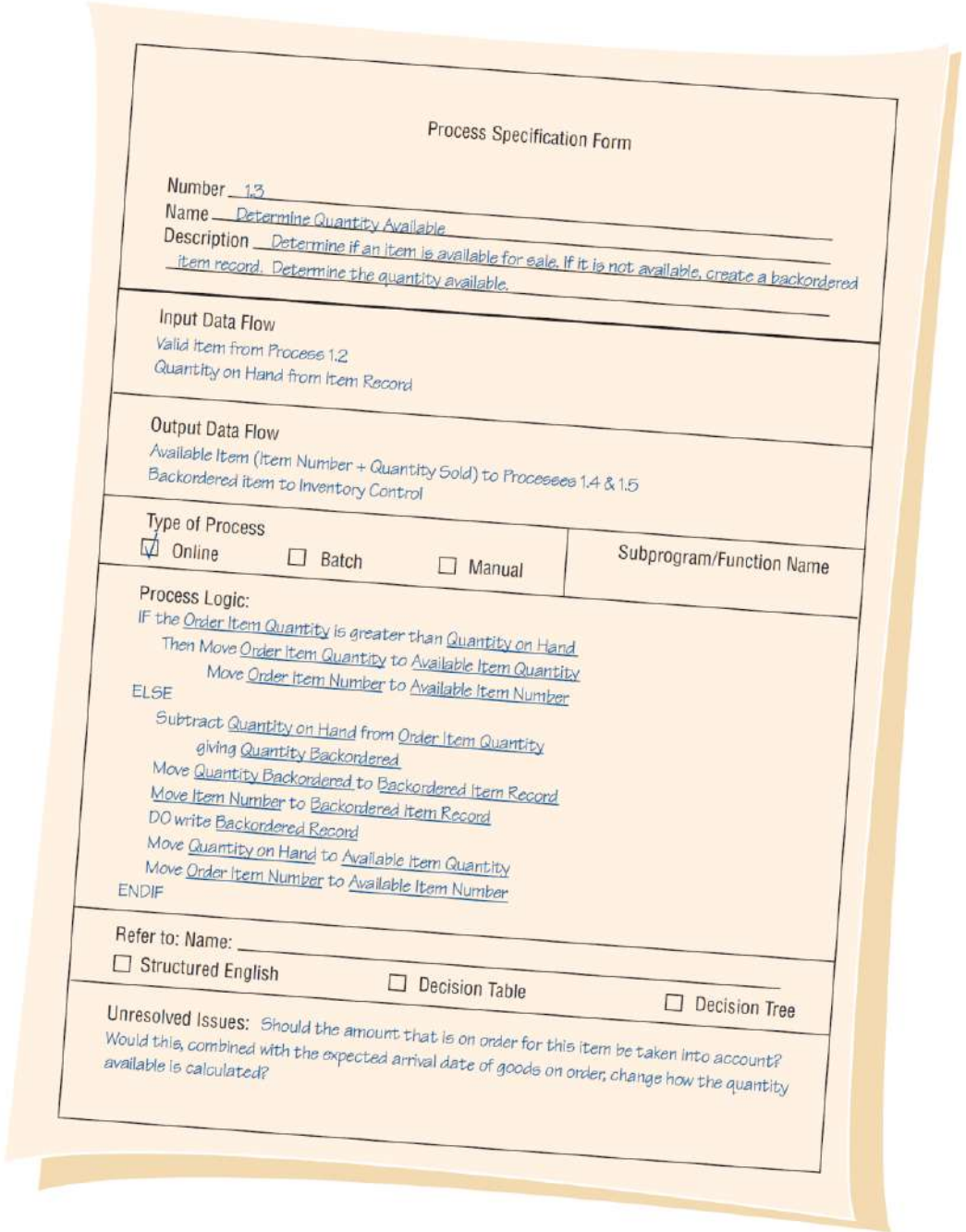
	PROCESS SPECIFICATION ITEMS	DESCRIPTION
1	The process number	• Must match the process ID on the data flow diagram • Allows the analyst to work on or review any process, and to locate the data flow diagram containing the process easily
2	The process name	The same as displays within the process symbol on the DFD
3	Description of what the process accomplishes	Example: Determine if an item is available for sale. If it is not available, create a backordered item record. Determine the quantity available.
4	A list of input data flow	• Uses the names found on the data flow diagram • Data names used in the formula or logic should match the data dictionary, for consistency and good communication
5	Output data flows	Uses data flow diagram and data dictionary names

	PROCESS SPECIFICATION ITEMS	DESCRIPTION
6	Type of process	1. Batch 2. Online - require screen design or web pages 3. Manual - should have well-defined procedures for employees performing the process tasks
7	Uses prewritten code	Include the name of the subprogram or function containing the code
8	Process logic description	• This should state policy and business rules, not computer language pseudo-code • Business rules* are the procedures that allow a corporation to run its business
9	Logic method reference	If there is not enough room for a complete structured English description include a reference to the structured English description, decision table, or tree depicting the logic
10	List any unresolved issues	• Incomplete portions of logic • These issues form the basis of the questions used for follow-up interviews with users or business experts you have added to your project team

*please refer next slide

BUSINESS RULES

- What is BUSINESS RULES?
  - A business rule is a rule that defines a specific constraint within the context of a business.
- Common business rules format
  - Definitions of business terms
  - Business conditions and actions
  - Data integrity constraints
  - Mathematical and functional derivations
  - Logical inferences
  - Processing sequences
  - Relationships among facts about the business



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DO write Backordered Record
Move Quantity on Hand to Available Item Quantity
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ENDIF

Refer to: Name:
☐ Structured English ☐ Decision Table ☐ Decision Tree

Unresolved Issues: Should the amount that is on order for this item be taken into account? Would this, combined with the expected arrival date of goods on order, change how the quantity available is calculated?

<Process Title>

Version x.x
Owner:

PROCESS SPECIFICATION

Revised: (date)
CID:

Purpose: <Add purpose for this process>

Entry Conditions: <add conditions that must exist in order to start this process>
-
-
-
-

Exit Conditions: <add conditions that must exist in order to exit this process>
-
-

Input:	**Process Steps:**	**Output:**
• List all required (mandatory) inputs you must have in order to start this (i.e. template, organization policy…) • … • …	1.1 List all steps in performing this process 1.2 … 1.3 …	1.1 List what should be the outputs from this process. Use the numbering to identify the output from a specific process step. 1.2 Output from step 1.2

MAJOR TOPICS

STRUCTURED ENGLISH

- Writing Structured English
- Data Dictionary and Process Specification

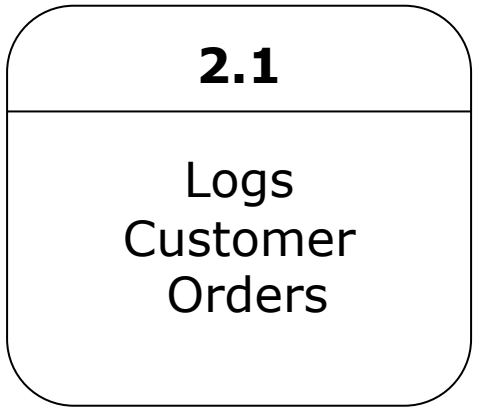
STRUCTURED ENGLISH

- Used when the process logic involves formulas or iteration, or when structured decisions are not complex
- Based on structured logic and simple English statements such as add, multiply, and move
- Advantages:
  1. Clarifying the logic and relationships found in human languages
  2. An effective communication tool, it can be taught to and understood by users in the organization

STRUCTURED ENGLISH

- It's similar to algorithm.
- It used to describe the logic process which involves formula, repetition, or simple structured decision.

```
DO
READ product's code
BEGIN IF
IF code  start with "F"
    ADD name, quantity, product code
       ACCUMULATE the numbers of MEALS
IF code  start with "D"
     ADD name, quantity, product code
    ACCUMULATE the numbers of DRINKS
IF code  start with "DE"
    ADD name, quantity, product code
    ACCUMULATE the numbers of DESSERT
ENF IF
UNTIL EOF
THEN
      GENERATE Goods sold records
```



WRITING STRUCTURED ENGLISH

- Express all logic in terms of sequential structures, decision structures, case structures, or iterations
- Use and capitalize accepted keywords such as IF, THEN, ELSE, DO, and PERFORM
- Indent blocks of statements to show their hierarchy (nesting) clearly
- Underline words or phrases that have been defined in a data dictionary
- Clarify the logical statements

STRUCTURED ENGLISH EXAMPLES

Structured English Type	Example
Sequential Structure A block of instructions in which no branching occurs	Action #1 Action #2 Action #3
Decision Structure Only IF a condition is true, complete the following statements; otherwise, jump to the ELSE	IF Condition A is True THEN implement Action A ELSE implement Action B ENDIF
Case Structure A special type of decision structure in which the cases are mutually exclusive (if one occurs, the others cannot)	IF Case #1 implement Action #1 ELSE IF Case #2 Implement Action #2 ELSE IF Case #3 Implement Action #3 ELSE IF Case #4 Implement Action #4 ELSE print error ENDIF
Iteration Blocks of statements that are repeated until done	DO WHILE there are customers. Action #1 ENDDO

DATA DICTIONARY AND PROCESS SPECIFICATIONS

- The data dictionary is a starting point for creating structured English:
  - Sequence—a simple sequence of statements MOVE, ADD, and SUBTRACT
  - Selection—[] entries become IF…THEN...ELSE statements
  - Iteration { } entries become DO WHILE, DO UNTIL, or PERFORM UNTIL

LET'S TRY

Checkpoint 1: Structured English

Encik Amir is reviewing his firm's expense reimbursement policies with a new salesperson in his department.

"Our reimbursement policies depend on the situation. You see, first we determine if it is a local trip. If it is, we only pay mileage of 18.5 cents a mile. If the trip was a one-day trip, we pay mileage and then check the times of departure and return. To be reimbursed for breakfast, you must leave by 7:00 A.M., lunch by 11:00 A.M., and have dinner by 5:00 P.M. To receive reimbursement for breakfast, you must return later than 10:00 A.M., lunch later than 2:00 P.M., and have dinner by 7:00 P.M. On a trip lasting more than one day, we allow hotel, taxi, and airfare, as well as meal allowances. The same times apply for meal expenses."

Write structured English for Encik Amir's narrative of the reimbursement policies.

MAJOR TOPICS

DECISION TABLE

- Developing Decision Table

DECISION TABLE

- A table of rows and columns, separated into four quadrants:
  - Conditions
  - Condition alternatives
  - Actions to be taken
  - Rules for executing the actions
- Advantages:
  - Help the analysis ensure completeness
  - Easy to check for possible errors
    - Impossible situations
    - Contradictions
    - Redundancy

Conditions and Actions	Rules
Conditions	Condition Alternatives
Actions	Action Entries

Standard Format Used for Presenting a Decision Table

DEVELOPING DECISION TABLE

1. Determine conditions that affect the decision
2. Determine possible actions that can be taken
3. Determine condition alternatives for each condition
4. Calculate the maximum number of columns in the decision table
5. Fill in the condition alternatives
6. Complete table by inserting an X where rules suggest actions
7. Combine rules where it is apparent
8. Check for impossible situations
9. Rearrange to make more understandable

DECISION TABLE EXAMPLE 1

Banner's restaurant has two categories of employees . First, an employee who will be paid based on monthly salary (S). Second, who based on hours worked (H). There are three types of hours worked, less than 40, exactly 40 and more than 40. If (S) employees who work for 40 hours or less than 40 hours or more than 40 hours, they will be paid on monthly-based. If (H) employees and work less than 40 hours, the system will calculate hourly wage and an absence report must be produced. If (H) employees who has worked exactly 40 hours, the system will pay hourly wage. If (H) employees and work more than 40 hours, the system will hourly calculate wage and also calculate for overtime.

DECISION TABLE EXAMPLE 1

Initial Table

Condition	Rules					
	1	2	3	4	5	6
Employee type	S	H	S	H	S	H
Hours worked	<40	<40	40	40	>40	>40
Action						
Pay base salary	X		X		X	
Calculate hourly wage		X		X		X
Calculate overtime						X
Produce absence report		X				

DECISION TABLE EXAMPLE 1

Simplified Table

Condition	**Rules**			
	1	2	3	4
Employee type	S	H	H	H
Hours worked	-	<40	40	>40
Action				
Pay base salary	X			
Calculate hourly wage		X	X	X
Calculate overtime				X
Produce absence report		X		

DECISION TABLE EXAMPLE 2

Constructing a Decision Table for Deciding Which Catalog to Send to Customers Who Order Only from Selected Catalogs

Conditions and Actions	Rules							
	1	2	3	4	5	6	7	8
Customer ordered from Fall catalog.	Y	Y	Y	Y	N	N	N	N
Customer ordered from Christmas catalog.	Y	Y	N	N	Y	Y	N	N
Customer ordered from specialty catalog.	Y	N	Y	N	Y	N	Y	N
Send out this year's Christmas catalog.		X		X		X		X
Send out specialty catalog.			X				X	
Send out both catalogs.	X				X			

DECISION TABLE EXAMPLE 2

Constructing a Decision Table for Deciding Which Catalog to Send to Customers Who Order Only from Selected Catalogs

Conditions and Actions	Rules 1	2	3	4	5	6	7	8
Customer ordered from Fall catalog.	Y	Y	Y	Y	N	N	N	N
Customer ordered from Christmas catalog.	Y	Y	N	N	Y	Y	N	N
Customer ordered from specialty catalog.	Y	N	Y	N	Y	N	Y	N
Send out this year's Christmas catalog.		X		X		X		X
Send out specialty catalog.			X				X	
Send out both catalogs.	X				X			

Conditions and Actions	Rules 1'	2'	3'
Customer ordered from Fall catalog.	—	—	—
Customer ordered from Christmas catalog.	Y	—	N
Customer ordered from specialty catalog.	Y	N	Y
Send out this year's Christmas catalog.		X	
Send out specialty catalog.			X
Send out both catalogs.	X		

DECISION TABLE EXAMPLE 2

Conditions and Actions	Rules 1	2	3	4	5	6	7	8
Customer ordered from Fall catalog	Y	Y	Y	Y	N	N	N	N
Customer ordered from Christmas catalog	Y	Y	N	N	Y	Y	N	N
Customer ordered from Special catalog	Y	N	Y	N	Y	N	Y	N
Send out this year's Christmas catalog		X		X		X		X
Send out Special catalog			X				X	
Send out both catalogs	X				X			

Constructing a decision table for deciding which catalog to send to customers who order only from selected catalogs

Conditions and Actions	Rules 1	2	3	4	5	6	7	8
Customer ordered from Fall catalog	Y	Y	Y	Y	N	N	N	N
Customer ordered from Christmas catalog	Y	Y	N	N	Y	Y	N	N
Customer ordered from specially catalog	Y	N	Y	N	Y	N	Y	N
Send out this year's Christmas catalog		X		X		X		X
Send out Specially catalog			X				X	
Send out both catalogs	X				X			

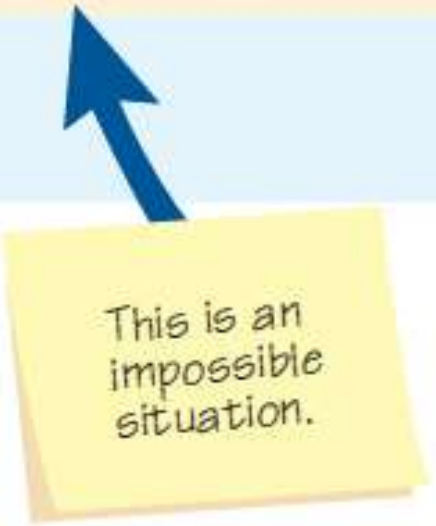
Combining rules to simplify the customer-catalog decision table

Conditions and Actions	1′	Rules 2′	3′
Customer ordered from Fall catalog	-	-	-
Customer ordered from Christmas catalog	Y	-	N
Customer ordered from Specially catalog	Y	N	Y
Send out this year's Christmas catalog		X	
Send out Specially catalog			X
Send out both catalogs	X		

CHECKING FOR COMPLETENESS & ACCURACY

1. Impossible Situations

Conditions and Actions	Rules 1	2	3	4
Salary > $50,000/year	Y	Y	N	N
Salary < $2,000/month	Y	N	Y	N
Action 1				
Action 2				



A person cannot earn greater than $50,000 per year and less than $2000 per month

CHECKING FOR COMPLETENESS & ACCURACY

2. Contradiction and redundancy

Conditions and Actions	Rules 1	2	3	4	5	6	7
Condition 1	Y	Y	Y	Y	Y	N	N
Condition 2	Y	Y	Y	N	N	Y	N
Condition 3	—	N	—	—	—	N	Y
Action 1	X			X	X		
Action 2			X			X	
Action 3		X					X

Contradiction

Have the same conditions but different results

Redundancy

Have the same conditions and results

LET'S TRY

Checkpoint 2: Decision Table

Using the same problem in the Checkpoint 1, create a decision table depicting the reimbursement for Encik Amir's office policies.

(from Checkpoint 1)

"Our reimbursement policies depend on the situation. You see, first we determine if it is a local trip. If it is, we only pay mileage of 18.5 cents a mile. If the trip was a one-day trip, we pay mileage and then check the times of departure and return. To be reimbursed for breakfast, you must leave by 7:00 A.M., lunch by 11:00 A.M., and have dinner by 5:00 P.M. To receive reimbursement for breakfast, you must return later than 10:00 A.M., lunch later than 2:00 P.M., and have dinner by 7:00 P.M. On a trip lasting more than one day, we allow hotel, taxi, and airfare, as well as meal allowances. The same times apply for meal expenses."

MAJOR TOPICS

DECISION TREE

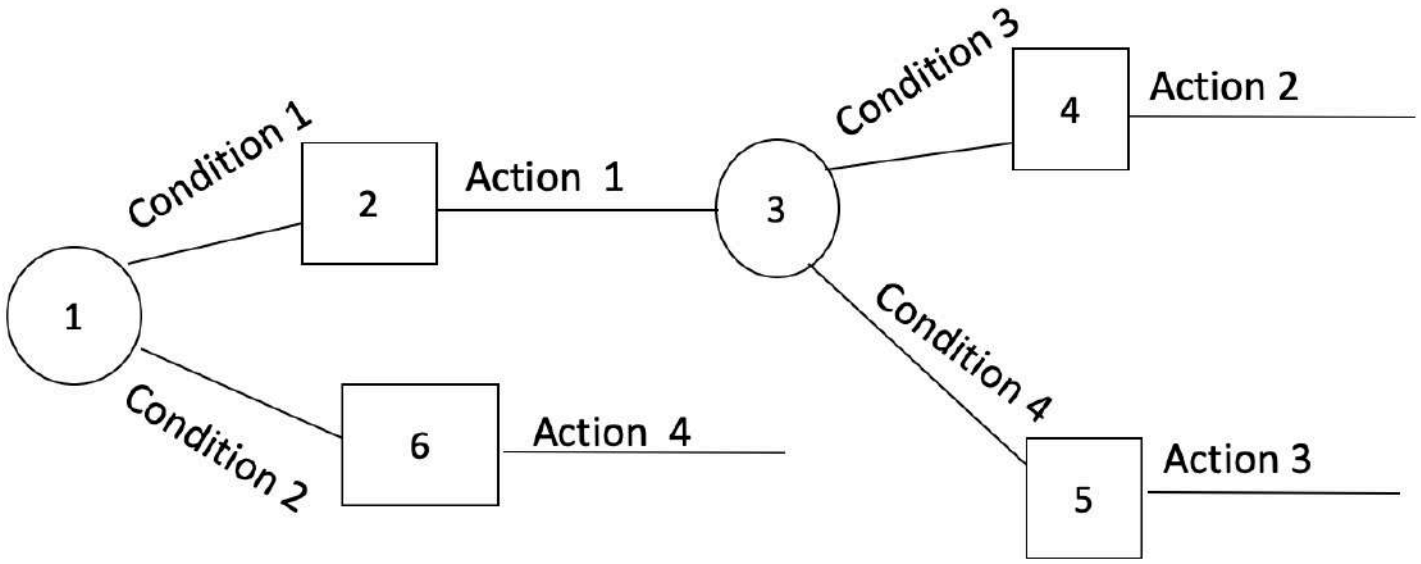
- Drawing Decision Tree

DECISION TREE

- Decision trees are used when complex branching occurs in a structured decision process
- Trees are also useful when it is essential to keep a string of decisions in a particular sequence
- Advantages:
  - The order of checking conditions and executing actions is immediately noticeable
  - Conditions and actions of decision trees are found on some branches but not on others
  - Compared to decision tables, decision trees are more readily understood by others in the organization

DRAWING DECISION TREE

- Identify all conditions and actions and their order and timing (if they are critical)
- Begin building the tree from left to right, making sure you list all possible alternatives before moving to the right



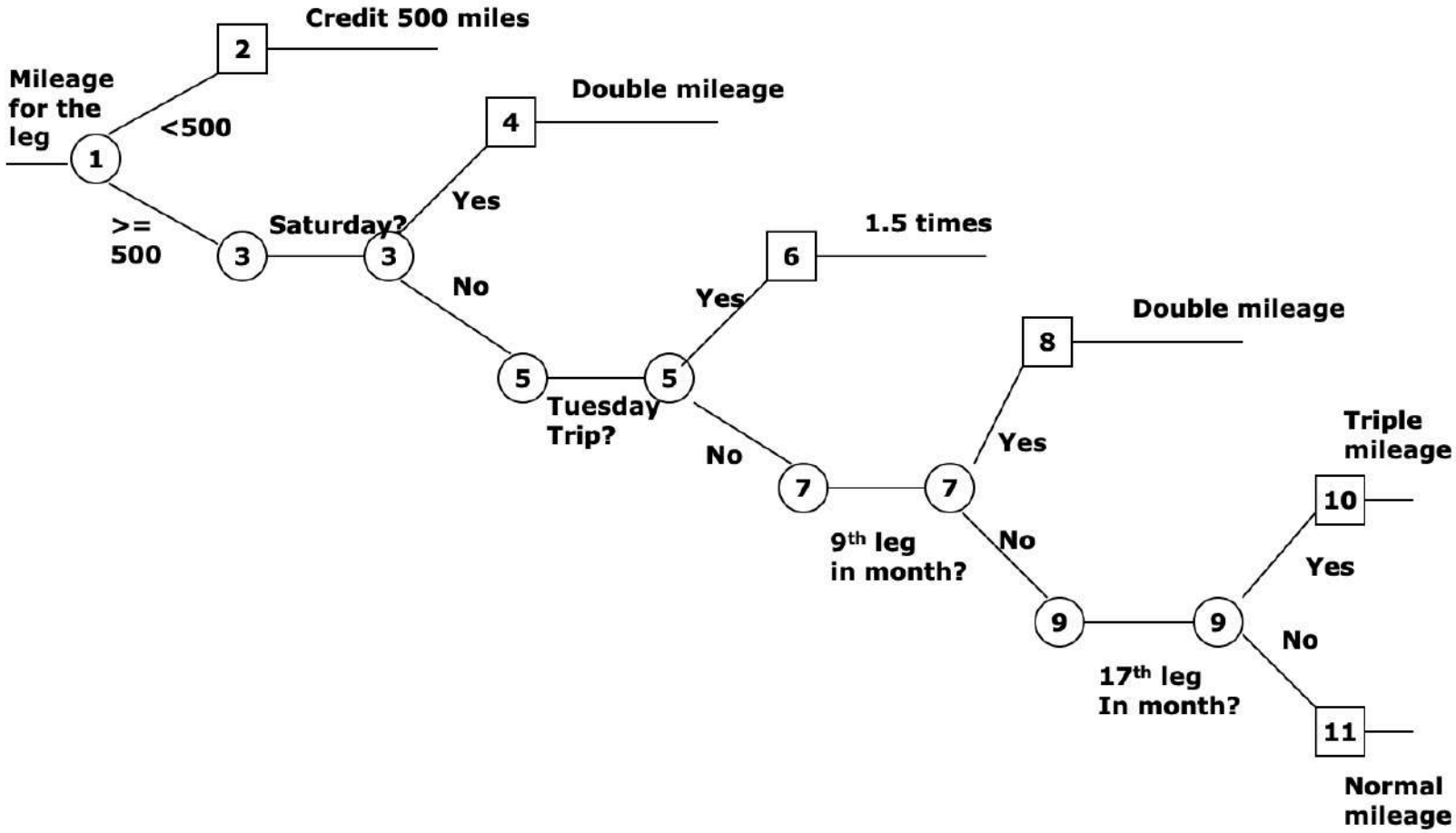
DECISION TREE EXAMPLE

A policy for Premium Airlines : Accumulating Miles For Awards, as explained by Glen Curtis (marketing manager)

"The traveler will be awarded the miles actually flown. If the actual mileage for the leg was less than 500 miles, the traveler will get 500 miles credit. If the leg was exactly or more than 500 miles and the trip was made on Saturday, the actual mileage will be multiplied by 2. If the trip was made on Tuesday, the multiplication factor is 1.5. If this is the ninth leg traveled during the calendar month, the mileage is doubled no matter what day, and if it is the seventeenth leg traveled, the mileage is tripled."

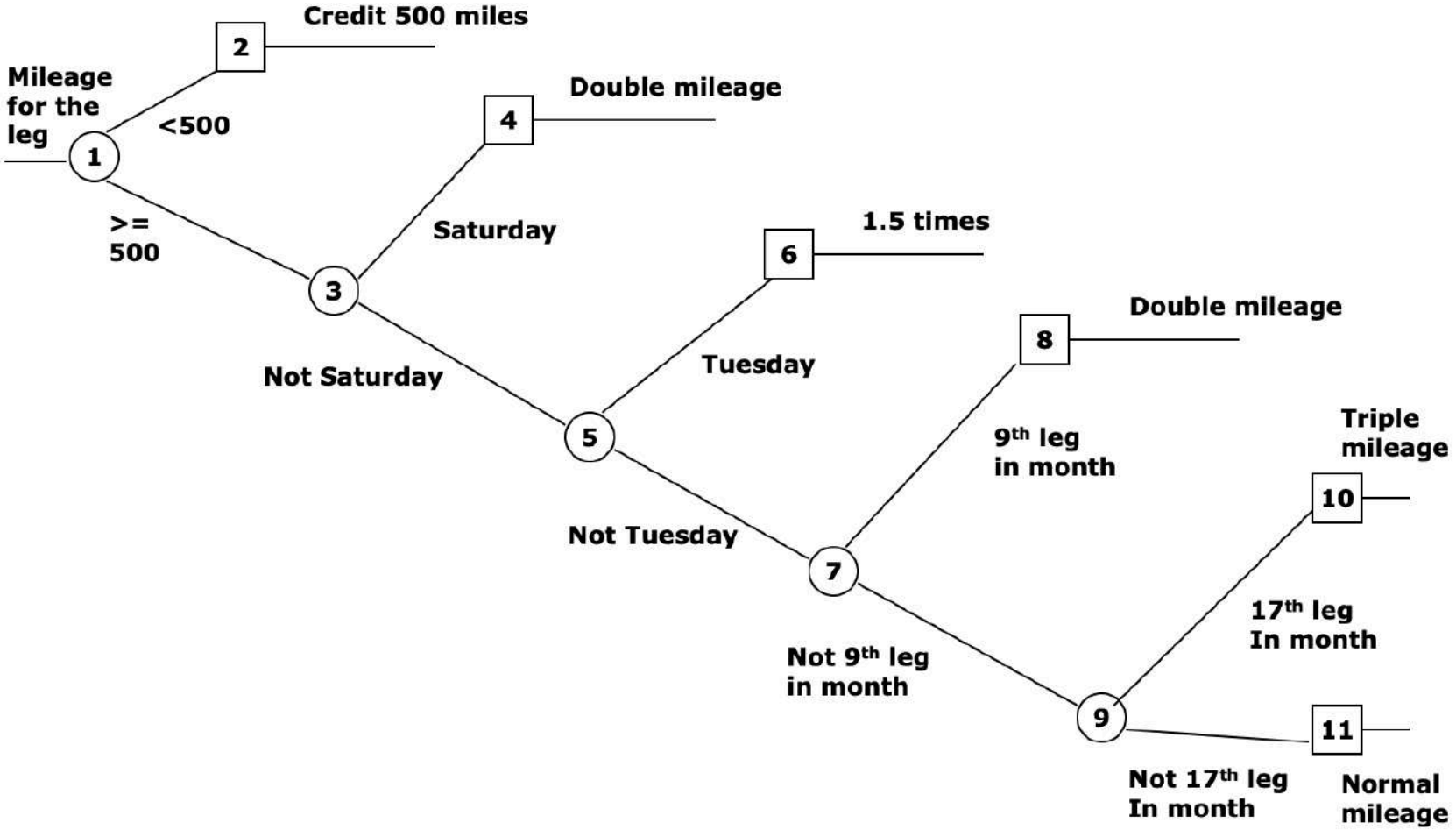
DECISION TREE EXAMPLE

Solution 1



DECISION TREE EXAMPLE

Solution 2



LET'S TRY

Checkpoint 3: Decision Tree

Based on your answer for the *Decision Table in Checkpoint 2*, draw a decision tree for Encik Amir's office reimbursement policies.

(from Checkpoint 1)

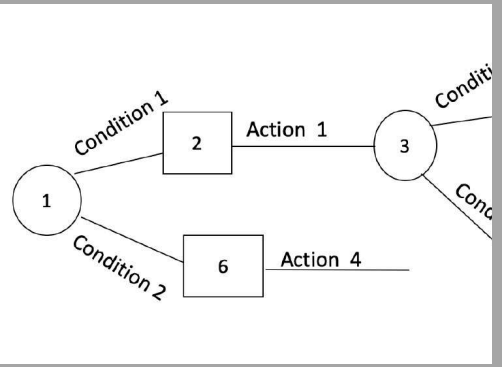
"Our reimbursement policies depend on the situation. You see, first we determine if it is a local trip. If it is, we only pay mileage of 18.5 cents a mile. If the trip was a one-day trip, we pay mileage and then check the times of departure and return. To be reimbursed for breakfast, you must leave by 7:00 A.M., lunch by 11:00 A.M., and have dinner by 5:00 P.M. To receive reimbursement for breakfast, you must return later than 10:00 A.M., lunch later than 2:00 P.M., and have dinner by 7:00 P.M. On a trip lasting more than one day, we allow hotel, taxi, and airfare, as well as meal allowances. The same times apply for meal expenses."

WHEN SHOULD BE USED?

```
DO
READ product's code
BEGIN IF
IF code  start with "F"
    ADD name, quantity, produ
      ACCUMULATE the numbers
IF code  start with "D"
     ADD name, quantity, proc
    ACCUMULATE the numbers of
IF code  start with "DE"
```

STRUCTURED ENGLISH

- It is well suited to modeling processes with many sequential steps and relatively simple control logic. It is not suitable for describing complex decision logic or few or no sequential processing steps. This technique is **complimentary with DFD** to designing a mini-spec for the certain process element of DFD.



DECISION TREE & TABLE

- It is used to summarizing complex decision logic more concisely than structured English. It is easier to describing the "branch" logic by using decision tree rather than decision table. These techniques are **complimentary with DFD** when importantly used to designing a mini-spec for the certain process element of DFD.

SUMMARY – DECISION ANALYSIS

- Selecting a structured decision analysis technique – What to consider?

	WHEN TO USE?	ADVANTAGES
STRUCTURED ENGLISH	When there are many repetitious actions or when communication to end users is important	Useful when many actions are repeated and when communicating with others is important
DECISION TABLES	When a complex combination of conditions, actions, and rules are found or you require a method that effectively avoids impossible situations, redundancies, and contradictions	Provide complete analysis of complex situations while limiting the need for change attributable to impossible situations, redundancies, or contradictions
DECISION TREES	When the sequence of conditions and actions is critical or when not every condition is relevant to every action (the branches are different)	Important when proper sequencing of conditions and actions is critical and when each condition is not relevant to each action

HOMEWORK Checkpoint 4: Final Exam 2016/2017

Your company has been hired as IT consultant to assist 'Exotic Treat' company in developing a newly system that allows their customer to purchase homemade sweets and cakes through online booking application. One of your job as the in-charge Business Analyst is to assist the development team in analyzing the detail process and logic flows for the determination of total payment invoice. The criteria in calculating the total payment invoice are as follows:

- Customers with e-coupon will be granted for $10 discounts less for each total payment invoice
- Customers who spent more than $250 purchase items with:
  i. Numbers of order items (more OR less than 4 order items);
  ii. Choices of delivery day once the order is placed (next day, second day, OR seventh day)

The specific conditions to calculate total payment invoice are summarized using the decision table in **Table 1.**

a) Construct an optimized decision tree to demonstrate the logic conditions and actions sequences of process flows in calculating the total payment invoice (8 marks)

b) In your opinion, which method (decision table or decision tree) is more helpful to analyze the process flows in calculating total payment invoice? Justify your reason. (2 marks)

Total $purchase > $250	YES						NO					
Number of items (n)	N ≤ 3			N ≥ 4			N ≤ 3			N ≥ 4		
Delivery day	Next	2nd	7th	Next	2nd	7th	Next	2nd	7th	Next	2nd	7th
Delivery $charge	25	10	n*1.5	n*6.0	n*2.5	Free	35	15	10	n*7.5	n*3.5	n*2.5
e-Coupon	YES						NO					
Total invoice ($)	(Total $purchase + Delivery $charge) – $10 discounts less						Total $purchase + Delivery $charge					

Table 1: Decision table for calculating shipping charges and total invoice

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Thank You

update: August 2019 (sharinhh)

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