

SCSD2613

System Analysis and Design



PART IV

The Analysis Process #2:

Process Specifications & Structured Decisions

www.utm.my

innovative • entrepreneurial • global



univteknologimalaysia



utm_my



utmoofficial

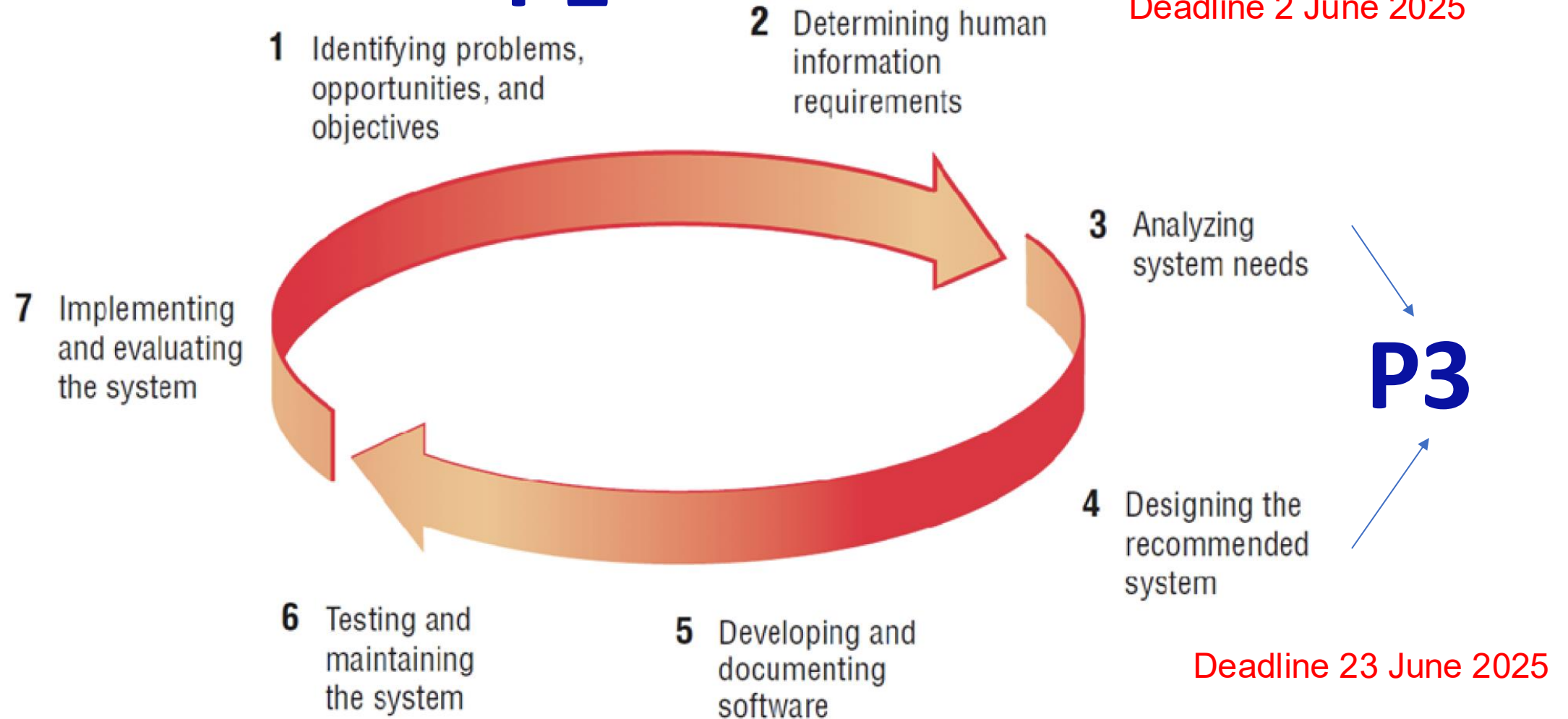
SDLC

Deadline 12 May 2025

P1

P2

Deadline 2 June 2025



■ OBJECTIVES

At the end of this topic, students shall be able to:

- i. Understand the purpose of process specifications in analyzing, describing and documenting structured decisions.
- ii. Produce process specification using structured English, decision tables, and decision trees
- iii. Choose an appropriate decision analysis method for analyzing structured decisions and creating process specifications.

■ LOGIC OF DECISION

- Methods of documenting and analyzing logic:
 - Structured English
 - Decision tables
 - Decision trees
- Important to distinguish between logic and structured decisions with semi-structured decisions
 - Semi-structured decisions may involve human judgement
- Structured decision analysis methods promote completeness, accuracy, and communication



wiki How to Decide on Your Major

■ 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

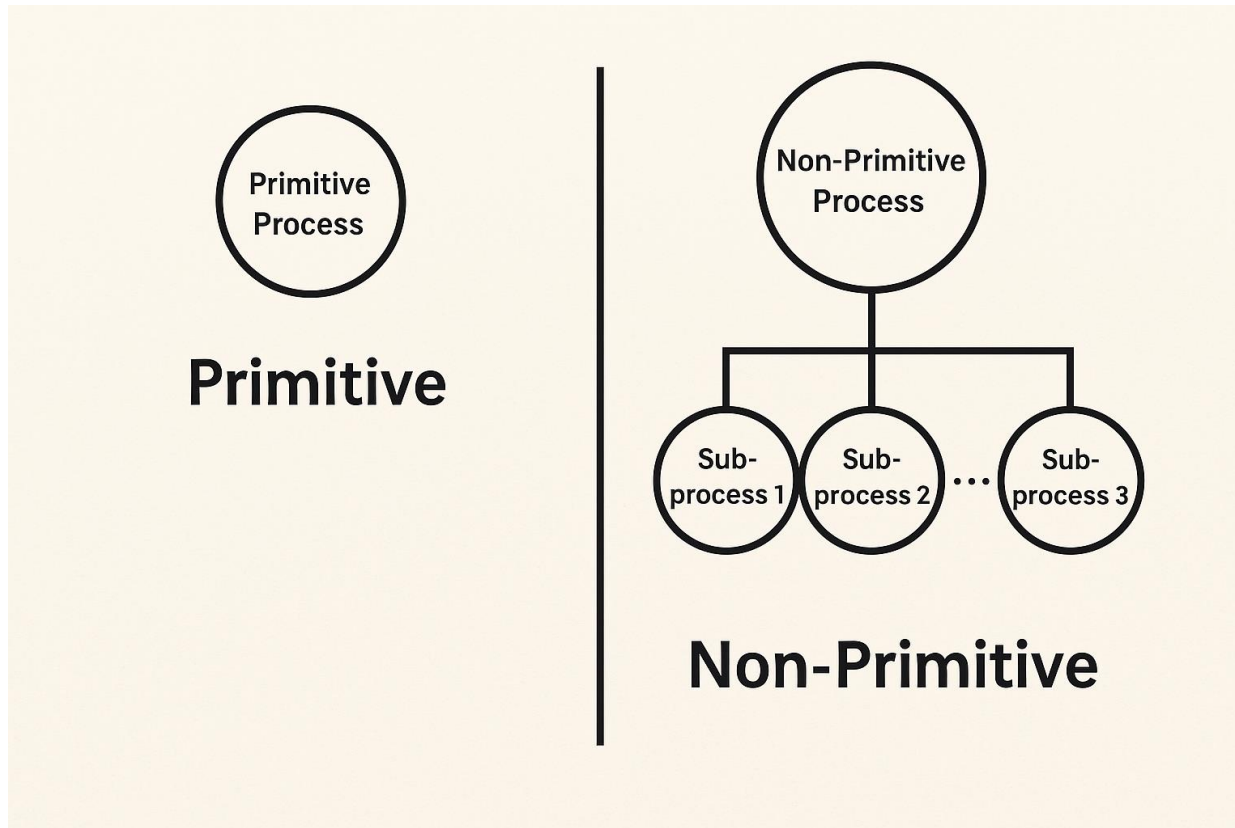
- Drawing Decision Tree

PART 1

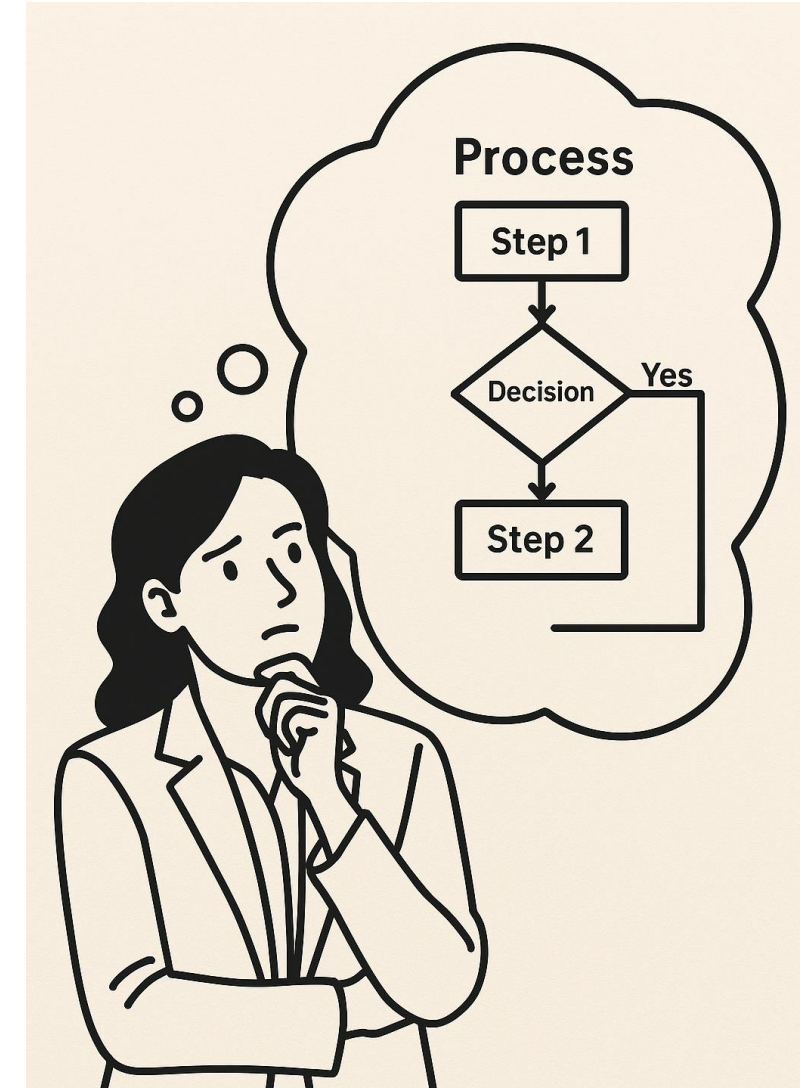
- Process Specification

What does a DFD shows?

What is a Primitive Process?



What is a Process Specification?



What is a Process Specification? An Example

Online Scholarship Application System

What the System Does:

Students apply for scholarships via an online form. The system automatically determines:

- **Whether the student is eligible?**
- **Which scholarship they qualify for?**

Example of criteria for selection?

1. **CGPA > 3.7**
2. **??**
3. **??**
4. **??**

■ BUSINESS RULES

- What are 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

PROCESS SPECIFICATIONS

- Sometimes called **minispecs**
- Created for:
 - In DFD - **primitive** processes
 - Primitive process - a process that cannot be exploded further.
 - Logic for this process need to be written to describe the primitive process.
- **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

User enters data into a form
System prints a receipt
Displays a confirmation message



Processes that represent simple data validation

Processes that check for:

- Empty fields
- Correct format (e.g., email, phone number)
- Basic rules like "age must be > 18"

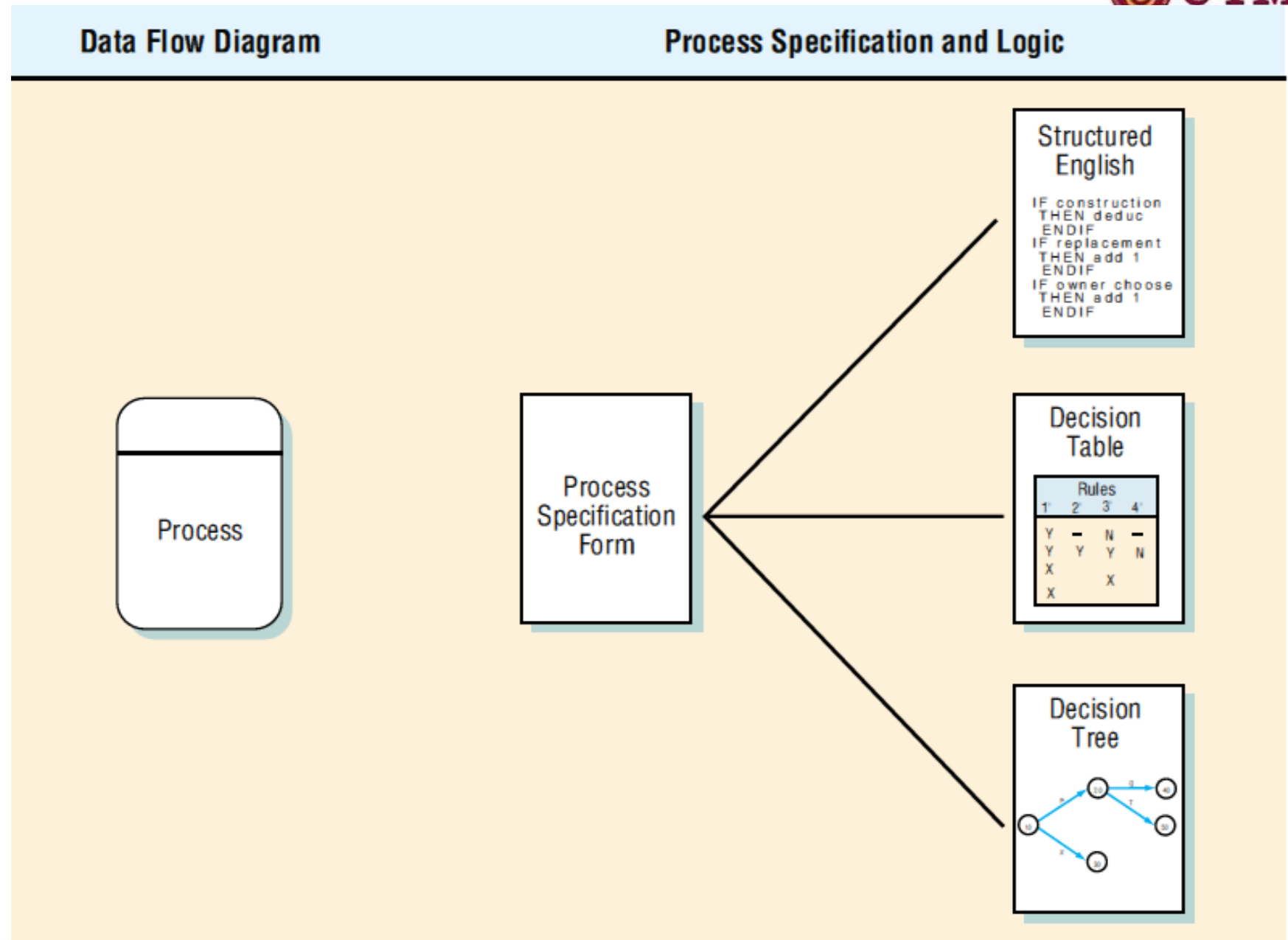


Processes that use prewritten code

This refers to:

- Built-in system functions
- Reused modules or packages
- External APIs where the logic is already encapsulated

HOW PROCESS SPECIFICATION RELATE TO DFD



Example of Process Specification Form

Process Specification Form	
Number <u>1.3</u> Name <u>Determine Quantity Available</u> Description <u>Determine if an item is available for sale. If it is not available, create a backordered item record. Determine the quantity available.</u>	
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 <input checked="" type="checkbox"/> Online <input type="checkbox"/> Batch <input type="checkbox"/> Manual	Subprogram/Function Name
Process Logic: IF the <u>Order Item Quantity</u> is greater than <u>Quantity on Hand</u> Then Move <u>Order Item Quantity</u> to <u>Available Item Quantity</u> Move <u>Order Item Number</u> to <u>Available Item Number</u> ELSE Subtract <u>Quantity on Hand</u> from <u>Order Item Quantity</u> giving <u>Quantity Backordered</u> Move <u>Quantity Backordered</u> to <u>Backordered Item Record</u> Move <u>Item Number</u> to <u>Backordered Item Record</u> DO write <u>Backordered Record</u> Move <u>Quantity on Hand</u> to <u>Available Item Quantity</u> Move <u>Order Item Number</u> to <u>Available Item Number</u> ENDIF	
Refer to: Name: _____ <input type="checkbox"/> Structured English <input type="checkbox"/> Decision Table <input type="checkbox"/> 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?	

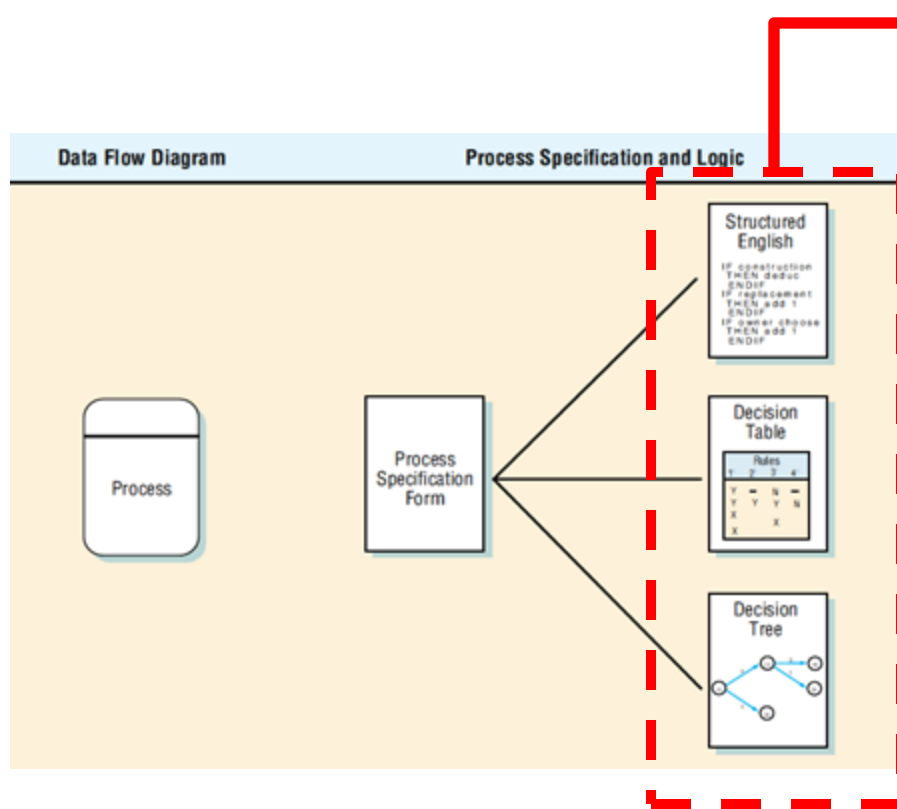
PROCESS SPECIFICATION FORMAT

- Items on a process specification form:

	PROCESS SPECIFICATION ITEMS	DESCRIPTION
1	The process number	<ul style="list-style-type: none"> 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	<ul style="list-style-type: none"> Must be the same name as the process name on the DFD
3	The process description	<ul style="list-style-type: none"> Brief description of the process. Example: <i>Determine if an item is available for sale. If it is not available, create a backordered item record. Determine the quantity available.</i>
4	A list of input data flow	<ul style="list-style-type: none"> 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	<ul style="list-style-type: none"> Uses the names found on the data flow diagram and data dictionary.

	PROCESS SPECIFICATION ITEMS	DESCRIPTION
6	Type of process	<ol style="list-style-type: none">1. Batch2. Online - require screen design or web pages3. Manual - should have well-defined procedures for employees performing the process tasks
7	Name of the subprogram or function	<ul style="list-style-type: none">• If the process uses a subprogram or function, include the name of the subprogram or function containing the code
8	Process logic description	<ul style="list-style-type: none">• Description of the process logic that states the policy and business rules. Written in everyday language not computer language pseudo-code• Business rules* are the procedures or a set of conditions or formulas, that allow a corporation to run its business
9	Logic method reference	<ul style="list-style-type: none">• 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	<ul style="list-style-type: none">• 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



All three tools are used to document and clarify the **logic of a process**, especially **structured decisions** (i.e., decisions based on specific rules, not human judgment).

They Can Be Derived from One Another

You can:

- Start with **Structured English** to clarify logic
- Then translate that logic into a **Decision Table** (to check for completeness)
- Or visualize it in a **Decision Tree** (to clarify the sequence and flow)

Tool	Format	Strength
Structured English	Textual / Pseudo-code	Easy to read, step-by-step flow
Decision Table	Tabular	Shows all combinations of conditions
Decision Tree	Diagram/Flowchart	Shows sequence of decisions and actions visually

Structured English is like writing **instructions**, while Decision Tables are like making sure you've **covered every situation/multiple rules** and Decision Trees help you **see the path** your decision takes.

What is a Process Specification? An Example

Online Scholarship Application System

What the System Does:

Students apply for scholarships via an online form. The system automatically determines:

- **Whether the student is eligible?**
- **Which scholarship they qualify for?**

Example of criteria for selection?

1. **CGPA \geq 3.7**

STRUCTURED ENGLISH

```
IF GPA  $\geq$  3.0 THEN  
    APPROVE application  
ELSE  
    REJECT application
```

Example of criteria for selection?

1. **CGPA ≥ 3.7**
2. **Family income**
3. **Extra curricular activities**

DECISION TABLE

Conditions	Rule 1	Rule 2	Rule 3	Rule 4
GPA ≥ 3.75	Y	Y	N	N
Family income < RM3000	Y	N	Y	N
Extracurricular activities = "High"	Y	Y	N	Y
Action: Award Type	A	B	C	Reject

Decision Table

- ◆ **A** = Full Scholarship
- ◆ **B** = Partial Scholarship
- ◆ **C** = Tuition Only

PART 2

- Structured English

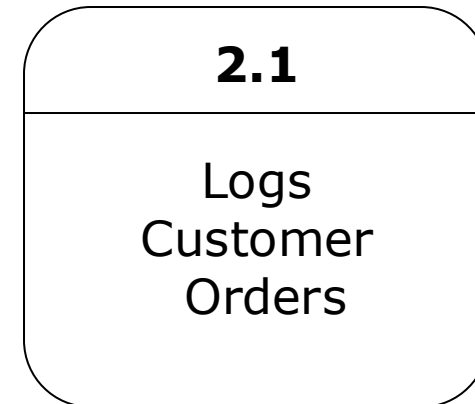
■ STRUCTURED ENGLISH

- 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

DATA DICTIONARY

A data dictionary is a collection of descriptions of data elements, including their names, types, formats, and other properties.

Data Dictionary			
Element Name	Data Type	Length	Description
Student ID	Integer	8	Unique identifier Full name of student
Student Name	String	30	
Date of Birth	Date		
GPA	Decimal		Grade point average

ADD discount TO total_price

You must know:

discount and total_price are numeric, not text

Both come from the data dictionary, which defines them



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.

PART 3

- 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

DECISION TABLE: PREVIOUS EXAMPLE

Example of criteria for selection?

1. **CGPA ≥ 3.7**
2. **Family income**
3. **Extra curricular activities**

DECISION TABLE

Conditions	Rule 1	Rule 2	Rule 3	Rule 4
GPA ≥ 3.75	Y	Y	N	N
Family income < RM3000	Y	N	Y	N
Extracurricular activities = "High"	Y	Y	N	Y
Action: Award Type	A	B	C	Reject

Decision Table

- ◆ **A** = Full Scholarship
- ◆ **B** = Partial Scholarship
- ◆ **C** = Tuition Only

■ 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 On

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		

Conditions and Actions	Rules			
	1'	2'	3'	4'
Customer ordered from Fall catalog.	—	—	—	—
Customer ordered from Christmas catalog.	Y	—	N	—
Customer ordered from specialty catalog.	Y	N	Y	—
Customer ordered \$50 or more.	Y	Y	Y	N
Send out this year's Christmas catalog.		X		
Send out specialty catalog.			X	
Send out both catalogs.	X			
Do not send out any catalog.				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				

This is an impossible situation.

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			X	
Action 3							X

Contradiction (Rules 1, 2, 3) **Redundancy** (Rules 4, 5)

PAGES
288 - 292

Have the same conditions but different results

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.”

PART 4

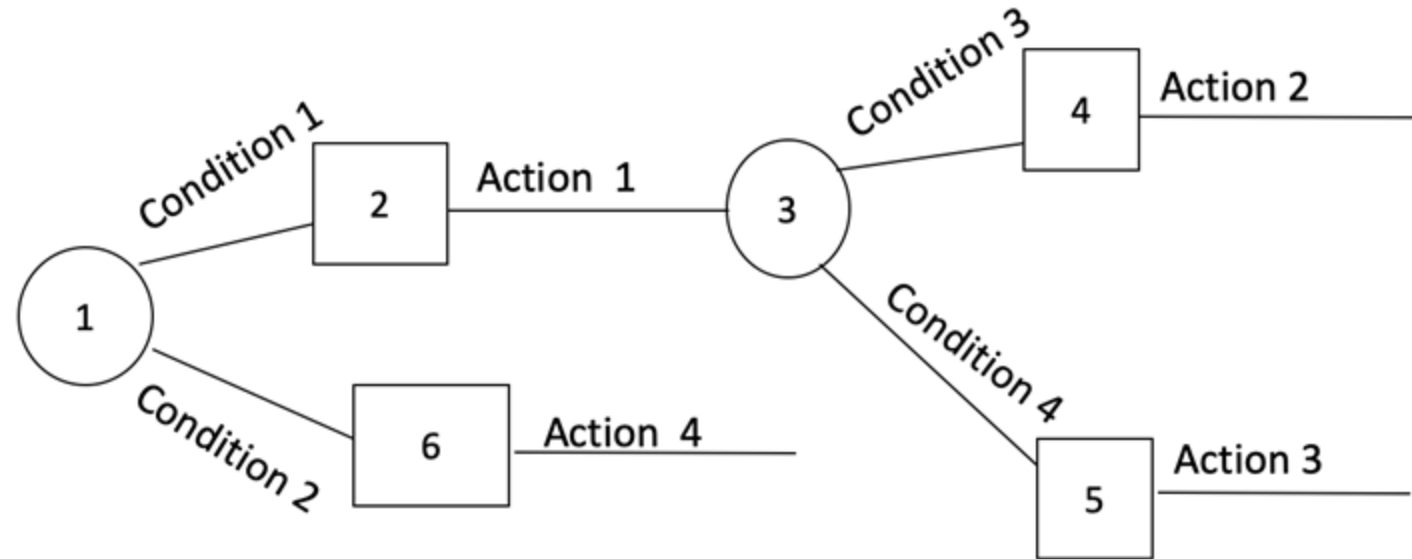
- Decision Tree

■ 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



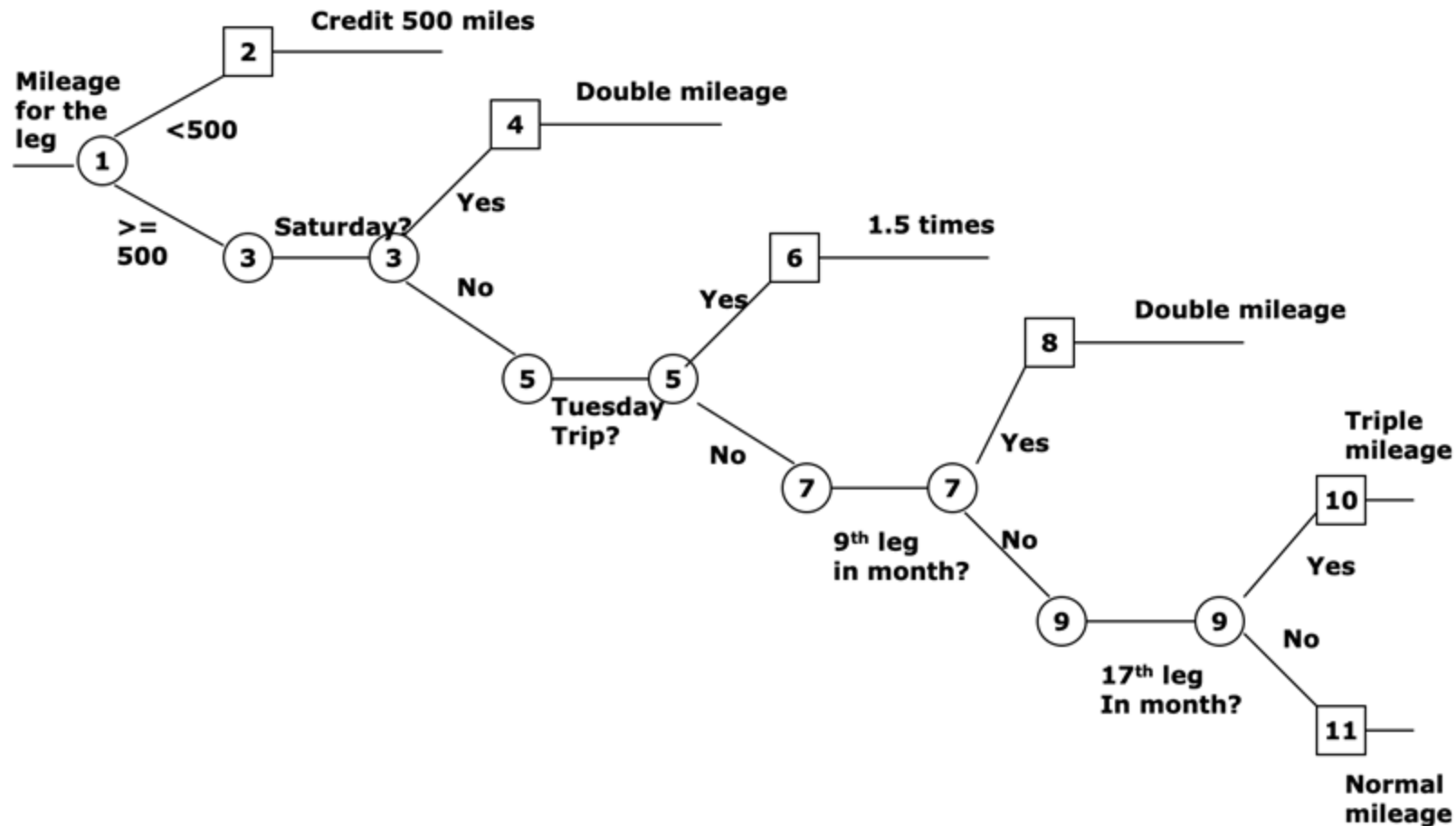
■ DECISION TREE EXAMPLE

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.”

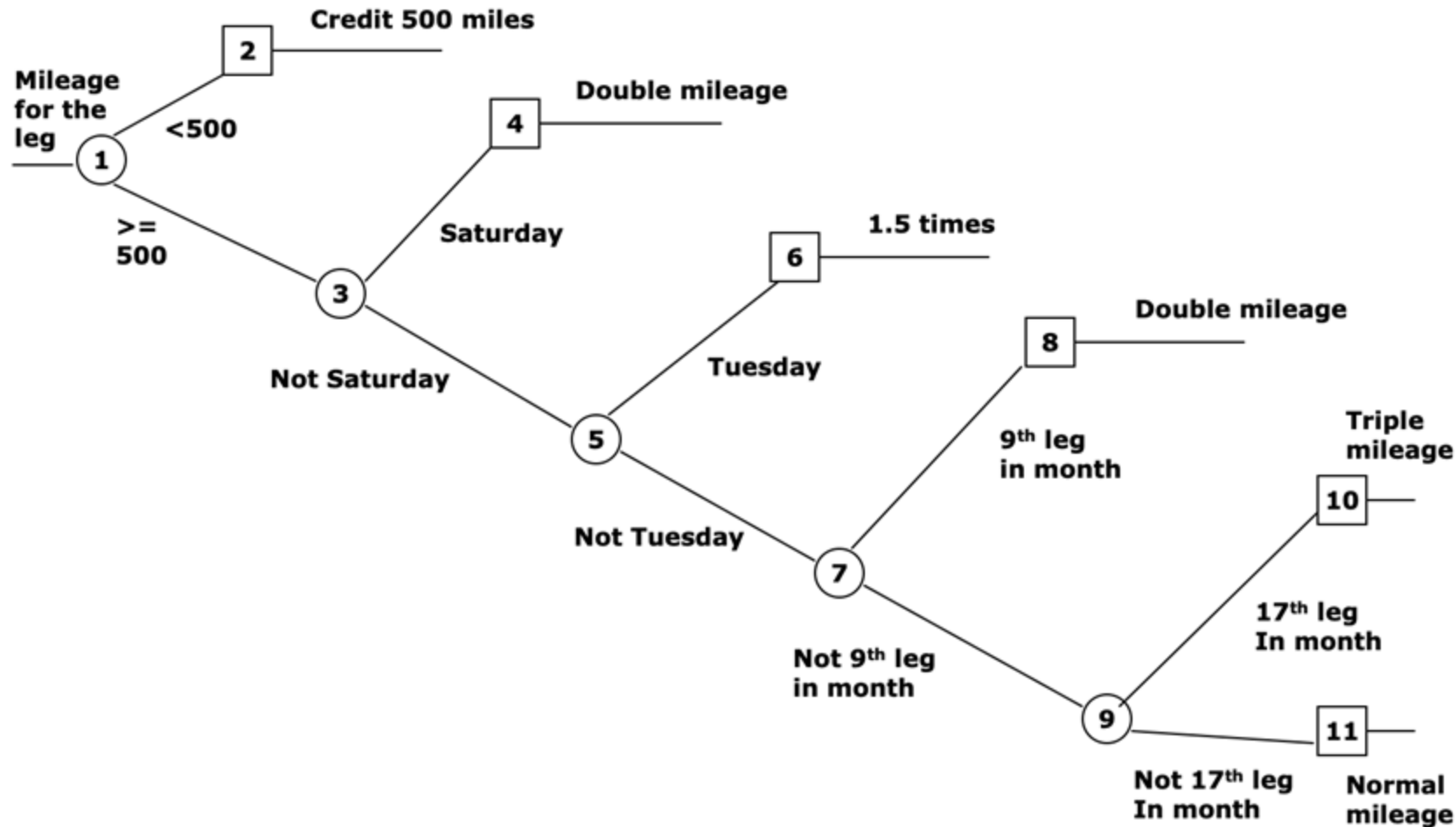
DECISION TREE EXAMPLE

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?

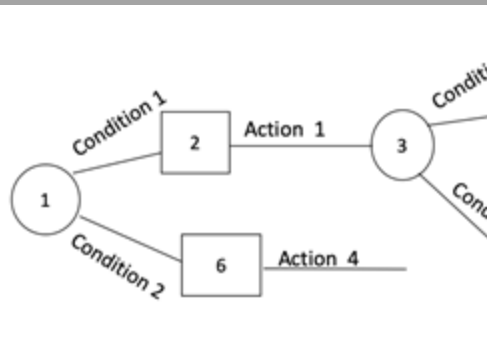
```

DO
READ product's code
BEGIN IF
IF code start with "F"
    ADD name, quantity, prod
    ACCUMULATE the numbers
IF code start with "D"
    ADD name, quantity, prod
    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

	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

REMINDER: PEER ASSESSMENT

GROUP TASK

Case Study Title:

Student Loan Application Process – "EduFund Student Loan Portal"

Scenario Overview:

EduFund is a newly launched online student loan application portal for university students. The process allows students to apply for tuition fee loans, and decisions are made based on a set of business rules.

Loan Eligibility Business Rules:

1. A student must be enrolled in a local accredited university.
2. For full loan:
 - Household income must be less than RM3000.
 - GPA must be at least 3.5
3. For partial loan:
 - Household income between RM3000 and RM6000.
 - GPA must be at least 3.00.
4. If the student does **not meet** either condition, the loan is rejected.
5. If approved, loan disbursement depends on:
 - If tuition fee < RM10,000 → full disbursement
 - If tuition fee ≥ RM10,000 → split disbursement into two phases
6. If student has existing unpaid loans, application is rejected.



UTM
UNIVERSITI TEKNOLOGI MALAYSIA



univteknologimalaysia



utm_my



utmofficial

Thank You

update: August 2019 (sharinhh)

www.utm.my

innovative • entrepreneurial • global