Lecture notes on

Decision tree and Decision Table
for 2nd Semester
(BCA-1205)

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Decision Table Vs Decision Tree:

Decision Table :

A decision table is a table that indicates conditions and actions in a simplified and orderly manner.

Decision tables are used to model complicated logic. It shows that all possible combinations of conditions have been considered and when conditions are not met, it is easy to see.

A decision table can be described as cause-effect table and is the best way to deal with combination inputs with their associated outputs.

It is an excellent tool to use in both testing and requirements management. Using decision tables it become easier for the requirements specialist to write requirements which cover all conditions.

In a decision table, the logic is well divided into **conditions, actions** (decisions) and rules for representing the various components that form the logical model.

The general format of a decision table has four basic parts.

1) Action entry: It indicates the actions to be taken.

2) Condition entry: It indicates conditions which are being met or answers the questions in

        the condition stub.

3) Action stub: It lists statements that describe all actions that can be taken.

4) Condition stub: it lists all conditions to be tested for factors necessary for taking a decision.

A **decision table** is a table of rows and columns separated into four quadrants.

In a **decision table**, the inputs are listed in a column, with the outputs in the same column but below the inputs.

Using decision tables make it possible to detect combinations of conditions either not tested or developed.

Decision tables should best be constructed during system design then they become useful to developers, testers and end-users.

Decision table testing is a black box test design technique to determine the test scenarios for complex business logic.

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There are two types of decision tables :

i)   extended entry table

ii)   limited entry table.

In **extended entry table** both the entry and stub section of any specific condition must be considered together if a condition is applicable to a given rule.

In **limited entry tables** the conditions or actions required are contained within the appropriate stubs.

To built decision tables, the analyst needs to determine the maximum size of the table; eliminate any impossible situations, inconsistencies or redundancies and simplify the table as much as possible.

Decision table shows conditions and actions in a simplified and orderly manner

Advantages Of Decision Table :

- Decision rules are clearly structured.

- Easy to use.

- Easier to draw or modify in comparison to flowcharts.

- They provide more compact documentation.

- Documentation is easily prepared , changed or updated.

- Decision tables can be changed easily according to the situation.

- Decision tables summarize all the outcomes of a situation and suggest suitable actions.

- Decision tables have a standard format.

Disadvantages Of Decision Tables :

- Decision tables do not show the flow of logic for the solution to a given problem.

- Decision table cannot list all alternatives.

- Not easy to translate it.

- Impose an additional burdens.

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- Decision tables only present a partial solution.

Decision Tree :

A decision tree is a decision tool that uses a branching method to illustrate every possible outcome of a decision.

Decision trees can be drawn by hand or created with a graphics program or specialized software. A decision tree begins with a single node, which have branches into possible outcomes. Each of those outcomes results to additional nodes, which branch off into other possibilities. This gives it a tree-like shape.

In decision tree (tree structure), the nodes representing the place where we pick an attribute and ask a question; edge represents the answers to the question and the leaves represent the actual output.

Decision trees demonstrate cause-effect relationships, which provides a simplified view of complicated process.

Basic assumptions for creating a decision tree:

- At the beginning, all possible set is taken as root.

- Records are distributed recursively on the basis of attribute values.

- Order to placing attributes as root or internal node of the tree is used to defined the problem.

It describes graphically all the possible alternatives, probabilities and outcomes and identifies the benefits of using decision analysis.

The decision tree is generally read from top (root) to the bottom (leaves). A question is asked at each node and the response to that question determines which branch is followed next. The prediction is given by the label of a leaf.

Decision trees can be drawn by hand or created with a graphics program or specialized software.

The goal of decision tree is to create a model that predicts the value of a target variable depended on the data features.

Decision trees are used in operation research which helps to identify a strategy to reach the goal.

In decision tree, the sample is split into two or more sets based on an input data.

There are two types of decision tree.

- categorical variable decision tree

- continuous variable decision tree.

In a decision tree, data type is never a constraint; it can handle both numerical and categorical variables.

Decision trees have no assumptions about the space distribution and the classifier structure.

Advantages Of Decision Trees :

- Decision trees provide a clear indication for prediction or classification.

- The Decision tree output is easy to read and interpret.

- It is able to generate understandable rules.

- It requires relatively little effort from users for data preparation.

- Decision trees perform classification without requiring much computation.

- Decision trees can handle both numerical and categorical variables.

Disadvantages Of Decision Trees :

- Decision trees are less appropriate for estimation tasks where the goal is to predict the value of a continuous attribute.

- They are unstable because a small change in the structure of the optimal decision tree.

- They are relatively inaccurate when compared to other predictors. Many other predictors perform better with similar data.

- Calculations can get very complex if many values are uncertain if many outcomes are linked.

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Difference Between Decision Tree And Decision Table:

BASIS OF COMPARISON	DECISION TABLE	DECISION TREE
DESCRIPTION	A decision table is a table that indicates conditions and actions in a simplified and orderly manner.	A decision tree is a graphical representation of possible solutions to a decision based on certain conditions.
PURPOSE	The purpose of a decision table is to structure logic by generating rules derived from the data entered in the table itself.	The purpose of a decision tree is to give an effective and easy way to visualize and understand the potential options of a decisions and its range of possible outcomes.
TYPES	Types of decision tables are extended entry table and limited entry table.	There are two types of decision tree; they include categorical variable decision tree and continuous variable decision tree.
Conditions	Decision tables will always have the same number of conditions that need to be evaluated and actions that must be performed even if the set of branches being analyzed is resolved to true.	A decision tree can have one branch with more conditions that need to be evaluated than other branches on the tree.
Representation	A decision table lists causes (business rule condition), which are represented through the use of matrix where each column represents a unique combination.	Each branch of the decision tree represents a decision option, its cost and the probability that it is likely to occur.
Analysis	Each row of a decision table collects and stores its data separately and then combines the data with a specific or customized template to generate a rule.	A decision tree creates a comprehensive analysis of the consequences along each branch and identifies decisions that need further analysis.
Communication Flexibility	Flow charts, symbols are not always standardized and this sometimes hinders their communication value.	The nodes are always standardized and hence the tree output is easy to read and interpret.

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