UNIVERSITÄT KOBLENZ · LANDAU

IWVI

BUSINESS PROCESS MANAGEMENT

BUSINESS RULES & BUSINESS RULES MANAGEMENT
PART 1A: BUSINESS RULES AS QUERY INPUTS
PART 1B: DECLARE

AGENDA

- Business Rules Introduction
- Business Rules Management
  - Part I (today) – Capturing & Authoring
  - Part II (next week) – Organizing & Implementing

MOTIVATION

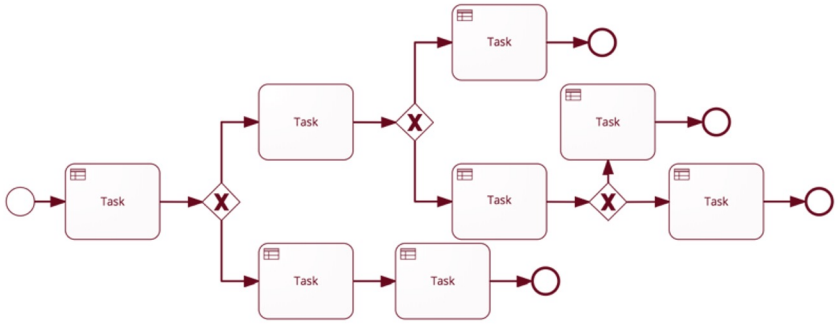
- CTL / GMQL / DMQL are great, but we also need to know what we should search for!

- Main areas of interest in the Information Systems discipline
  - Business Process Improvement
  - Business Process Compliance Management

- In both areas of interest, we want to know in which places our business processes contain problematic structures or behavior

WHAT ARE BUSINESS RULES?

- Model queries normally check so-called business rules
- Business rules depict principles that business processes must comply with
  - concerning their structure
  - concerning the behavior of single instances



BUSINESS RULES DEFINITION

- A business rule is a compact, atomic, well-formed, declarative statement about an aspect of a business, using simple unambiguous language

- General form: IF A_1, A_2, …, A_n THEN B

- With business rules, we can express rules about a domain of interest

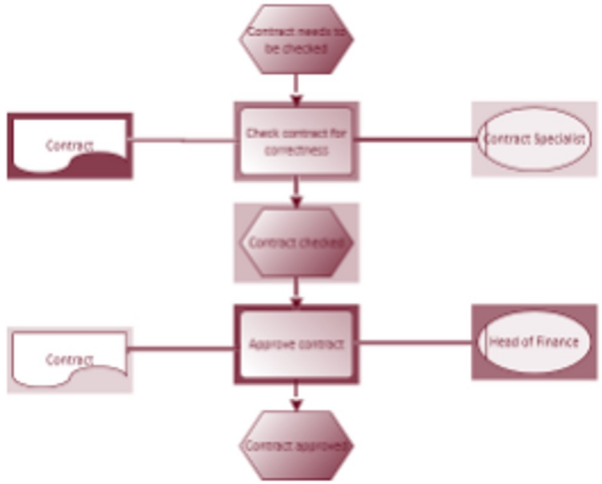
EXAMPLES FOR BUSINESS RULES

- Structure and common behavior-related rules:
  see examples from the last three lectures

- Behavior of single instances:
  - Bob is only credit-worthy, if his credit history score is better than BBB and he is older than 24 years and he has no mental condition problems

WHY DO WE NEED BUSINESS RULES?

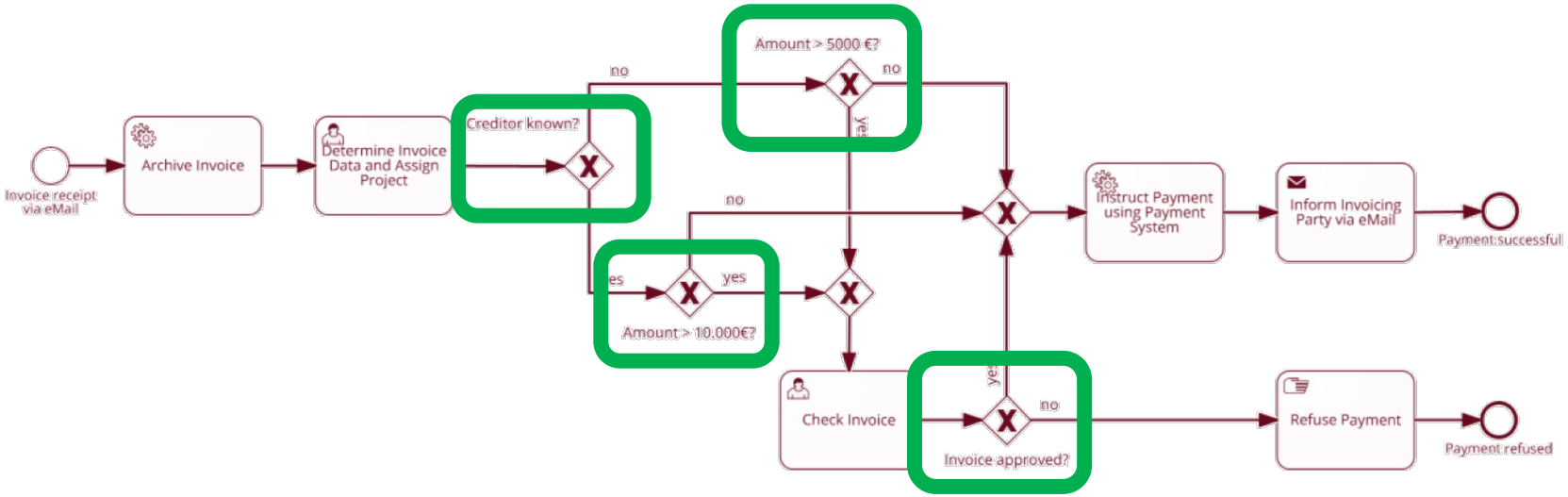
- Ensure the compliance of business process(es) (models), resp. company activities
  - Rules and regulations affect companies and how they are allowed to conduct activities
    - E.g. Sarbanes-Oxley Act
    - Basel III
    - Recent debate on Article 13 of German UrhG



"A loan application must always be approved by the supervisor (4-eye-principle)"

MOTIVATION FOR ABSTRACTION

- Process models may contain multiple rules



- Makes models unclear
- Slows down (automatic) analysis (!)

[© viadee]

BUSINESS RULE MANAGEMENT

- Exemplary Lifecycle Model (Nelson et al. (2009))
- Systematic Methodology to derive and implement a set of business rules

- Plan
  - Identify company processes/legal domains
  - Assign human resources
- Capture
  - Identify: What are the relevant business rules?
- Author
  - Formalize Business Rules
- Organize
  - Ensure the formalized set of business rules is correct/sound
- Apply
  - Utilize business rules to ensure compliant processes/models

BUSINESS RULE MANAGEMENT

Today

Next week

BUSINESS RULE MANAGEMENT

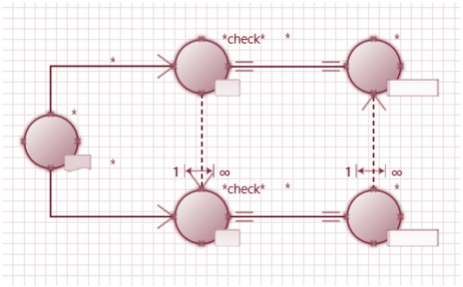
CAPTURE

PROCEDURE

Where does this come from?

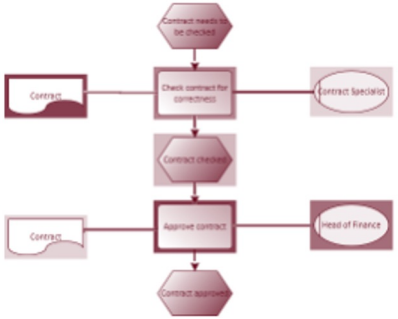
- Description of a shortcoming/violation

Transformation



- Pattern of a model query language

Query



- Query results

SOURCES OF KNOWLEDGE

SHORTCOMINGS AND VIOLATIONS

- Own experiences
- Consultants
- Checklists
- For compliance: compliance rule providers
- Rule mining
- Weakness pattern collections
- Compliance pattern collections

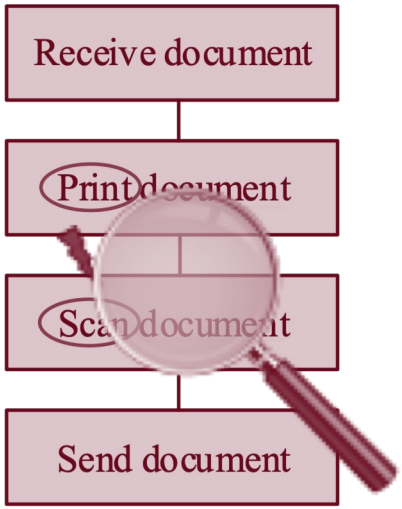
PROBLEMATIC STRUCTURES OR BEHAVIOR

- Business Process Improvement (BPI):
  Eliminate inefficiencies and quality shortcomings and replace corresponding process structures

- Business Process Compliance Management (BPCM):
  Eliminate illegal behavior, violation of corporate guidelines and/or violation of generally accepted rules (e.g., proposed by compliance task forces such as the Sarbanes-Oxley-Act, Basel III, MaRisk etc.)

OVERVIEW OF PROBLEMATIC STRUCTURES AND BEHAVIOR (BPI)

- Overview based on empirical findings
- Manual (!) analysis of over 2000 business process models
- Evaluation of the models by 15 business process management experts
- Double analysis (4-eye-principle)
- Detection of 280 distinct weaknesses
- Consolidation into 111 weakness patterns
- Subdivision in 7 weakness categories

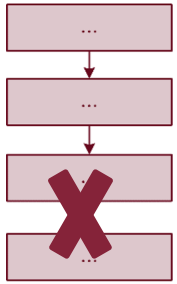


WEAKNESS CATEGORIES I

Modeling Error 23

Incorrect way of modeling

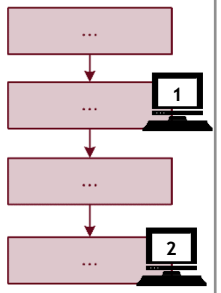
Examples:
Decision without impact
Sent document never received



Information Handling 14

Various ways of information processing

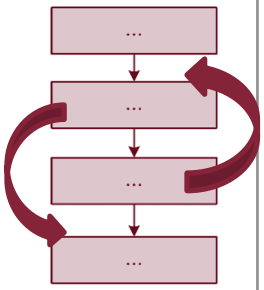
Examples:
Data digitalized twice
Creation without use



Process Flow 39

Inefficient order or missing aggregation

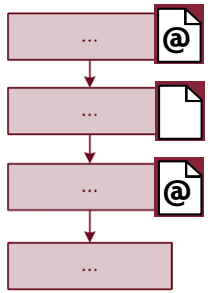
Examples:
Redundant activities
Edit document after copying



Technology Switch 6

Change of used technology and information medium

Examples:
Digitalization after printing
Double archiving

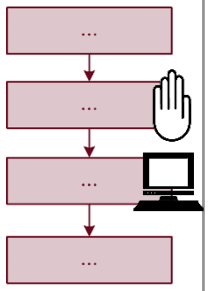


WEAKNESS CATEGORIES II

Automation 20

Unnecessary manual execution of activities

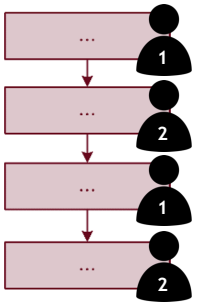
Examples:
Manual calculation
Data transferred manually



Organization 7

Inefficient organizational structure

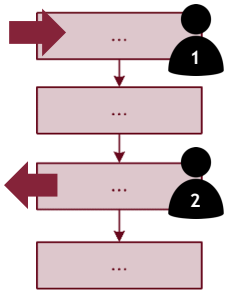
Examples:
Distributed responsibilities
Excessive inform. exchange



Environment 2

Inefficient communication with external partners

Examples:
Multiple negotiations
Varying communication ch.



WEAKNESS CATEGORIES

MODELING ERROR

- Inappropriate use of model elements
  (e.g., a process consists of only one element)
- Control flow errors
  (e.g., decision without impact (“check” → “checked”)
- Unclear interfaces
  (e.g., a business object to be processed has not (yet) entered the process)

WEAKNESS CATEGORIES

PROCESS FLOW

- Process modeled unnecessarily complicated or unclear
  (e.g., too many split/join branches)
- Redundancy (e.g., redundant sub-processes)
- Tasks in inappropriate order
  (e.g., decision before check)
- Inappropriate handling of business objects
  (e.g., receive but never use again)
- Avoidable waiting time (e.g., bad system performance)
- Information (transmission) deficit
  (e.g., decision followed by inquiry)
- Delayed transfer of document slows down process
  (e.g., information could be obtained/sent earlier)
- Missing task composition or decomposition
  (e.g., unnecessary batch processing and/or periodic activities)

WEAKNESS CATEGORIES

INFORMATION HANDLING

- Inefficient document forwarding
  (e.g., receive – archive & do nothing else – send)
- Multiple information existence
  (e.g., digitize information twice)
- Inappropriate communication channel
  (e.g., send information via different channels)

WEAKNESS CATEGORIES

TECHNOLOGY SWITCH

- Archiving
  (e.g., IT and paper based archiving)
- Printer usage
  (e.g., first print, then scan)
- Software usage
  (e.g., use different systems for the same information)
- Editing
  (e.g., enter into IT but edit the paper document)

WEAKNESS CATEGORIES

AUTOMATION

- Inappropriate exchange of information
  (e.g., exchange digital information via fax or phone)
- Manual execution of tasks
  (e.g., check manually for formal correctness)
- Inappropriate usage of software applications (e.g., redundant activities using multiple software applications)
- Information stored inappropriately (e.g., both scan and enter document into a software application”)

WEAKNESS CATEGORIES

ORGANIZATION

- Several faces to the customer (e.g., several organizational units make agreements with the same customer)
- Distributed responsibilities
  (e.g., ping-pong responsibilities)
- Unclear responsibility
  (e.g., multiple or missing responsibilities)
- Inappropriate capacity allocation (e.g., bottleneck)
- Inappropriate capability allocation
  (e.g., resource too specialized or generalized)
- Excessive information exchange (e.g., ping-pong inquiries)

OVERVIEW OF PROBLEMATIC STRUCTURES AND BEHAVIOR (BPCM)

- At present, no exhaustive list
- Still subject of research (formalized and categorized compliance pattern catalogues for different industries)
- Some examples from information-intensive industries:
  - 4-eye-principle
  - Required provision of consultation documents
  - Required provision of regulation documents
  - Required gathering of customer information
  - Required authorization levels of approving persons

RULE MINING

- Applying data mining approaches to extract/abstract business rules
  - Extracting decision logic from source code
  - Extracting business rules from text (natural language)

BUSINESS RULE MANAGEMENT

CAPTURE

AUTHORING

- Now that we have an idea of what our business rules are, we need a representation formalism
  - Rules need to be stored in a machine accessible way to facilitate automated analysis
- Exemplary rule formalisms you know: CTL, GMQL
  - Problem

AUTHORING

- High diversity of (technical) expertise in employees involved in business rule management!
  - E.g. domain experts, knowledge engineers, programmers, business analysts, CEOs, business process modelers, etc.
- Need for formalisms with a shared understanding!

AUTHORING

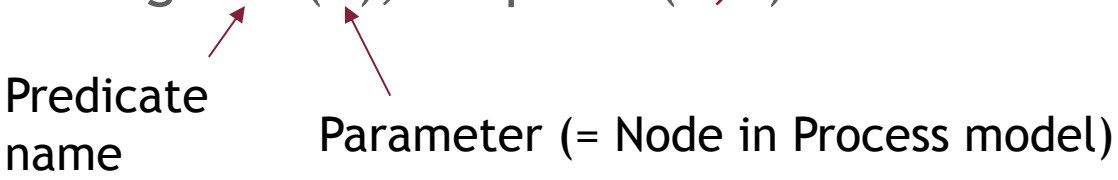
- Reminder – Business Rules…
  - concerning the structure and common behavior (of models)
    - Formalism I: Declare
  - concerning the behavior of single instances
    - Formalism II: Decision Model and Notation (DMN)

AUTHORING

- Reminder – Business Rules…
  - concerning the structure and common behavior (of models)
    - Formalism I: Declare
  - concerning the behavior of single instances
    - Formalism II: Decision Model and Notation (DMN)

DECLARE

- "New" Layer on top of CTL, to bridge gap between technicians and business analysts
- Set of "intuitive", predefined predicates
  - E.g. Init(X), Response(X,Y)



  - Predicates have a CTL-Semantics "under the hood"
    - Allows end-users to defined model queries, with the complexity of CTL "hidden" from them

DECLARE - EXAMPLES

- Init(A):
  - *"The process model should start with task A"*
- Response(A,D):
  - "Task A must be eventually followed by D"
- ChainResponse(A,B):
  - "Task A must be directly followed by B"

DECLARE - EXAMPLES

- Response(A,D):
  - “Task A must be eventually followed by D”

- How does this work “under the hood”
  - Predicates have predefined CTL Semantics!
  - Response(A,D) = $AG(A \rightarrow \neg\, EF(D))$

- *"Any task A should be eventually followed by a task D"*
  (legal text)

- Response(A,D)
  (Declare)

- $A \rightarrow EF(D)$
  (CTL-Syntax)

- $M,s \not\models A \quad \vee \quad M,s \models \forall \langle sRs' .. Rs_n \rangle, \exists i : M,s_i \models D$
  (CTL-Semantics)

DECLARE

- A set of DECLARE rules is a tuple $M = (A, T, C)$, where A is a set of tasks (e.g. labels from the process model), T is a set of constraint templates, and C is the set of actual constraints, which instantiate the template elements in T with tasks in A.

- Example:
  - Init (A) *(= constraint in C)*

Template in T

Task in A

DECLARE – CONSTRAINTS (SET T)

Template Name	Description	Semantics
Participation(a)	„a must occur at least once“	tbd
Response(a,b)	„If a occurs, then a must be *eventually* followed by b“	
ChainResponse(a,b)	„If a occurs, then a must be *directly* followed by b“	
Precedence(a,b)	„b occurs only if preceeded (somewhere) by a“	
ChainPrecedence(a,b)	„b occurs only if directly preceeded by a“	
NotResponse(a,b)	„if a occurs, it is **not** followed by b“	
NotChainResponse(a,b)	And so on…	
NotPrecedence(a,b)		
NotChainPrecedence(a,b)		

DECLARE - SYNTAX

- φ ::= a|(¬φ)|(φ1 ∧ φ2) | Xφ | Yφ | φ1Uφ2 | φ1Sφ2 | Fφ | Pφ | Gφ
  - X: next (directly following)
  - Y: previous (directly preceeding)
  - U: until
  - S: since
  - F: future (somewhere)
  - P: past (somewhere)
  - G: Globally

DECLARE – SYNTAX (RECAP)

- $M,s \models a$ iff a in $L(s)$
- (negation and $\wedge$, c.f. slides on CTL)
- $M,s_i \models X\varphi$ iff $\forall s'$, if $s_i R s'$, then $M,s' \models \varphi$
- $M,s_i \models Y\varphi$ iff $\forall s'$, if $s' R s_i$, then $M,s' \models \varphi$
- $M,s_i \models \varphi_1 U \varphi_2$ iff $\forall \langle s_i R s' \ldots R s_n \rangle$, $M,sj \models \varphi_2$ with $i \leq j \leq n$, and $M,s_k \models \varphi 1$ for all $k<j$
- $M,s_i \models \varphi_1 S \varphi_2$ iff $\forall \langle s_1 R s' \ldots R s_i \rangle$, $M,sj \models \varphi_2$ with $1 \leq j \leq i$, and $M,s_k \models \varphi 1$ for all k s.t. $j<k \leq i$

DECLARE – SYNTAX (RECAP) CONT‘D

- Helper: $M,s \models True$
- $M,s_i \models F\varphi$ iff $M,s_i \models True\ U\ \varphi$
- $M,s_i \models P\varphi$ iff $M,s_i \models True\ S\ \varphi$
- $M,s_i \models G\varphi$ iff $M,s_i \models \neg F \neg \varphi$

DECLARE – CONSTRAINTS (SET T)

Template Name	Description	Syntax
Participation(a)	„a must occur at least once)	EF a
Response(a,b)	„If a occurs, then a must be eventually followed by b“	G(a → Fb)
ChainResponse(a,b)	„If a occurs, then a must be directly followed by b“	G(a → Xb)
Precedence(a,b)	„b occurs only if preceeded (somewhere) by a“	G(b → Pa)
ChainPrecedence(a,b)	„b occurs only if directly preceeded by a“	G(b → Ya)
NotResponse(a,b)	„if a occurs, it is not followed by b“	G(a → ¬Fb)
NotChainResponse(a,b)	And so on…	G(a → ¬Xb)
NotPrecedence(a,b)		G(b → ¬Oa)
NotChainPrecedence(a,b)		G(b → ¬Ya)

REMINDER

"Task A must be eventually followed by D"

formalize

ChainResponse(A,D)

check

AUTHORING

- Reminder – Business Rules…
  - concerning the structure and common behavior (of models)
    - Formalism I: Declare
  - concerning the behavior of single instances
    - Formalism II: Decision Model and Notation (DMN)

DECISION MODEL AND NOTATION

Dish

decision

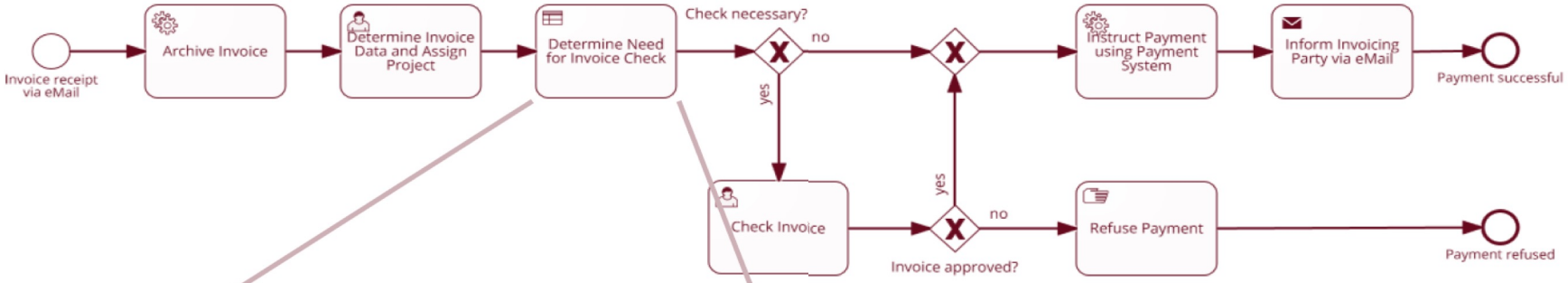
U	Input +		Output +
	Season	How many guests	Dish
	season	guestCount	desiredDish
	string	integer	string
1	"Fall"	<= 8	"Spareribs"
2	"Winter"	<= 8	"Roastbeef"
3	"Spring"	<= 4	"Dry Aged Gourmet Steak"
4	"Spring"	[5..8]	"Steak"
5	"Fall", "Winter", "Spring"	> 8	"Stew"
6	"Summer"	-	"Light Salad and a nice Steak"

- IF A_1 AND A_2 THEN B

[https://camunda.com/dmn]

IDEA

- Separate the process model from (parts of) the rules



Decision: Invoice check necessary?

Known creditor?	Amount >	Amount<=	Check necessary?
no		5.000	no
	5.000		yes
yes		10.000	no
	10.000		yes

- Business rules are now encapsulated
- → Process base + rule base

USING DMN TABLES AS DECISION OPERATORS

Dish

decision

U	Input +		Output +
	Season	How many guests	Dish
	season	guestCount	desiredDish
	string	integer	string
1	"Fall"	<= 8	"Spareribs"
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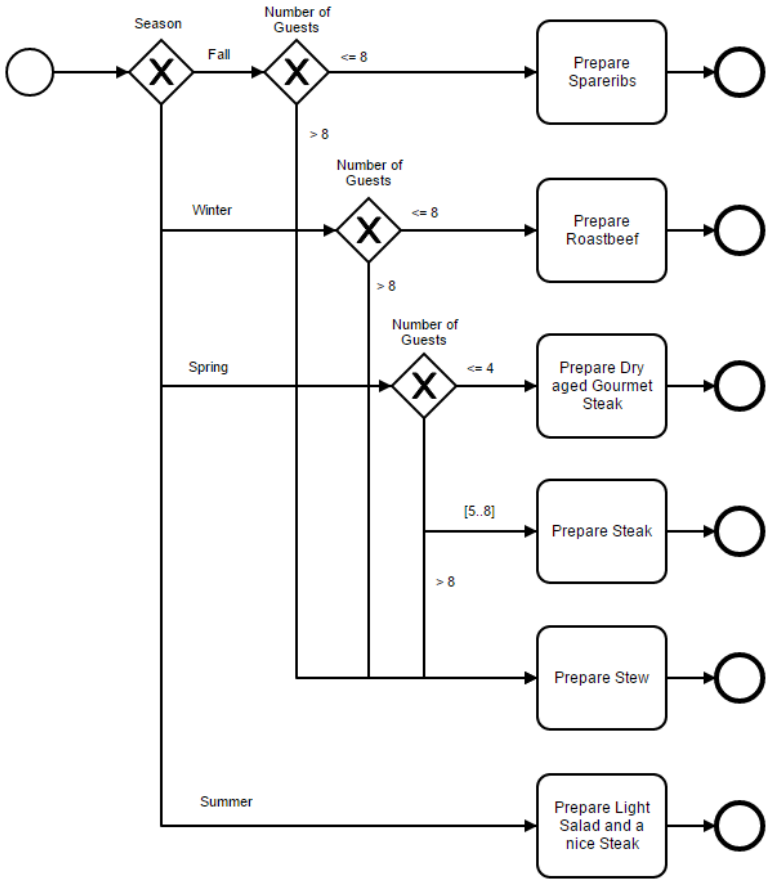
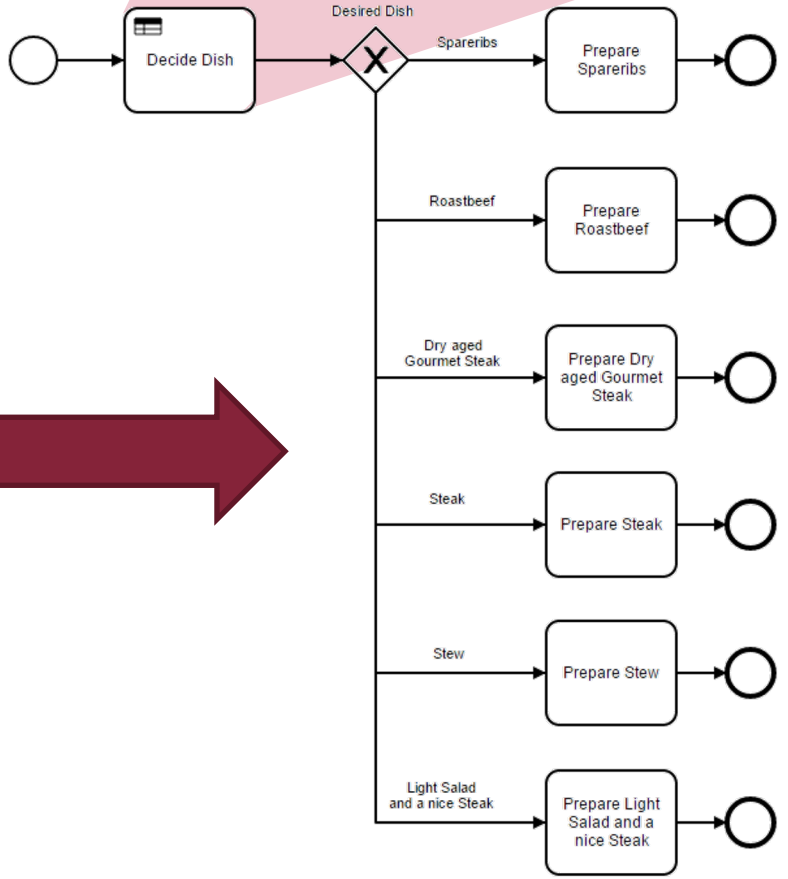
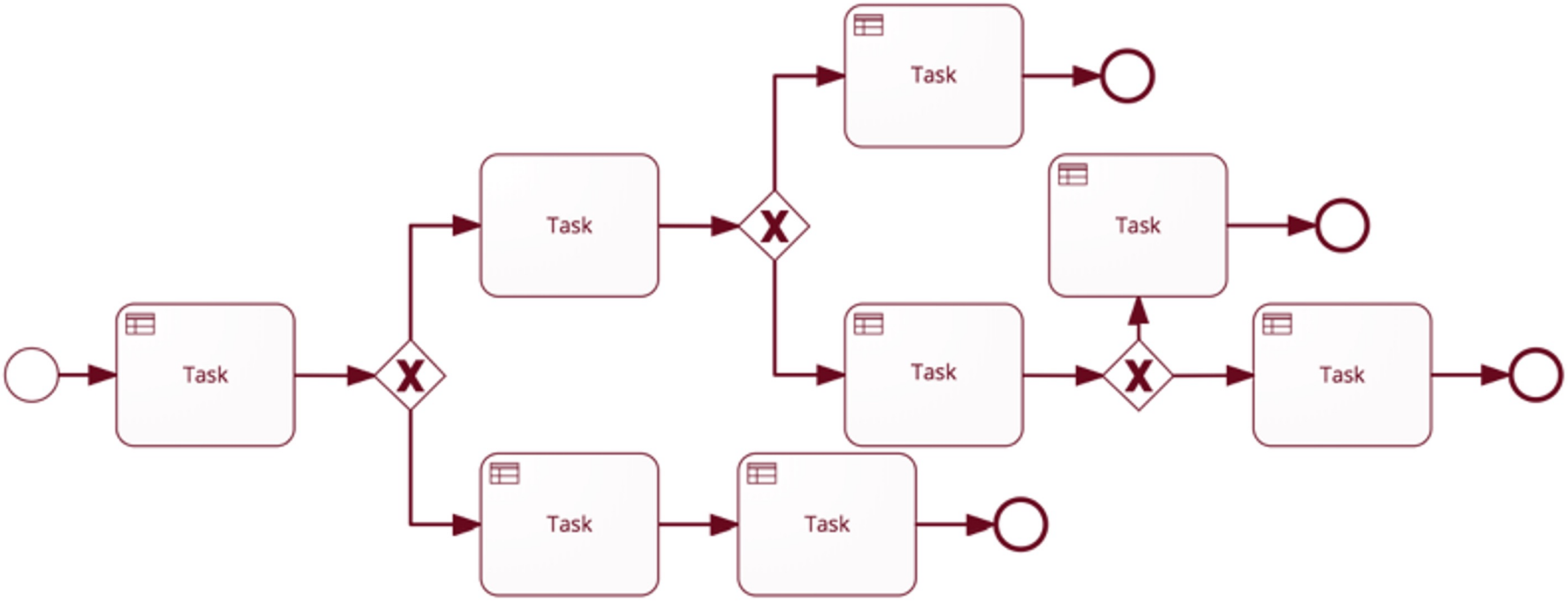




[https://camunda.com/dmn]

USING DMN TO ROUTE PROCESS INSTANCES



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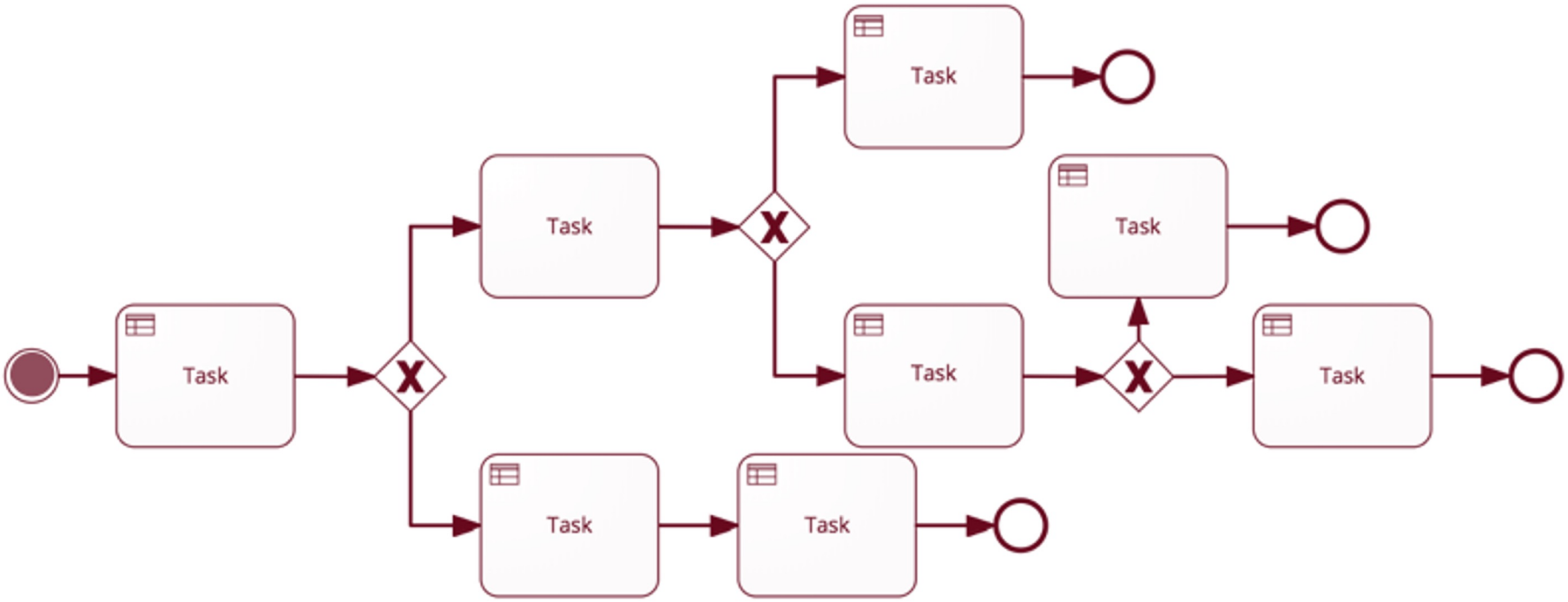

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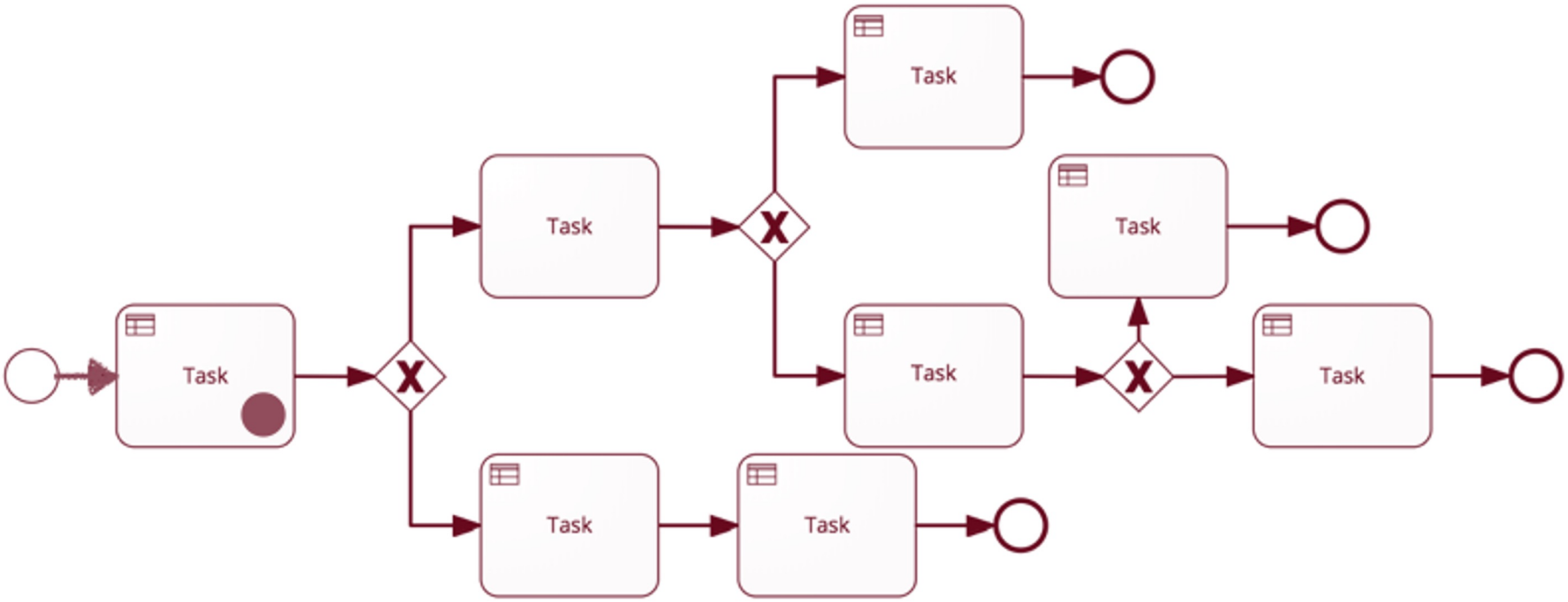
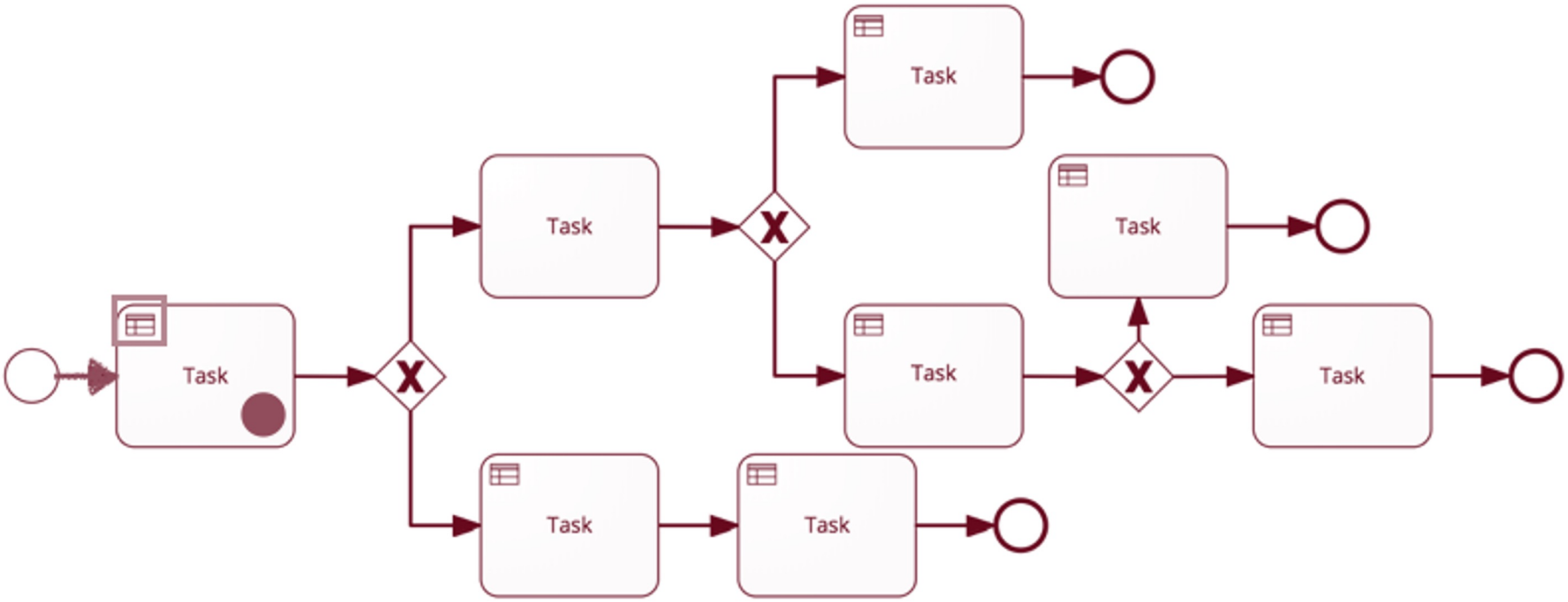


USING DMN TO ROUTE PROCESS INSTANCES



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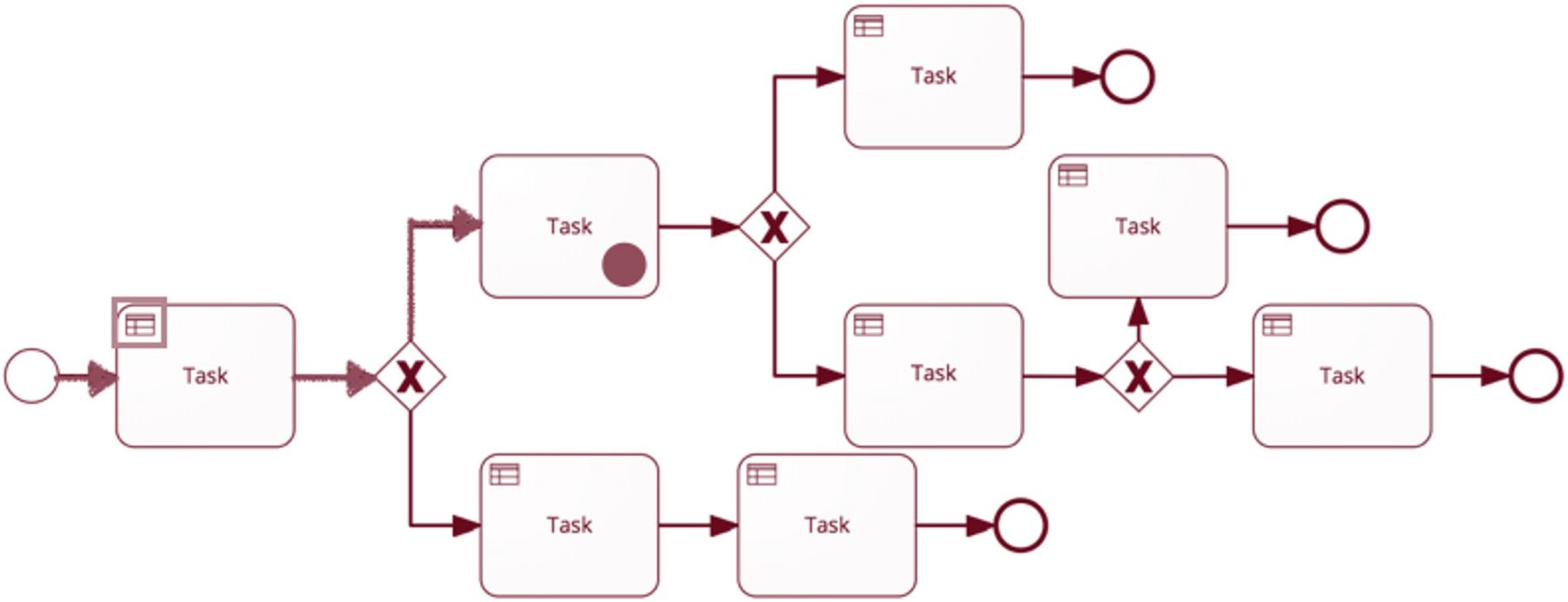
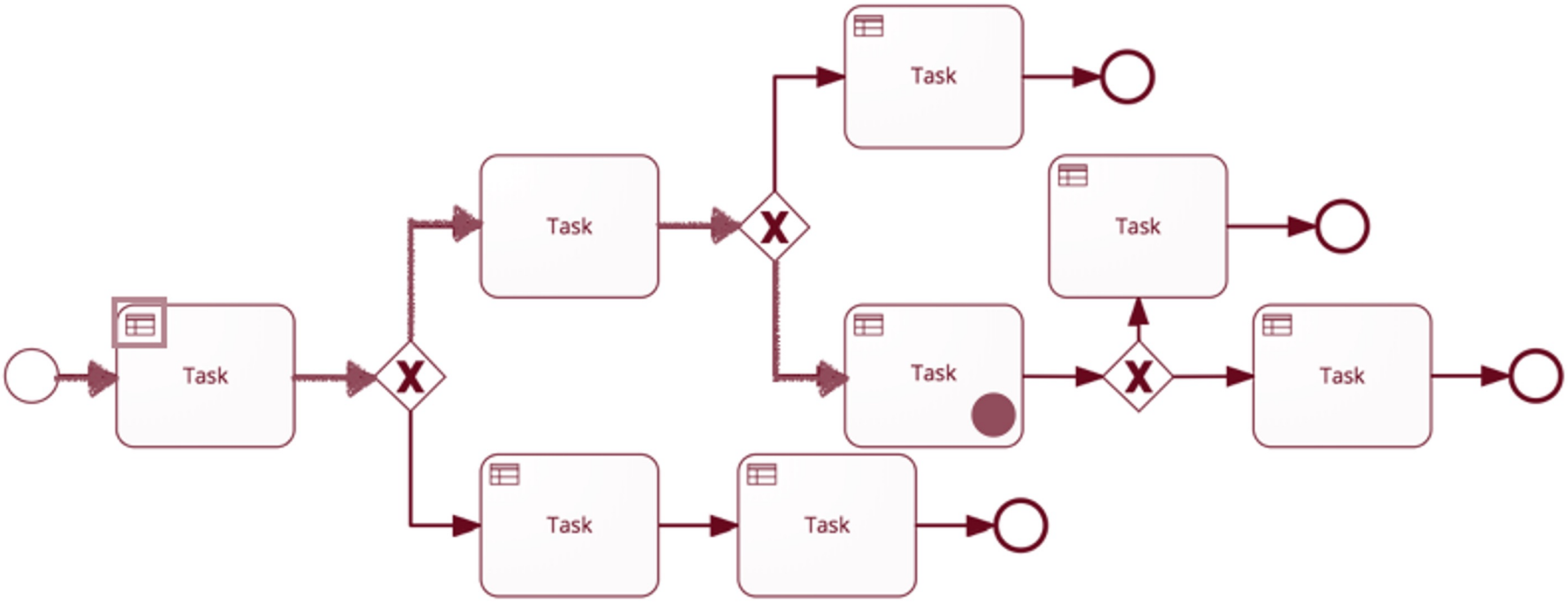
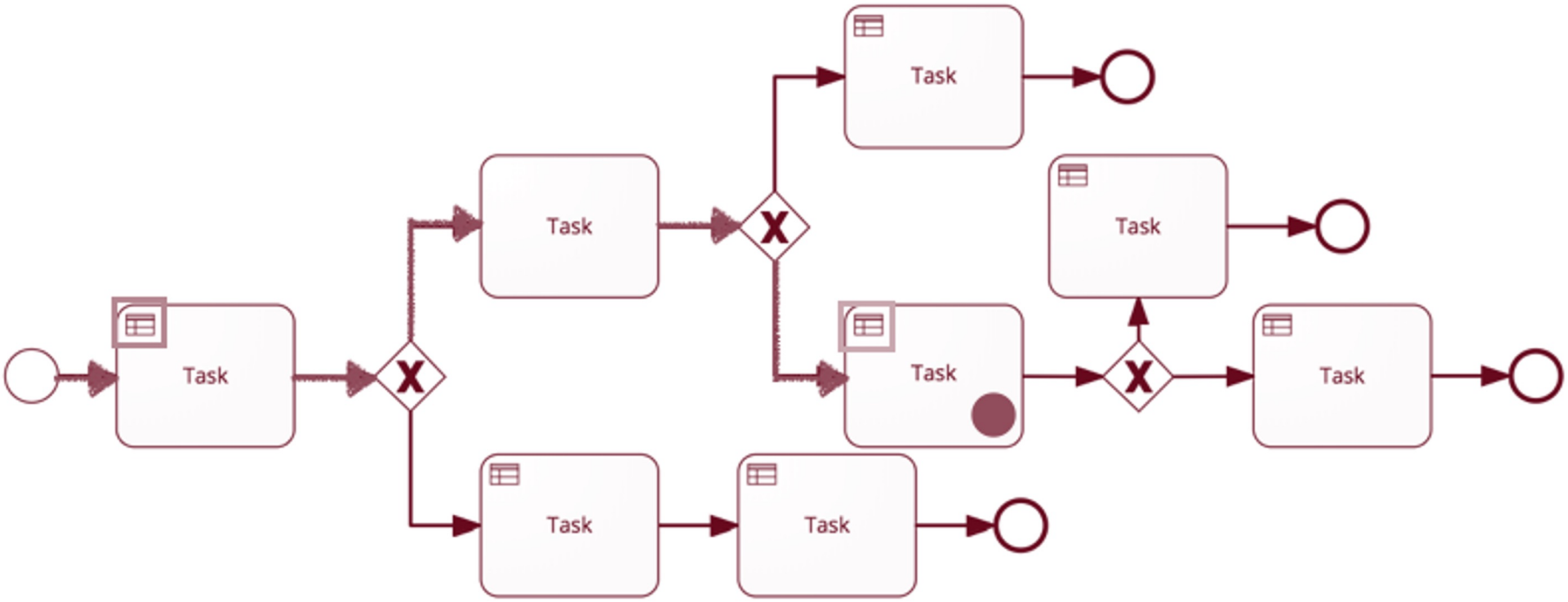


USING DMN TO ROUTE PROCESS INSTANCES



USING DMN TO ROUTE PROCESS INSTANCES



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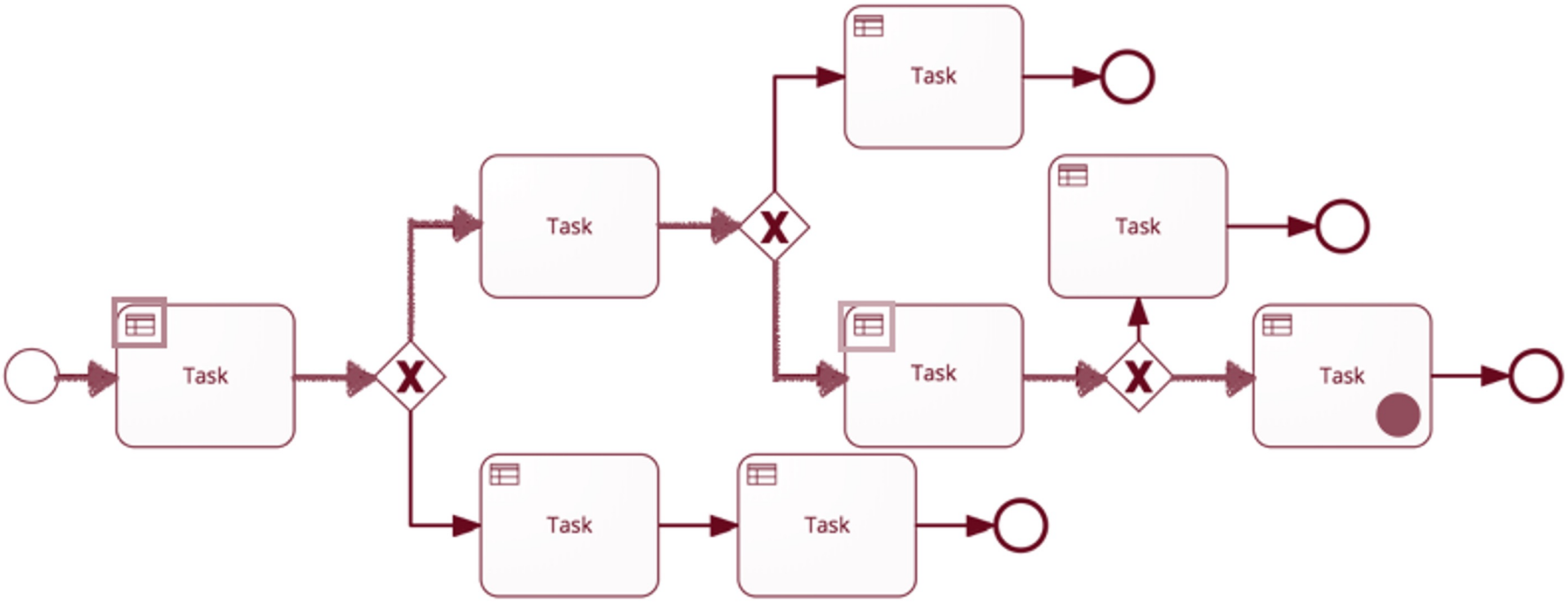

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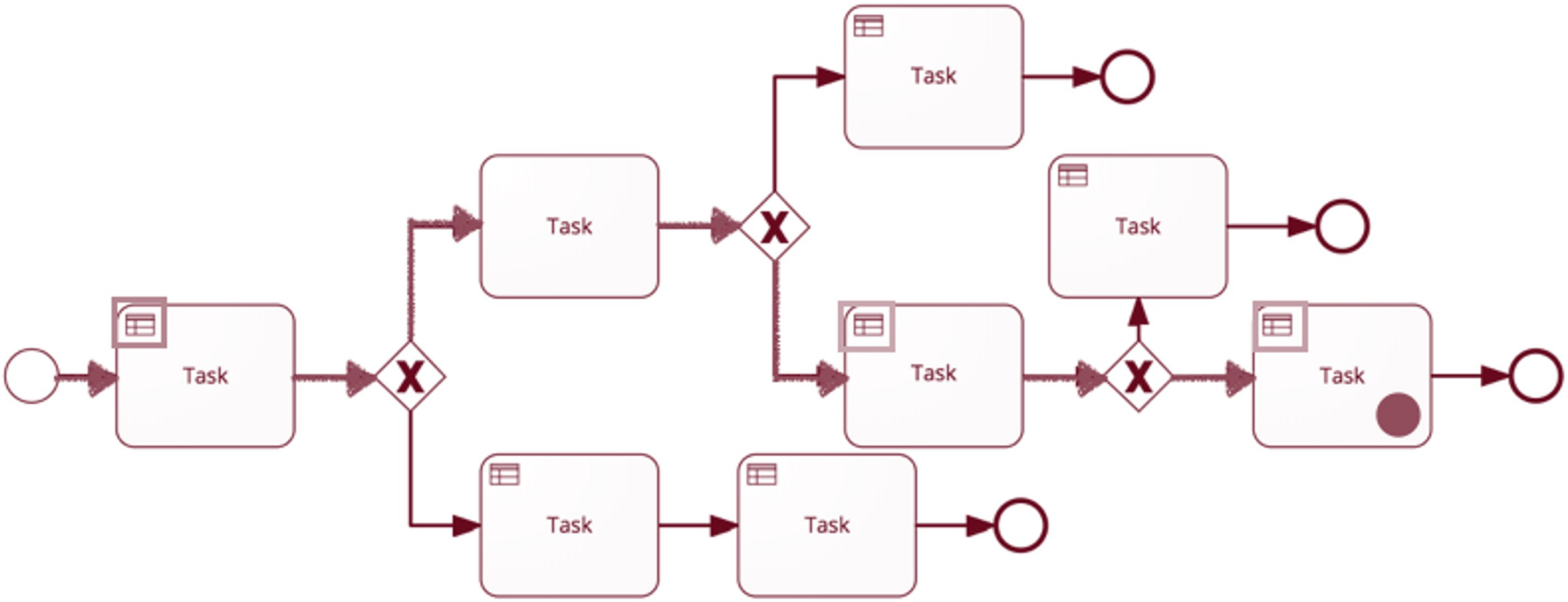

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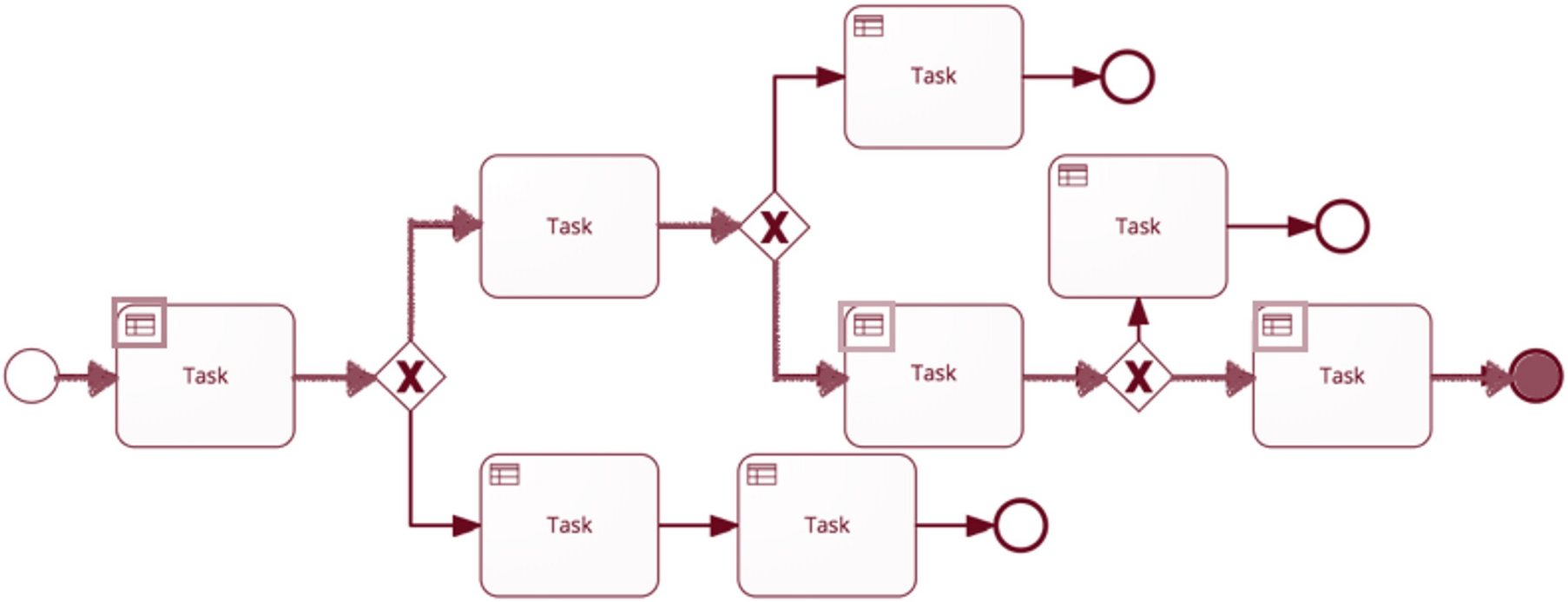
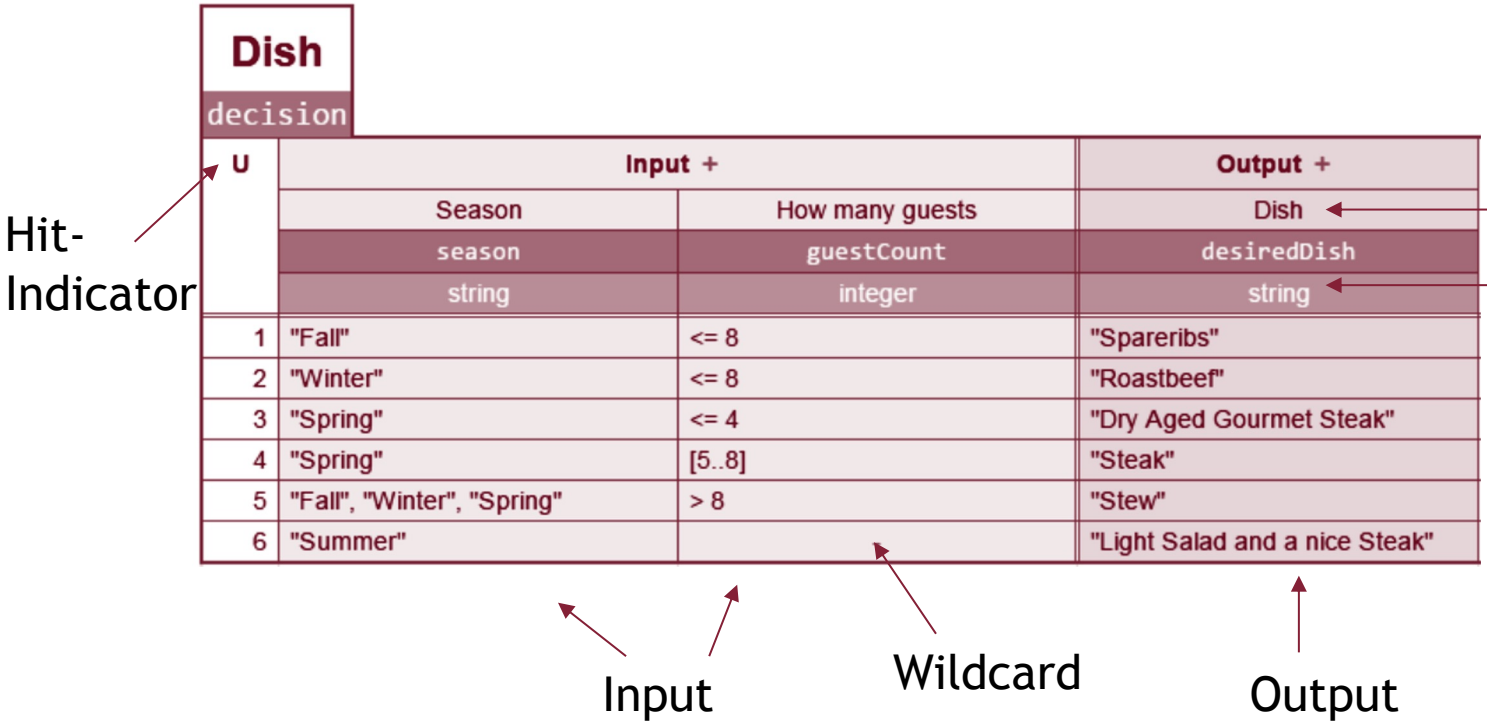


DMN - STANDARD



Each row = 1 business rule

[https://camunda.com/dmn]

DMN – HIT INDICATOR

- Unique: Only 1 rule may be activated (= „fire“)
- First: The first row which matches the input is activated (regardless of if there are other rules that may also fire)
- Collect: All rows that match the input are activated

DMN – DEFINITION

- A decision table ***D*** is a tuple (*T*, *I*, *O*, *Type*, *R*, *Order*, *H*) where:
  - *T* is the table name
  - *I* and *O* are disjoint, finite sets of input and output attributes (represented as strings)
  - *Type* : *I* ∪ *O* $\rightarrow \Gamma$ is a typing function that associates each input/output attribute to its corresponding data type (in Γ)
  - *R* is a finite set of rules $\{r_1, \ldots, r_n\}$. Each rule r_i is a pair $\langle If_i, Then_i \rangle$, where If_i is an input entry function that associates each input attribute m ∈ *I* to a condition over *Type*(m), and $Then_i$ is an output entry function that associates each output attribute n ∈ O an object in *Type*(n)

DMN – DEFINITION (CONT‘D)

- A decision table ***D*** is a tuple (*T, I, O, Type, R, Order, H*) where:
  - Order: R $\rightarrow$ {1, . . . , |R|} is a priority function injectively mapping rules in R to a corresponding rule number defining its priority (important for „first“ hit indicator)
  - H $\in$ {u, f, c} is the hit indicator, where u = unique, f = first and c = collect

DMN – SEMANTICS

- Reminder:

Dish

decision

U	Input +		Output +
	Season	How many guests	Dish
	season	guestCount	desiredDish
	string	integer	string
1	"Fall"	<= 8	"Spareribs"
2	"Winter"	<= 8	"Roastbeef"
3	"Spring"	<= 4	"Dry Aged Gourmet Steak"
4	"Spring"	[5..8]	"Steak"
5	"Fall", "Winter", "Spring"	> 8	"Stew"
6	"Summer"	-	"Light Salad and a nice Steak"

- IF A_1 AND A_2 THEN B

[https://camunda.com/dmn]

SUMMARY

- Capturing: Elicitation of rules
  - Identification, rule mining
- Authoring: Formalization of business rules
  - Model-Level (Declare)
  - Behavior of Instances (DMN)

LITERATURE

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BUSINESS PROCESS MANAGEMENT

BUSINESS RULES MANAGEMENT PART 1

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