UNIVERSITÄT KOBLENZ · LANDAU

BUSINESS PROCESS MANAGEMENT - EXERCISE

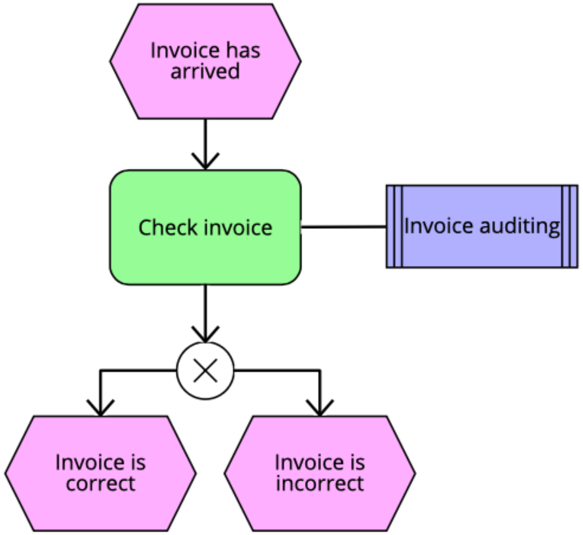
FORMALIZATION

FORMAL REPRESENTATION OF (PROCESS) MODELS

- In order to represent process models in a machine-readable way, we formalize process models
- A (process) model is a tuple

  $M=(V,E,C,L,T_V,T_E,\alpha,\beta,\chi)$

- Each element of this tuple must be formally defined

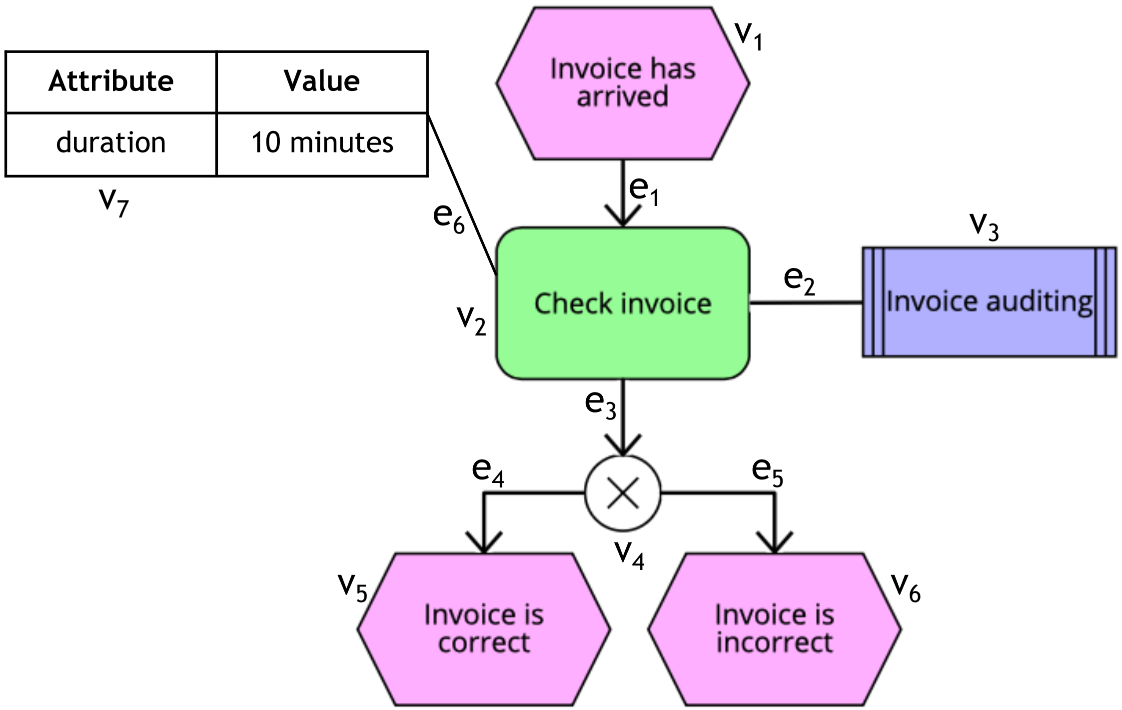


TUPLE VS. SET

- Tuple
  - ( )
  - express direction, i.e., the order of elements matters

- Set
  - { }
  - can contain each element only once
  - are undirected, i.e., the order of elements does not matter

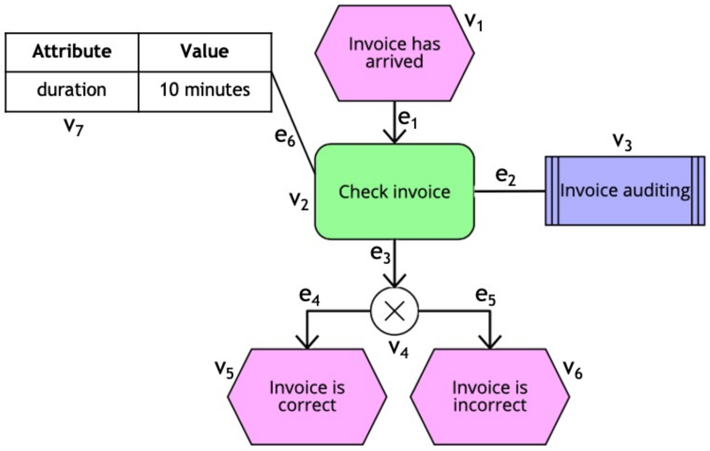
VERTICES (V) & EDGES (E)



VERTICES (V) & EDGES (E)

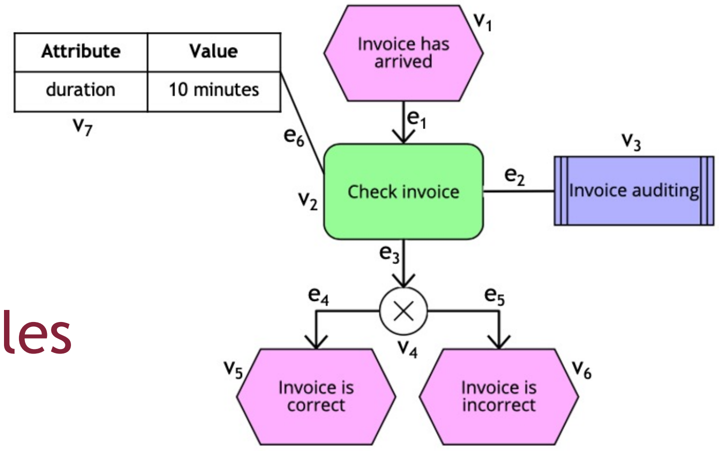
- V is the set of vertices
  - $V = \{v_1, v_2, v_3, v_4, v_5, v_6, v_7\} = \{v_1, \dots, v_7\}$

- E is the set of edges
  - $E = E_D \cup E_U$
  - E_D is the set of directed edges
    - $E_D = \{e_1, e_3, e_4, e_5\}$
  - E_U is the set of undirected edges
    - $E_U = \{e_2, e_6\}$



EDGES (E)

- E is the set of edges
  - $E = E_D \cup E_U$
    - $E_D = \{e_1, e_3, e_4, e_5\}$
    - $E_U = \{e_2, e_6\}$



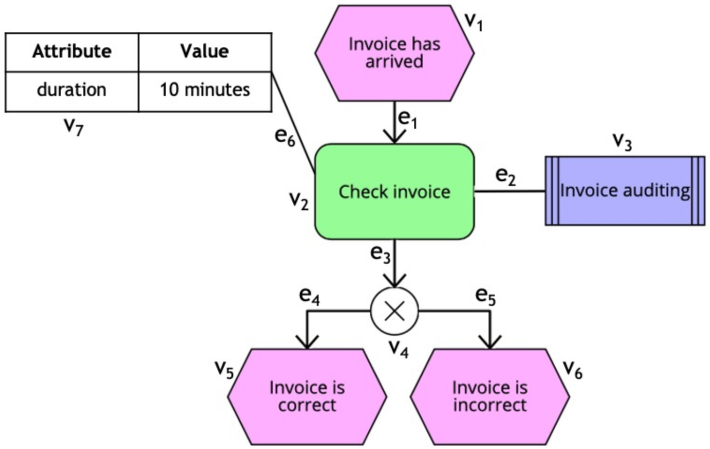
- $e_1 = (v_1, v_2, 1),\ \ e_3 = (v_2, v_4, 1),$
  $e_4 = (v_4, v_5, 1),\ \ e_5 = (v_4, v_6, 1)$ → tuples

- $e_2 = \{v_2, v_3, 1\},\ \ e_6 = \{v_2, v_7, 1\}$ → sets

CAPTIONS (C)

- C is a set of captions

- C = {"Invoice has arrived", "Check invoice", "Invoice auditing", "Invoice is correct", "Invoice is incorrect", "10 minutes"}



LANGUAGE (L)

- L is the modeling language the model M belongs to
- This means that L defines, which types of vertices can be connected by which types of edges
- Hence, $T_V, T_E \in L$

- A modeling language is a tuple
  - $L=(T_V,T_E)$

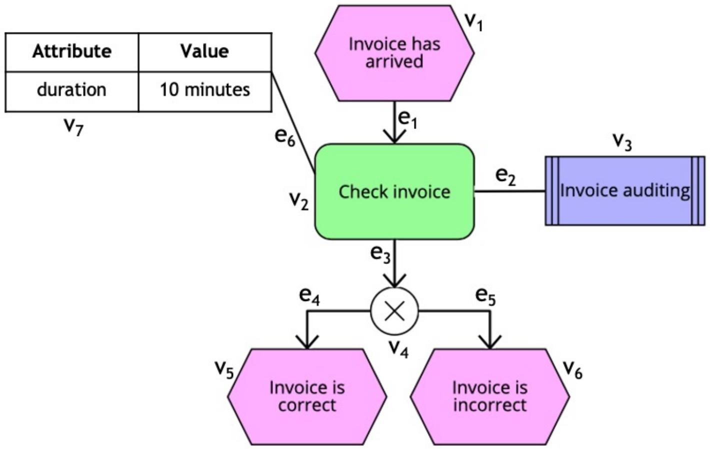
VERTEX TYPES (T_V) & EDGE TYPES (T_E)

- T_V is the set of vertex types
  - T_V={<u>e</u>vent,<u>f</u>unction,<u>x</u>or,<u>s</u>ystem,<u>d</u>uration}

- T_E is the set of edge types
  - $T_E = T_{ED} \cup T_{EU}$

  - T_{ED} = {e_f, f_x, x_e}
  - T_{EU} = {f_s, f_d}

  - T_{ED}: e_f = (event, function, 1) …
  - T_{EU}: f_s = {function, system, 1} …



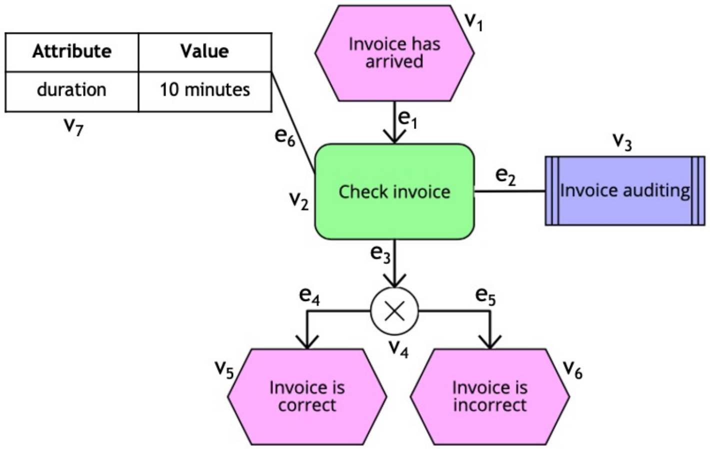
(analog for remaining types)

FUNCTION α

- α: $V \rightarrow T_V$ is a function that assigns each vertex V a vertex type T_V

- $V = \{v_1,v_2,v_3,v_4,v_5,v_6,v_7\}$
- $T_V=\{\underline{e}vent, \underline{f}unction, \underline{x}or, \underline{s}ystem, \underline{d}uration\}$

- $\alpha(v_1) = \alpha(v_5) = \alpha(v_6) = event$
- $\alpha(v_2) = function$
- $\alpha(v_3) = system$
- $\alpha(v_4) = xor$
- $\alpha(v_7) = duration$

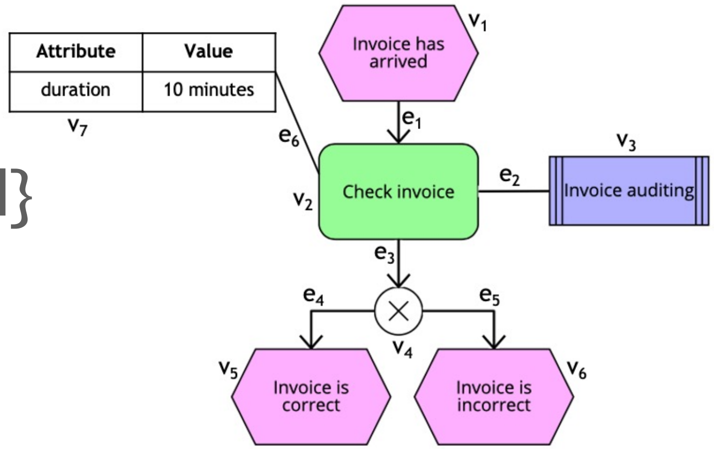


FUNCTION β

- $\beta: E \rightarrow T_E$ is a function that assigns each edge E an edge type T_E

- $E_D = \{e_1, e_3, e_4, e_5\}$, $E_U = \{e_2, e_6\}$
- $T_{ED} = \{e\_f, f\_x, x\_e\}$, $T_{EU} = \{f\_s, f\_d\}$

- $\beta(e_1) = e\_f$,
- $\beta(e_2) = f\_s$,
- $\beta(e_3) = f\_x$,
- $\beta(e_4) = \beta(e_5) = x\_e$,
- $\beta(e_6) = f\_d$

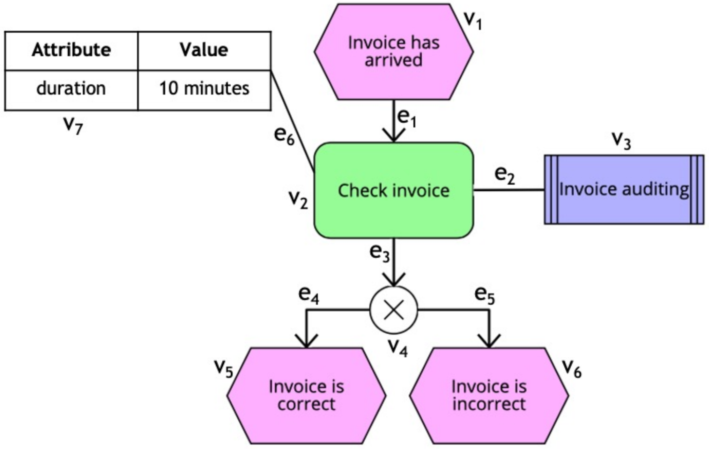


FUNCTION χ

- χ: Z→C is a function that assigns a caption C to each vertex V (or edge E)

- C = {“Invoice has arrived”, “Check invoice”, “Invoice auditing”, “Invoice is correct”, “Invoice is incorrect”, “10 minutes”}
- $V = \{v_1, v_2, v_3, v_4, v_5, v_6, v_7\}$

- $\chi(v_1)$=“Invoice has arrived”
- $\chi(v_2)$=“Check invoice”
- $\chi(v_3)$=“Invoice auditing”
- $\chi(v_5)$=“Invoice is correct”
- $\chi(v_6)$=“Invoice is incorrect”
- $\chi(v_7)$=“10 minutes”



SUMMARY EXAMPLE - 1

- $V = \{v_1,v_2,v_3,v_4,v_5,v_6,v_7\}$
- $E = E_D \cup E_U$
  - $E_D = \{e_1,e_3,e_4,e_5\}$
  - $E_U = \{e_2,e_6\}$
- C = {“Invoice has arrived”, “Check invoice”, “Invoice auditing”, “Invoice is correct”, “Invoice is incorrect”, “duration”}
- $L=(T_V, T_E)$
- $T_V=\{\underline{e}vent,\underline{f}unction,\underline{x}or,\underline{s}ystem,\underline{d}uration\}$
- $T_E=T_{ED} \cup T_{EU}$
  - $T_{ED} = \{e\_f,\ f\_x,\ x\_e\}$
  - $T_{EU} = \{f\_s,\ f\_d\}$
  - T_{ED}: e_f = (event, function, 1) …
  - T_{EU}: f_s = {function, system, 1} …

SUMMARY EXAMPLE - 2

- $\alpha(v_1) = \alpha(v_5) = \alpha(v_6)$ = event
- $\alpha(v_2)$ = function
- $\alpha(v_3)$ = system
- $\alpha(v_4)$ = xor
- $\alpha(v_7)$ = duration

- $\beta(e_1)$ = e_f,
- $\beta(e_2)$ = f_s,
- $\beta(e_3)$ = f_x,
- $\beta(e_4) = \beta(e_5)$ = x_e,
- $\beta(e_6)$ = f_d

- $\chi(v_1)$=“Invoice has arrived”
- $\chi(v_2)$=“Check invoice”
- $\chi(v_3)$=“Invoice auditing”
- $\chi(v_5)$=“Invoice is correct”
- $\chi(v_6)$=“Invoice is incorrect”
- $\chi(v_7)$=“10 minutes”

GENERAL HINTS

- Make sure to specifically define each element of M
- Define tuples ( ) and sets { } correctly
- In the exam, you can annotate captions straight to visible vertices (unless stated otherwise)
- Abbreviate things such as
  - $V = \{v_1,\dots,v_7\}$
  - $\alpha(v_1) = \alpha(v_5) = \alpha(v_6) = \text{event}$
  - T_{ED}: e_f = (event, function, 1) … analog for remaining directed edges

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