Verbalization of Business Rules in ORM

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Keywords: Verbalization, Value constraints, Cardinality, multiplicity, Rules, Business Rules, Business logic derivation rules, integrity constraints

Conceptual Schema Design Steps

1. From examples to elementary facts

2. Draw fact types and apply population check

3. Combine entity types

4. Add uniqueness constraints

5. Add mandatory constraints
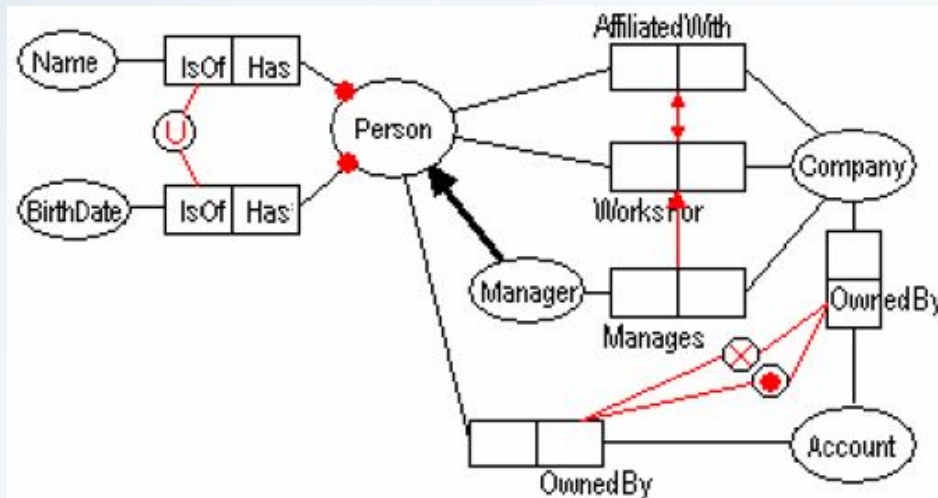
6. Add subtype relations and other constraints

7. Final checks, & schema engineering issues

Rules Verbalization

Verbalization is the process of writing the semantics captured by the ORM constrains as pseudo-natural language (fixed-syntax) sentences.

Notice that these verbalizations can be generated atomically using fixed templates

- *Subsumption*: **Each** Manager **must be a type of** Person.
- *Mandatory*: **Each** Person **must** Has **at least one** Name.
- *Mandatory*: **Each** Person **must** Has **at least one** BirthDate.
- *InterUniqueness*: **The combination of {**BirthDate, Name**} must refer to at most one** Person.
- *Equality*: **Each** Person WorksFor **a** Company **must** AffliatedWith **that** Company, **and vice versa.**
- *Subset*: **Each** Manager **who** Manages **a** Company **must** WorksFor **that** Company.
- *ExMandatory*: **Each** Account OwnedBy Person **or** OwnedBy Company**, or both**.
- *Exclusion*: **No** Account **can be** OwnedBy **a** Company **and** OwnedBy **a** Person.

Rules Verbalization

Verbalization is the process of writing the semantics captured by the ORM constrains as pseudo-natural language (fixed-syntax) sentences.

> ➢ This pseudo-natural language is understandable for domain experts, which enables them to help in the modeling process, as they can review whether the rules are correct.

> ➢ See http://www.jarrar.info/orm/verbalization/
>   which offers templates for verbalizing ORM in 10 languages

- *Subsu...*
- *Manda...*
- *Manda...*
- *InterUniqueness*: **The combination of {**BirthDate, Name**} must refer to at most one** Person.
- *Equality*: **Each** Person WorksFor **a** Company **must** AffliatedWith **that** Company, **and vice versa.**
- *Subset*: **Each** Manager **who** Manages **a** Company **must** WorksFor **that** Company.
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An ORM model with many constraints
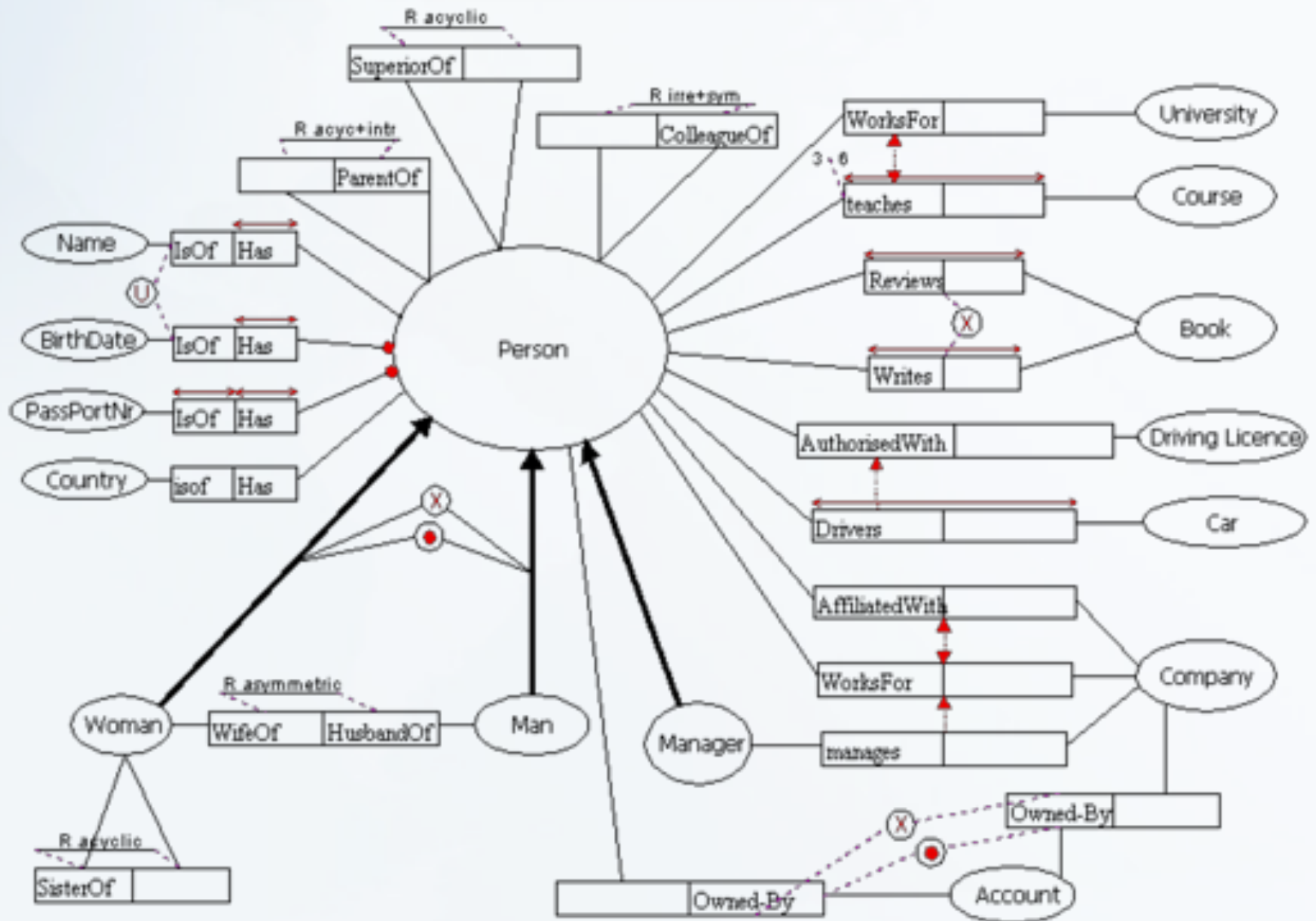
Verbalization of the constraints (English)

-[Mandatory] Each Person must Has at least one PassPortNr.
-[Mandatory] Each Person must Has at least one BirthDate.
-[Mandatory] Each Account should be Owned-By Company or Owned-By Person.
-[Uniqueness] Each Person must Has at most one BirthDate.
-[Uniqueness] Each Person must Has at most one Name.
-[Uniqueness] Each Person must Has at most one PassPortNr.
-[Uniqueness] Each PassPortNr must IsOf at most one Person.
-[Uniqueness] It is possible that Person teaches more than one Course , and vice versa.
-[Uniqueness] It is possible that Person Reviews more than one Book , and vice versa.
-[Uniqueness] It is possible that Person Writes more than one Book , and vice versa.
-[Uniqueness] It is possible that Person Drivers more than one Car , and vice versa.
-[Uniqueness] The combination of { BirthDate and Name } must refer to at most one Person.
-[Exclusive] Each Person should be either Woman or Man.
-[Totality] Each Person must be, at least, Man or Woman.
-[Subset] If Person Drivers Car then this Person AuthorisedWith Driving Licence.
-[Subset] If Manager manages Company then this Person WorksFor that Company.
-[Equality] Person WorksFor University if and only if this Person teaches Course.
-[Equality] Person AffiliatedWith Company if and only if this Person WorksFor that Company.
-[Exclusion] No Account Owned-By Company and also Owned-By Person.
-[Exclusion] No Person Writes Book and also Reviews that Book.
-[Value] The possible instances of Country are :{Belgium, France, Germany}
-[Irreflexive] No Person ColleagueOf it/him self.
-[Symmetric] If Person X ColleagueOf Person Y, it must be vice versa.
-[Acyclic] Person cannot be directly (or indirectly through a chain) SuperiorOf it/him self .
-[Acyclic] Woman cannot be directly (or indirectly through a chain) SisterOf it/him self .
-[Asymmetric] If Person X WifeOf Person Y, it cannot be vice versa .
-[Intransitive] If Person X ParentOf Person Y, and Y ParentOf Z, then it cannot be that X ParentOf Z.
-[Frequency] If Person Teaches Course, then this Person Teaches at least 3 and at most 6 Course(s).

Same Example in Arabic
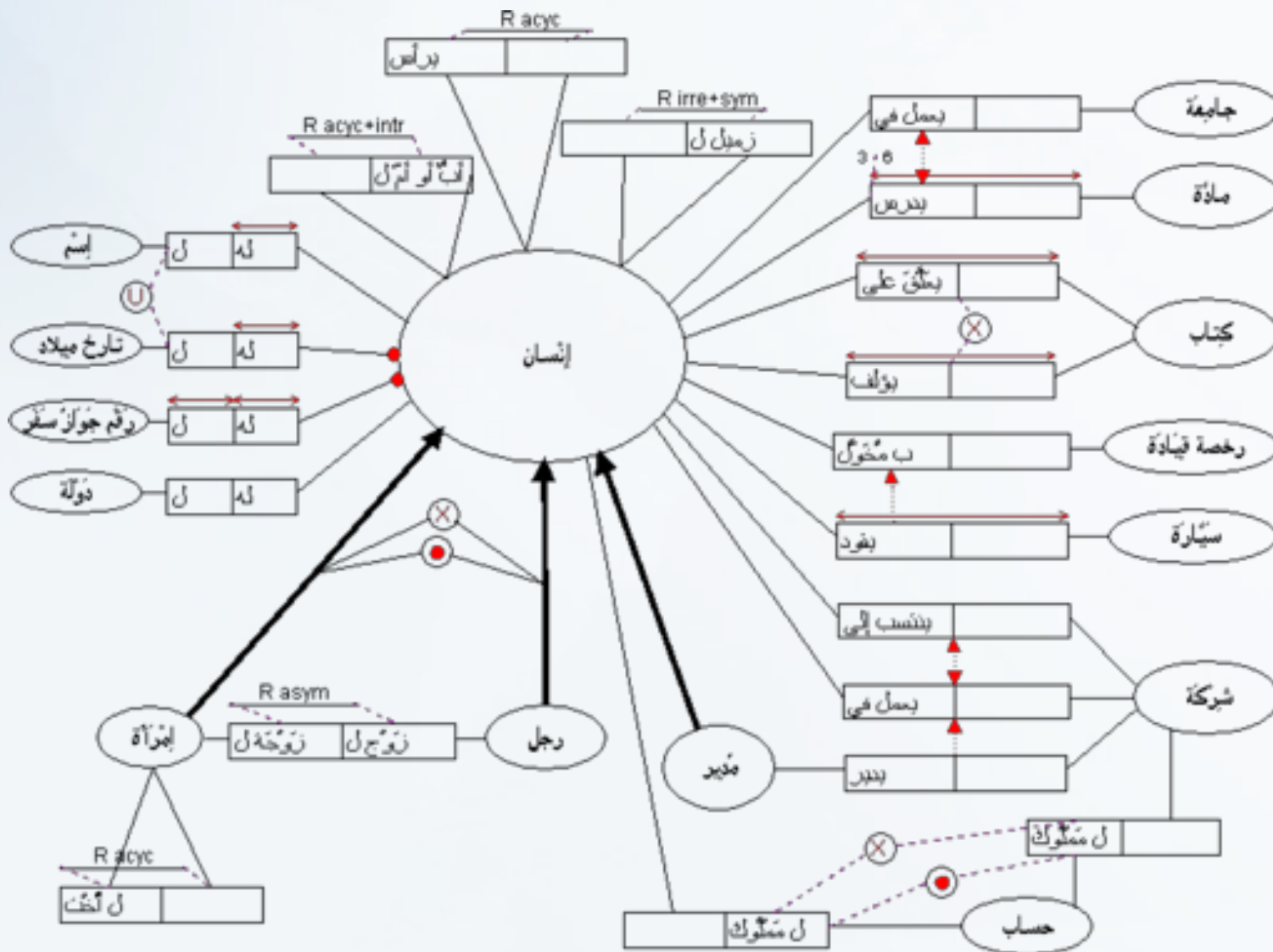
Verbalization of all constraints (Arabic)

[Mandatory]- كل إِنْسان له رَقْم جَوَازُ سَفَر الاقل

[Mandatory]- كل إِنْسان له تارخ مِيلاد واحد على الاقل

[Mandatory]- كل حساب يجب ان يكون مملوك لانسان او مملوك لشركة

[Uniqueness]- كل انسان له تاريخ ميلاد واحد على الاكثر

[Uniqueness]- كل انسان له اسم واحد على الاكثر

[Uniqueness]- كل انسان له رقم جواز سفر واحد على الاكثر

[Uniqueness]- كل رقم جواز سفر لانسان واحد على الاكثر

[Uniqueness]- كل انسان يمكن ان يدرس اكثر من مادة والعكس صحيح

[Uniqueness]- كل انسان يمكن ان يؤلف اكثر من كتاب والعكس صحيح

[Uniqueness]- كل انسان يمكن ان يعلق على اكثر من كتاب والعكس صحيح

[Uniqueness]- كل انسان يمكن ان يقود اكثر من سيارة والعكس صحيح

[Uniqueness]- اتحاد كل من تاريخ ميلاد واسم يشير الى انسان واحد على الاكثر

[Exclusive]- كل انسان يمكن ان يكون اما رجل او اِمْرَأة

[Totality]- كل انسان يجب ان يكون رجل او اِمْرَأة

[Subset]- اذا انسان يقود سيارة فان هذا الانسان مخول برخصة سياقة

[Subset]- اذا مديريديرشركة فان هذا المديريعمل في هذة الشركة

[Equality]- كل انسان يعمل في جامعة اذا و فقط اذا هذا الانسان يدرس مادة

[Equality]- كل انسان منسوب لشركة اذا و فقط اذا هذا الانسان يعمل في هذة الشركة

[Exclusion]- لا يمكن ان يكون حساب مملوك لا نسان و في نفس الوقت مملوك لشركة

[Exclusion]- لا يمكن ان يكون انسان يعلق على كتاب و في نفس الوقت يؤلف ذلك كتاب

[Value]- القيم الممكنة ل دولة هي:{ بلجيكا, فرنسا, المانيا}

[Irreflexive]- لا يجوز لانسان ان يكون زميل لنفسه

[Symmetric]- اذا انسان س زميل ل ص,فان العكس بالعكس

[Acyclic]- لايمكن لانسان ان يكون (بطريقة مباشرة او غير مباشرة) اب او ام لنفسه

[Acyclic]- لايمكن لانسان ان يكون (بطريقة مباشرة او غير مباشرة) مشرف على نفسه

[Asymmetric]- اذا انسان س زوجة لانسان ص, فان العكس غير صحيح

[Intransitve]- ل ج اذا انسان س اب او ام لانسان ص, و ص اب او ام لانسان ج, فانه لايمكن ان يكون س اب او ام

[Frequency]- اذا الانسان يدرس مادة, فان هذا الانسان يجب ان يدرس بين 2 الى 3 مادة

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