Semantics

1 Literals and blank nodes

Let Γ be the RDF graph below. You will need to interpret both blank nodes and literals using the semantics layed out in the lectures.

1. Create an interpretation $\mathcal{I}_1$ such that $\mathcal{I}_1 \models \Gamma$.
2. Create an interpretation $\mathcal{I}_2$ such that $\mathcal{I}_2 \not\models \Gamma$.

```
@prefix : <http://www.example.org#> .
@prefix rdf: <http://www.w3.org/1999/02/22-rdf-syntax-ns#> .

:Tweety rdf:type   :Bird .
:Nixon  rdf:type   :Republican .
:Nixon  rdf:type   :Quacker .
:Nixon  :listensTo :Tweety .
:Nixon  :likes     [ a :Bird ]  .
[]      :likes     :Nixon .
:Nixon  :hasNickname "Ric" .
:Tweety :hasNickname "Mr. Man" .
:Tweety :likes     :Tux .
```

1.1 Solution

New things to pay attention in this exercises are:

- Λ is the set of all literals. All literals are interpreted to themselves(, i.e., there is no $\Lambda^{\mathcal{I}}$).
- We need to interpret blank nodes. For this we use a *blank node valuation* function β, which assigns values from $\Delta^{\mathcal{I}} \cup \Lambda$ to blank nodes: $\beta(b) \in \Delta^{\mathcal{I}} \cup \Lambda$ for all blank nodes b.

First, let's create an interpretation which satisfies Γ.

Since there are blank nodes in Γ the interpretation we give needs to interpret them, i.e., we need to find an interpretation $\mathcal{I}$ such that there exists a blank node valuation β where $\mathcal{I}, \beta \vDash \Gamma$.

We let b_1 identify the blank node in

```
:Nixon  :likes     [ a :Bird ]  .
```

and b_2 identify the blank node in

```
[]       :likes     :Nixon .
```

Construct the following interpretation $\mathcal{I}$:

- $\Delta^{\mathcal{I}} = \{Tweety, Nixon, aBird, Something, Tux\}$
- `:Tweety` $^{\mathcal{I}} = Tweety$
- `:Nixon` $^{\mathcal{I}} = Nixon$
- `:Tux` $^{\mathcal{I}} = Tux$
- `:Bird` $^{\mathcal{I}} = \{Tweety, aBird\}$
- `:Republican` $^{\mathcal{I}} = \{Nixon\}$
- `:Quacker` $^{\mathcal{I}} = \{Nixon\}$
- `:listensTo` $^{\mathcal{I}} = \{\langle Nixon, Tweety\rangle\}$
- `:likes` $^{\mathcal{I}} = \{\langle Nixon, aBird\rangle, \langle Something, Nixon\rangle, \langle Tweety, Tux\rangle\}$
- `:hasNickname` $^{\mathcal{I}} = \{\langle Nixon, \text{"Rix"}\rangle, \langle Tweety, \text{"Mr. Man"}\rangle\}$

Let

- $\beta(b_1) = aBird$, and
- $\beta(b_2) = Something.$

Then $\mathcal{I}, \beta \vDash \Gamma$, so we also have that $\mathcal{I} \vDash \Gamma$.

To construct a new interpretation such that $\mathcal{I} \nvDash \Gamma$, let $\mathcal{I}$ be as above, but let `:Bird` $^{\mathcal{I}} = \emptyset$. Then there is nothing we can send the blank node b_1 to have $\mathcal{I}, \beta \vDash$ `:Nixon :likes [ a :Bird ] .` (and also nothing to send `:Tweety` to), so this interpretation does not satisfy Γ: $\mathcal{I} \nvDash \Gamma$.