6 Programming languages and its creators*

6.1 Abstract

The article examines the properties of programming languages based on the knowledge base of the international project Wikidata. A number of problems have been solved with the help of SPARQL queries calculated on objects of the "programming language" type in Wikidata. Lists of all programming languages under permissive licenses and languages with closed licenses were obtained and their percentage was calculated. A bubble chart was built by the number of source code file formats. Maps have been received showing the location of educational institutions and companies in which people associated with the creation of programming languages studied or worked. A bubble diagram has been built showing the professions of people involved in the creation and development of programming languages. A list of all object-oriented programming languages was obtained and a conclusion was drawn about the exhaustive completeness of Wikidata regarding them. Comparison and analysis of the results of SPARQL queries of 2017 and 2020 are carried out, the main changes are noted.

* Panorama of San Jose, the unofficial capital of Silicon Valley. Silicon Valley is a region in the southern part of the San Francisco Bay Area in Northern California that serves as a global center for high technology and innovation. Author: Ben Loomis, WikiCommons / 2014 / Creative Commons Attribution License.

6.2 Formulation of the problem

We study programming languages, in particular, information about them in Russian Wikipedia, English Wikipedia and Wikidata. Tasks:

1. Construct an ordered list of programming languages by the number of interlinks.
2. Construct a list of languages by the number of visits of articles in Russian Wikipedia.
3. Construct a directed acyclic graph of dependencies of programming languages from each other (or find cycles in dependencies, if such a graph can not be constructed). See the "influenced by" property in Java.

~~Instances of the "Programming Language" object~~

Let's build a list of all languages.

```
#List of 'instances of' "programming language"
SELECT ?lang ?langLabel
WHERE
{
    ?lang wdt:P31 wd:Q9143.
    SERVICE wikibase:label
    {bd:serviceParam wikibase:language "en"}
}
```

Listing 6.1: List of programming languages.
The result contains 732 languages in 2017, 1422 languages in 2020.
SPARQL query: w.wiki/kCe

The most complete and well-developed programming languages on Wikidata for 2017 were: Java (Q251), Python (Q28865), C (Q15777). For 2020 the most well-developed programming languages on Wikidata are: C++ (Q2407) (26 properties), Java (Q251) (26 properties), JavaScript (Q2005) (25 properties), R (Q206904) (25 properties).

Almost empty and uninformative languages for 2017 were: CLIPS (Q165372), Dylan (Q1268744), Go! (Q3109515).

The disadvantage of the resulting list is that a number of objects turned out to be nameless on the Wikidata (No label defined). Let's try to get a list of languages, which "label" field will be non-empty.

```
#List of 'instances of' "programming language" only with a label.
SELECT ?item ?item_label
WHERE
{
    ?item wdt:P31 wd:Q9143
    ; rdfs:label ?item_label .

    FILTER (LANG(?item_label) = "en") .
}
```

Listing 6.2: List of programming languages with label.
The result contains 709 languages in 2017, 1422 languages in 2020.
SPARQL query: w.wiki/kCf

For 2020, all languages in the list have a filled label field.

Correlate a programming language and its developer.

Developer	Language
J. Ichbiah	Ada
C. Moore	Forth
J. Armstrong	Erlang

The answer is on page 66.

6.3 Demonstration of work with operations on sets in SPARQL

Output all programming languages that are open (free) software and / or experienced the influence of at least one of the following programming languages: C (Q15777), Python (Q28865), Java (Q251). At the same time, developed by any of the companies, except: Sun Microsystems, Johnson Space Center.

```
SELECT DISTINCT ?item ?item_label
WHERE
{
    ?item wdt:P31 wd:Q9143 # instances of programming language
    ; rdfs:label ?item_label .

    FILTER (LANG(?item_label) = "en") .

    {
      { ?item wdt:P737 wd:Q15777 } UNION # influenced by C
      { ?item wdt:P737 wd:Q28865 } UNION # influenced by Python
      { ?item wdt:P737 wd:Q251   } UNION # influenced by Java
```

Listing 6.3: An example of working with sets.
The result contains 115 languages in 2017, 122 languages in 2020.
SPARQL query: w.wiki/n9H