Programming Expertise
University of Potsdam SS 2021
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Test-Exam July, 2021

The theory questions in 1-3 are to be answered first without any aids and the sheet with the answers is to be handed in after about 15 minutes.

Thereafter you have 80 minutes time for the implementation of the programming tasks. Make after the steps of task 4-6 intermediate versions: GooboParser4.cpp, GooboParser5.cpp and GooboParser6.cpp. Submit at the end of the exam those single versions by E-Mail preferentially as zip or tar.gz archive (surname.zip) to me (E-Mail: dgroth@uni-potsdam.de). Although the tasks become more difficult from 4 to 6, all tasks are evaluated equally. 75% of the tasks will be on execute correctness and 25% of the tasks will be weighted by usefulness and clearness of the implementation. In Task 6 you can either choose to solve the GUI task 6A or add more complex functionality to your app in Task 6B. Both task are valid 4 points. For the computer tasks 4-6 all aids are allowed during the exam. This does not include personal support from fellow students or other persons.

Clarification

With this I state, that I will not take and give any not allowed support during the exam.

Name, Matrikel-Number.: Signature:

1. 2 points (theory – C)
2. 2 points (theory – C)
3. 2 points (theory - C++)
4. 2 points (layout console application)
5. 4 points (implementation of console application)
6. 4 points (extended functionality)

Sum: 16 points

Good luck !!

4. 1. Layout of console application and utilizing command line arguments (2 points): Create the basic outline of a console application with main function, help function and usage of command line arguments. Save the possible command line arguments in two variables . If not two argument were given call the help function and exit the application. The two arguments should be a goobo input filename and a taskname like *searchEC* or *getInfo*. You can as well use argparse library for command line parsing. The database file was downloaded from:
http://purl.obolibrary.org/obo/go/go-basic.obo

C++ filename first task: _____

5. Opening and searching in the GO-obo file (4 points):

Our program should work with any goobofile file. Please don't hardcode the filename in your application, if you do, you get a minus point. Implement a search function for a specific gene Ontology ID. If the user gives the three arguments: filename.obo *getInfo* GO:0000xyz on the command line, then the whole text belonging to this entry should be printed to the terminal. Hint: You can print the text inside of the function or you return the text to the function caller, for instance as a vector of strings, print it then outside of the function. This approach better fits with task 3. Hint use a ID from the beginning for your searches during debugging to save your time.

C++ filename(s) second task:
_____

6. Opening and searching EC identifiers (4 points)

Extend the program with an *searchEC* command so that it searches for EC identifiers in the xref lines of the Gene Ontology file. For instance the following output should be expected (line wraps are not neccessary):

```
$ dg-goobo --command searchEC --id EC:2.4.1 --filename  \
                      gene_ontology_edit.obo.2020-01-01.gz
GO:0000009     alpha-1,6-mannosyltransferase activity
GO:0001888     glucuronyl-galactosyl-proteoglycan
                    4-alpha-N-acetylglucosaminyltransferase...
GO:0001962     alpha-1,3-galactosyltransferase activity
GO:0003825     alpha,alpha-trehalose-phosphate synthase
                       (UDP-forming) activity
...
```

Alternatively your program could be as well called like:

```
$ dg-goobo searchEC EC:2.4.1 gooboe-filename
```

C++ filename(s) third task: _____

Name, Matrikel-Number.: Signature:

1-3. Theoretical questions:

1. C – Question 1 (see other page, 2 points)

2. C – Question 2 (see other page, 2 points)

Answer either question 6A or 6B!!

6A: Multiple Inheritance (2 points)
Explain in 3-4 sentences the advantages and disadvantages of multiple inheritance in C++. What would be a possible alternative approach to multiple inheritance.

6B: Dynamic Memory (3 points)
Explain in 3-4 sentences what dynamic memory in C++ is and how you should use it with a modern C++ compiler.