VE482 Lab5

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1. Layer programming

The program can be divided into three layers, what are they?

- list data structure
- sorting logic
- user interface

Split the program into files according to the defined layers.

- list data structure: `list.h`, `list.c`
- sorting logic: `sort.c`, `sort.h`
- user interface: `ui.c`, `ui.h`
- main for command line user interface: `main_cmd.c`
- main for menu user interface: `main_menu.c`

See the folder `./ex1` for details :)

2. Libraries

- **What are the four stages performed when compiling a file?**
  - **preprocessing**: removes comments, expands macros, expands included files
  - **compiling**: generates assembly code
  - **assembly**: converts the assembly code into binary code or machine code (also known as object code)
  - **linking**: merges all object codes from multiple modules into a single one
- **Static and dynamic libraries**
  - **static libraries**: statically linked, because a copy of the libraries is physically part of the executable. At compile time, static libraries stay locked into a program.
  - **dynamic libraries**: dynamically linked, because it contains filenames that enable the loader to find the program's library references at runtime, the dynamic libraries exist as separate files outside of the executable.

Static library

- **Create 2 static libraries, 1 for each of the 2 lowest layers in the previous program.**

```
gcc -c list.c -o list.o
ar -crs liblist.a list.o
gcc -c sort.c -o sort.o
ar -crs libsort.a sort.o
```

- **Compile the command line version using the static libraries**

```
gcc -L. -o ui_menu main_menu.c ui.c -lsort -llist
./ui_menu
```

Dynamic library

```
gcc list.c main_menu.c sort.c ui.c -c -fpic
gcc *.o -shared -o libmenu.so
gcc -L. -o ui_menu main_menu.c ui.c -lmenu
# using environment variable LD_LIBRARY_PATH
# to tell compiler where to find the shared library
export LD_LIBRARY_PATH=./
./ui_menu
```

- **What is the difference between a library and the API?**
  - An API (application programming interface) is the way that an application communicates with some software components, typically a library.
  - A library is a collection of functionality. A library may not be executable, but can be a part of other executable.
  - See `./ex2` for the implementation