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## **VE482 - Lab 5**

Introduction to Operating Systems

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## 1. Layer Programming

For coding part, please refer to folder ex1

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

- Data structure layer: Link list
- Logic layer: Sorting algorithm
- Interface layer: User interface

**Split the program into files according to the defined layers.**

- Data structure layer: `list.c/h`
- Logic layer: `sort.c/h`
- Interface layer: `ui.c/h`

## 2. Libraries

**What are the four stages performed when compiling a file? Briefly describe each of them.**

- Preprocess, compile and link.
- **Preprocess:** do preprocessing such as strip comment, expand macros, include head files
- **Compile:** compiler compiles source files and produce assembly code in object file
- **Link:** linker links object files and combines them into a single executable file

**Explain the difference between the static and dynamic library.**

- A static library, which is reusable in multiple programs, are locked into a program at compile time.
- A dynamic library, which lives outside of the executable file, can be modified without a need to re-compile.

**Create two static libraries**

```
1 #!/bin/sh
2 gcc -c list.c -o list.o
3 gcc -c sort.c -o sort.o
4 ar -rcs list.a list.o
5 ar -rcs sort.a sort.o
```

**Compile the command line version of the program using these two static libraries**

```
1 #!/bin/sh
2 gcc -c ui_cmd.c -o ui_cmd.o
3 gcc -o ui_cmd ui_cmd.o -L. -llist -lsort
```

**Generate two dynamic libraries**

```
1 #!/bin/sh
2 gcc *.c -c -fpic
3 gcc -shared -o liblist.so list.o
4 gcc -shared -o libsort.so sort.o
5 gcc -L. -o ui_menu ui_menu.c -llist -lsort
6 export LD_LIBRARY_PATH=./:$LD_LIBRARY_PATH
7 ./ui_menu
```

**What is the difference between a library and the API.**

- An API (Application Programming Interface) is the way a application communicates with some software components, typically a library.
- A library is a collection of functionality not making up an application of its own, but offered to application software to ease implementing some tasks.

**Implement the API below for the two libraries**

Please refer to folder `dlist`