

## Cross-Platform Inline Assembly Library Project

C언어 인라인 어셈블리(inline Assembly)를 활용한 연산 처리 구현 및 OS별(Linux/Windows) 라이브러리 저작 컴파일 실습

### Tech Stack & Environment

- Language: C, Assembly (AT&T Syntax)
- OS: WSL (Ubuntu 20.04), Windows 10/11
- Compiler: GCC (GNU Compiler Collection), MinGW-w64
- Build Targets: Static Library (.a), Shared Object (.so), Dynamic Link Library (.dll)

### 0. 실행 환경 준비 (Prerequisites)

프로젝트 디렉토리에 필요한 GCC 컴파일러와 필수 라이브러리를 설치하는 과정입니다. WSL(Ubuntu) 환경에서 진행했습니다.

#### Command:

```
sudo apt update
sudo apt install build-essential gcc-multilib
```

#### Details:

- build-essential: gcc, make를 포함해 필요한 기본 도구 모음
- gcc-multilib: 32비트 및 64비트 아키텍처를 모두 지원하기 위한 라이브러리

### 1. 핵심 코드 구현 (Core Implementation)

C언어 변수가 아닌 CPU 코어스터(Reg)를 직접 채어야하는 잇센 연산을 수행하는 함수를 작성하고 이를 헤더와 소스로 분리하여 모듈화했습니다.

#### 1-1. 인라인 어셈블리 (mylib.h)

GCC 기본의 AT&T 문법을 사용하여 하드웨어 계열의 연산 과정을 C 코드 내에 통합했습니다. [Assembly Code]

```
GNU nano 6.2
#include <stdio.h>

int main() {
    int a = 10, b = 20, result;
    // GCC 인라인 어셈블리 (AT&T 문법)
    __asm__ volatile (
        "movl %1, %eax;"          // movl N1, Maxx;
        "addl %2, %eax;"          // addl N2, Maxx;
        "movl %eax, %3;"          // movl Maxx, N3;
        : "+r"(%result)           // %result(a);
        : "%r"(a), "%r"(b)         // "%eax"
    );
    printf("결과: %d\n", result);
    return 0;
}
```

#### 1-2. 모듈화된 메인 함수 (main.c)

라이브러리 헤더(mylib.h)를 포함하여 아新浪微博의 로직을 외부 함수처럼 호출하는 구조입니다. [Main Code]

```
GNU nano 6.2
#include <stdio.h>
#include "mylib.h"

int main() {
    int a = 100, b = 200;
    int res = myLibAdd(a, b);

    printf("결과: %d\n", res);
    return 0;
}
```

### 2. 기본 로직 검증 (Basic Verification)

라이브러리 디렉토리 단일 파일 상태에서 컴파일하여 인라인 어셈블리 로직이 정상 작동하는지 우선 확인했습니다.

```
youngcha@DESKTOP-4A07M0:~/Desktop/2821963834/ex$ nano main.c
youngcha@DESKTOP-4A07M0:~/Desktop/2821963834/ex$ gcc main.c -o main
 결과: 30
```

[Test] gcc main.c -o main 명령어로 컴파일 후 실행하여 결과값 30이 정상적으로 출력됨을 확인했습니다.

### 3. Linux (WSL) 라이브러리 빌드

리눅스 환경에서 정적(Static) 및 동적(Dynamic) 라이브러리를 생성했습니다.

- Static Link (.a): ls -l 명령어로 아카이브 생성.
- Dynamic Link (.so): gcc -shared 및 -fPIC 플린 사용.
- Execution: LD\_LIBRARY\_PATH 를 지정하여 편집으로 라이브러리를 동적으로 로드.

#### [Linux Build Process]

```
youngcha@DESKTOP-4A07M0:~/Desktop/2821963834/ex$ gcc main.c -o main
 결과: 39
youngcha@DESKTOP-4A07M0:~/Desktop/2821963834/ex$ nano mylib.h
youngcha@DESKTOP-4A07M0:~/Desktop/2821963834/ex$ nano mylib.c
youngcha@DESKTOP-4A07M0:~/Desktop/2821963834/ex$ gcc -c mylib.c -o mylib.o
youngcha@DESKTOP-4A07M0:~/Desktop/2821963834/ex$ ar rcs libmylib.a mylib.o
youngcha@DESKTOP-4A07M0:~/Desktop/2821963834/ex$ gcc main.c -L. -lmylib -o main
youngcha@DESKTOP-4A07M0:~/Desktop/2821963834/ex$ gcc -shared -o mylib.so mylib.o
youngcha@DESKTOP-4A07M0:~/Desktop/2821963834/ex$ gcc main.c -L. -lmylib -o main.so
youngcha@DESKTOP-4A07M0:~/Desktop/2821963834/ex$ LD_LIBRARY_PATH=. ./main
 결과: 39
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youngcha@DESKTOP-4A07M0:~/Desktop/2821963834/ex$ LD_LIBRARY_PATH=. ./main
 결과: 39
youngcha@DESKTOP-4A07M0:~/Desktop/2821963834/ex$
```

[Success] WSL 터미널에서 라이브러리 생성부터 테스트까지 성공했습니다.

### 4. 실행착오 및 문제 해결 (Troubleshooting)

개발 과정에서 발생한 주요 오류와 해결 과정입니다.

#### 4-1. 링킹(Linking) 오류

라이브러리 파일이 존재함에도 불구하고 컴파일러가 함수를 찾지 못하는 문제를 발생했습니다. [Linking Error]

```
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youngcha@DESKTOP-4A07M0:~/Desktop/2821963834/ex$ gcc main.c -o main
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youngcha@DESKTOP-4A07M0:~/Desktop/2821963834/ex$ ar rcs libmylib.a mylib.o
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youngcha@DESKTOP-4A07M0:~/Desktop/2821963834/ex$ LD_LIBRARY_PATH=. ./main
年轻: ./main: undefined reference to `asm_add'
年轻: collect2: error: ld returned 1 exit status
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youngcha@DESKTOP-4A07M0:~/Desktop/2821963834/ex$ nano main.c
youngcha@DESKTOP-4A07M0:~/Desktop/28219
```