21MIS1001 01-10-2024
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SWE4001- Lab 6

Lab Question 5 – Direct Linking Loader

Write a C program to Implement pass one of a direct-linking loader. Sample three input files are given.

PROGA.txt

```
H^PROGA^000000^0063
D^LISTA^000040^ENDA^000054^
R^LISTB^ENDB^LISTC^ENDC
T^000020^0A^03201D^77100004^050014
T^000054^0F^000014^FFFFF6^00003F^000014^FFFFC0
M^000024^05^+LISTB
M^000054^06^+LISTC
M^000057^06^+ENDC
M^000057^06^-LISTC
M^00005A^06^+ENDC
M^00005A^06^-LISTC
M^00005A^06^+PROGA
M^00005D^06^-ENDB
M^00005D^06^+LISTB
M^000060^06^+LISTB
M^000060^06^-PROGA
E^000020
```

PROGB.txt

```
H^PROGB^000000^007F
D^LISTB^000060^ENDB^000070^
R^LISTA^ENDA^LISTC^ENDC
T^000036^0B^03100000^772027^05100000
T^000070^0F^000000^FFFFF6^FFFFFF^FFFFF0^000060
M^000037^05^+LISTA
M^00003E^05^+ENDA
M^00003E^05^-LISTA
M^000070^06^+ENDA
M^000070^06^-LISTA
M^000070^06^+LISTC
M^000073^06^+ENDC
M^000073^06^-LISTC
M^000076^06^+ENDC
M^000076^06^-LISTC
M^000076^06^+LISTA
M^000079^06^+ENDA
M^000079^06^-LISTA
M^00007C^06^+PROGB
M^00007C^06^-LISTA
E
```

PROGC.txt

```
H^PROGC^000000^0051
D^LISTC^000030^ENDC^000042^
R^LISTA^ENDA^LISTB^ENDB
T^000018^0C^03100000^77100004^05100000
T^000042^0F^000030^000008^000011^000000^000000
M^000019^05^+LISTA
M^00001D^05^+LISTB
M^000021^05^+ENDA
M^000021^05^-LISTA
M^000042^06^-ENDA
M^000042^06^-LISTA
M^000042^06^+PROGC
M^000048^06^+LISTA
M^00004B^06^+ENDA
M^00004B^06^-LISTA
M^00004B^06^-ENDB
M^00004B^06^+LISTB
M^00004E^06^+LISTB
M^00004E^06^-LISTA
E
```

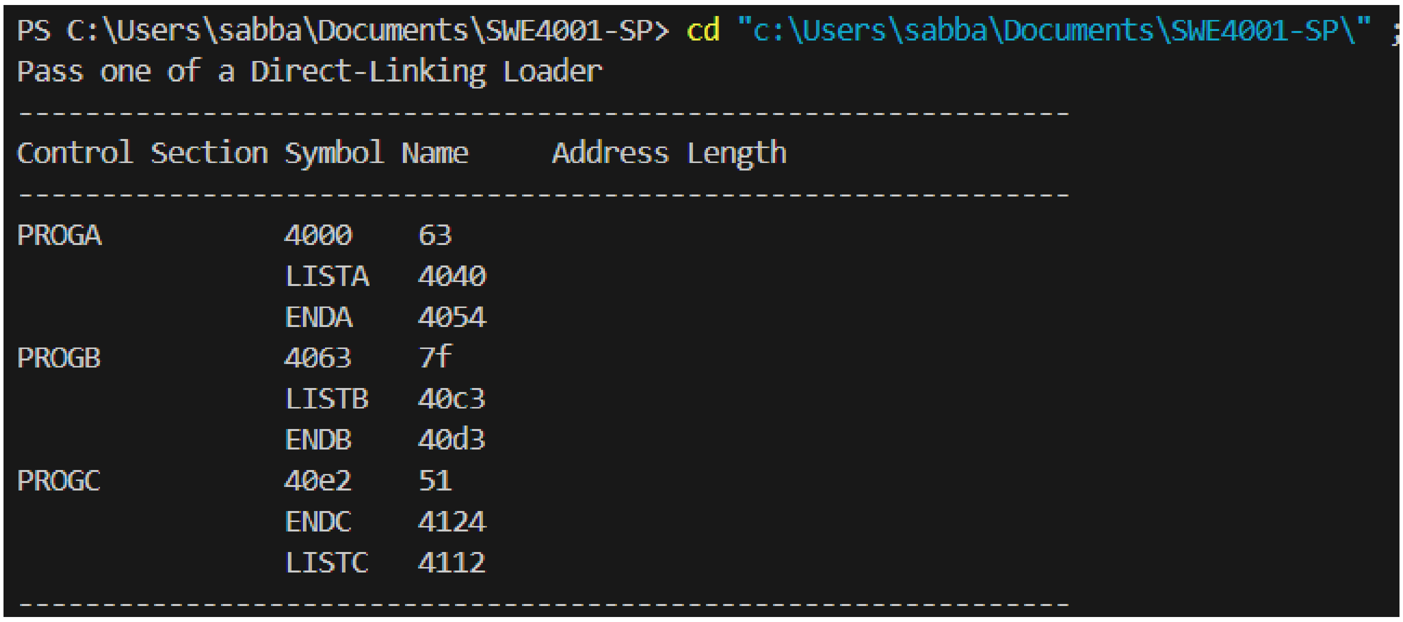
CODE

```cpp
#include <iostream>
#include <fstream>
#include <sstream>
#include <string>
#include <vector>
#include <unordered_map>
#include <iomanip>
using namespace std;
struct Symbol {
string symbolName;
int address;
};
struct ControlSection {
string sectionName;
int startAddress;
int length;
};
int hexToInt(const string& hexStr) {
int value;
stringstream ss;
ss << hex << hexStr;
ss >> value;
return value;
}
int main() {
unordered_map<string, Symbol> symbolTable;
vector<ControlSection> controlSections;
int currentAddress = 0x4000;
```

```
string inputFiles[] = { "PROGA.txt", "PROGB.txt", "PROGC.txt" };
for (const string& fileName : inputFiles) {
ifstream inputFile(fileName);
string line;
if (!inputFile.is_open()) {
cerr << "Error opening file: " << fileName << endl;
return 1;
}
string currentSectionName;
int sectionLength = 0;
while (getline(inputFile, line)) {
if (line[0] == 'H') {
stringstream ss(line);
string recordType, sectionName, startAddressStr, lengthStr;
getline(ss, recordType, '^');
getline(ss, sectionName, '^');
getline(ss, startAddressStr, '^');
getline(ss, lengthStr, '^');
currentSectionName = sectionName;
sectionLength = hexToInt(lengthStr);
controlSections.push_back({ currentSectionName, currentAddress,
sectionLength });
} else if (line[0] == 'D') {
stringstream ss(line);
string recordType, symbolName, addressStr;
getline(ss, recordType, '^');
while (getline(ss, symbolName, '^') && getline(ss, addressStr, '^'))
{
int symbolAddress = hexToInt(addressStr) + currentAddress;
symbolTable[symbolName] = { symbolName, symbolAddress };
}
}
}
currentAddress += sectionLength;
inputFile.close();
}
cout << "Pass one of a Direct-Linking Loader" << endl;
cout << "---------------------------------------------------------------" <<
endl;
cout << "Control Section\tSymbol Name\tAddress\tLength" << endl;
cout << "---------------------------------------------------------------" <<
endl;
for (const auto& section : controlSections) {
cout << section.sectionName << "\t\t" << hex << section.startAddress << "\t"
<< hex << section.length << endl;
for (const auto& symbol : symbolTable) {
if (symbol.second.address >= section.startAddress &&
symbol.second.address < section.startAddress + section.length) {
cout << "\t\t" << symbol.second.symbolName << "\t" << hex <<
symbol.second.address << endl;
}
}
}
cout << "---------------------------------------------------------------" <<
```

```
endl;
return 0;
}
```

OUTPUT



```
PS C:\Users\sabba\Documents\SWE4001-SP> cd "c:\Users\sabba\Documents\SWE4001-SP\" ;
Pass one of a Direct-Linking Loader
---------------------------------------------------------------
Control Section Symbol Name     Address Length
---------------------------------------------------------------
PROGA           4000    63
                LISTA   4040
                ENDA    4054
PROGB           4063    7f
                LISTB   40c3
                ENDB    40d3
PROGC           40e2    51
                ENDC    4124
                LISTC   4112
---------------------------------------------------------------
```