# Assignment 4

# (CS 348)

Q1. Write a C program to implement an assembler that processes assembly code in two passes.

The program should support the given instruction set:

ADD, SUB, MUL, DIV, COMP, JMP, JLE, JE, JGE, JNE, JL, JG, MOV, RESW, RESB, BYTE, WORD, CALL, RET, PUSH, POP, LDA, LDX, LDL, RD, WD, TD, STA, STX, STL, LDCH, STCH.

Q2. Write a C program to implement one pass assembler.
(who ever implements this will get bonus marks)
(Note: you may ignore this question if you don't want bonus marks)

For more information refer to Chapter 2 "Assembler" from the book attached

| Line | Loc | Source statement | | | Object code |
|---|---|---|---|---|---|
| 5 | 1000 | COPY | START | 1000 | |
| 10 | 1000 | FIRST | STL | RETADR | 141033 |
| 15 | 1003 | CLOOP | JSUB | RDREC | 482039 |
| 20 | 1006 | | LDA | LENGTH | 001036 |
| 25 | 1009 | | COMP | ZERO | 281030 |
| 30 | 100C | | JEQ | ENDFIL | 301015 |
| 35 | 100F | | JSUB | WRREC | 482061 |
| 40 | 1012 | | J | CLOOP | 3C1003 |
| 45 | 1015 | ENDFIL | LDA | EOF | 00102A |
| 50 | 1018 | | STA | BUFFER | 0C1039 |
| 55 | 101B | | LDA | THREE | 00102D |
| 60 | 101E | | STA | LENGTH | 0C1036 |
| 65 | 1021 | | JSUB | WRREC | 482061 |
| 70 | 1024 | | LDL | RETADR | 081033 |
| 75 | 1027 | | RSUB | | 4C0000 |
| 80 | 102A | EOF | BYTE | C'EOF' | 454F46 |
| 85 | 102D | THREE | WORD | 3 | 000003 |
| 90 | 1030 | ZERO | WORD | 0 | 000000 |
| 95 | 1033 | RETADR | RESW | 1 | |
| 100 | 1036 | LENGTH | RESW | 1 | |
| 105 | 1039 | BUFFER | RESB | 4096 | |
| 110 | | . | | | |
| 115 | | . | SUBROUTINE TO READ RECORD INTO BUFFER | | |
| 120 | | . | | | |
| 125 | 2039 | RDREC | LDX | ZERO | 041030 |
| 130 | 203C | | LDA | ZERO | 001030 |
| 135 | 203F | RLOOP | TD | INPUT | E0205D |
| 140 | 2042 | | JEQ | RLOOP | 30203F |
| 145 | 2045 | | RD | INPUT | D8205D |
| 150 | 2048 | | COMP | ZERO | 281030 |
| 155 | 204B | | JEQ | EXIT | 302057 |
| 160 | 204E | | STCH | BUFFER,X | 549039 |
| 165 | 2051 | | TIX | MAXLEN | 2C205E |
| 170 | 2054 | | JLT | RLOOP | 38203F |
| 175 | 2057 | EXIT | STX | LENGTH | 101036 |
| 180 | 205A | | RSUB | | 4C0000 |
| 185 | 205D | INPUT | BYTE | X'F1' | F1 |
| 190 | 205E | MAXLEN | WORD | 4096 | 001000 |
| 195 | | . | | | |
| 200 | | . | SUBROUTINE TO WRITE RECORD FROM BUFFER | | |
| 205 | | . | | | |
| 210 | 2061 | WRREC | LDX | ZERO | 041030 |
| 215 | 2064 | WLOOP | TD | OUTPUT | E02079 |
| 220 | 2067 | | JEQ | WLOOP | 302064 |
| 225 | 206A | | LDCH | BUFFER,X | 509039 |
| 230 | 206D | | WD | OUTPUT | DC2079 |
| 235 | 2070 | | TIX | LENGTH | 2C1036 |
| 240 | 2073 | | JLT | WLOOP | 382064 |
| 245 | 2076 | | RSUB | | 4C0000 |
| 250 | 2079 | OUTPUT | BYTE | X'05' | 05 |
| 255 | | | END | FIRST | |

This is the sample Input Assembly Language Program.

This is the object code corresponding to the above Assembly Language Program.

```
HCOPY  001000001070A
T001000 1E 14 1033 48 2039 00 1036 28 1030 30 1015 48 2061 3C 1003 00 102A 0C 1039 00 102D
T00101E 15 0C 1036 48 2061 08 1033 4C 0000 454F46 000003 000000
T002039 1E 04 1030 00 1030 E0 205D 30 203F D8 205D 28 1030 30 2057 54 9039 2C 205E 38 203F
T002057 1C 1010 36 4C 0000 F1 001000 041030 E0 2079 30 2064 50 9039 DC 2079 2C 1036
T002073 07 3820 64 4C 0000 05
E001000
```