Assignment 2
(CS 348)

Q1. Design and implement a **two-pass assembler** in C for the given assembly language. The assembler should process the input assembly program in two passes to generate the corresponding object code. It must support the following 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.

The assembler should follow the standard two-pass assembler design, including symbol table construction, address assignment, and object code generation.

Q2. Design and implement a **one-pass assembler** in C for the same instruction set. The assembler should generate object code in a single pass while handling forward references appropriately.

Note: This **question is optional** and carries 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
```