

Spring Semester Examination 2024
System Software (CSN-252)
B. Tech. II Year (CSE)

M. Marks 60

Time 2 Hrs

- Note: 1. Make suitable assumptions wherever needed and state them clearly.
2. ASCII code of Z = $(5A)_{16}$, a = $(61)_{16}$.

- ✓ (i) [2 Marks] Write the size of following SIC/XE registers (in bits)
(a) SW (b) F
- (ii) [2 Marks] Write the size of following 8086 registers (in bits)
(a) AL (b) SP
- (iii) [2 Marks] Consider a SIC/XE program that is loaded in the memory for execution starting from address $(1000)_{16}$. The contents of memory location X are X+1 for all memory locations starting from $(1100)_{16}$. What will be the contents of register A after the instruction 022106 at address $(1006)_{16}$ is executed? Show Calculations.
- (iv) [4 Marks] The contents of some of the 8086 registers are given below:
(BX) = 0508 (DI) = 015C (DS) = 1B00
Displacement in instruction is 2B47. Calculate and write effective and physical addresses if addressing mode is
(a) Register relative assuming register BX
(b) Based indexed
- ✓ [5 Marks] Mohan executes following SIC program on the SIC simulator (SICSIM) that was provided to you during the course. Show the contents of register A (in hex) just after the execution of each "lda" and each "ldch" instruction?

1000	test	start	1000
1000	five	word	1024
1003	input1	byte	x'F1'
1004	input2	byte	c'basic'
1009	first	lda	five
100C		sta	alpha
100F		lda	input1
1012		lda	input2
1015		ldch	charz
1018		stch	c1
101B		ldch	input3
101E		rsub	
1021	alpha	resw	1
1024	charz	byte	c'Z'
1025	input3	word	90
1028	c1	resb	1
1029		end	first

Fig. 1

3. [5 Marks] What would be the contents of register A (write in hex) just after the execution of each LDA instruction of the program given in Fig. 2? Register A is initially 0. What will be the contents of word labeled as INT (write in hex) just after the execution of STA instruction? Write object code of each instruction.

PROG1	START	0
FIRST	LDA	#LOC
	LDA	INT - 1
	SUB	#1
	STA	INT
	RSUB	
LOC	EQU	100
INT	WORD	1025
	END	FIRST

Fig. 2

4. [10 Marks] Consider the SIC program given in Fig. 1. User assembles the program using a one pass SIC assembler that produces object program for later execution.

- Write the complete object program generated by the one pass SIC assembler.
- Show symbol table just before the "rsub" instruction is executed.

5. [10 Marks] The program in Fig. 3 is processed by the single pass SIC/XE macro-processor.

- Show the contents of the Macro Name Table (NAMETAB) and the Macro Definition Table (DEFTAB) just after the macro processor has processed line marked with '*'. *
- Show the complete output of the macro processor. Assume that the SIC/XE macro-processor is written in C language.

PROG	START	0
SAVE	MACRO	&A, &B
	LDA	&A
	STA	&B
	ONE	&A
	STA	AA
	MEND	
ONE	MACRO	&W
	ADD	&W
	MEND	
BEGIN	CLEAR	A
	SAVE	XX, MEM
	ONE	YY
	RSUB	
XX	WORD	5
YY	WORD	10
AA	RESW	1
MEM	RESW	1
	END	BEGIN

Fig. 3

6. [10 Marks] Consider the following two C files:

```
#include <stdio.h>
int x=7;      char y = ' ';  int z = 5;
int p2();
int main() {
    p2();
    printf("%x %x\n", x, y); }
```

First.c

```
float x;
int y;
int p2() {
    x = 4.5;
    y = 10;
}
```

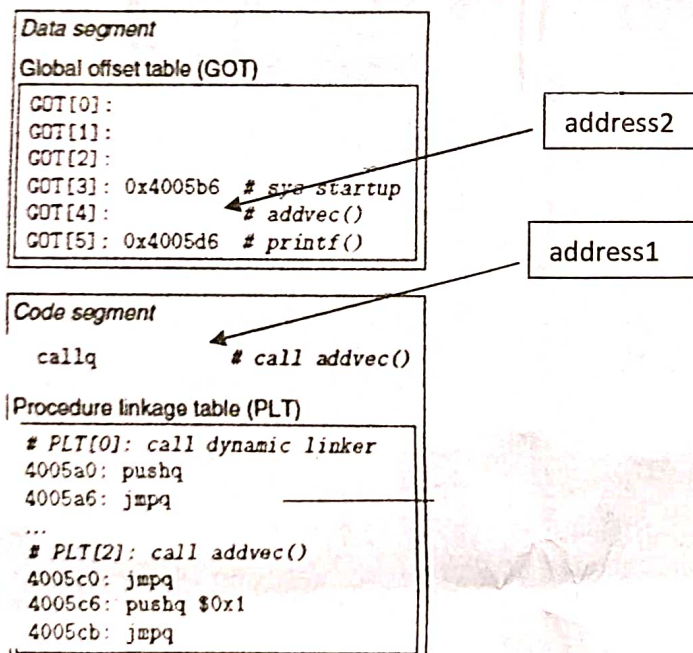
second.c

```
char 8 bit;
int 32 bit;
float 32 bit;
```

These two files are compiled using the command "gcc first.c second.c". Program gcc produces the executable file a.out. What will be the output (in hex) if file "a.out" is executed? Justify your answer.

7. [10 Marks] Refer to the GNU dynamic linker that handles PIC function calls using a combination of GOT and PLT. Function "addvec" from shared library abc.so is called at run time. The following figure shows GOT and PLT needed to resolve the run-time address of function addvec when it is first time called. Write the following:

- What is the use of entries GOT[0], GOT[1] and GOT[2].
- Write missing address1 of callq instruction and missing address2 at GOT[4] entry.
- Complete pushq and jmpq instructions at the addresses 4005a0, 4005a6, 4005c0 and 4005cb.



(a) First invocation of addvec