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### CSA PRACTICAL: ASSIGNMENT 4

1. Write an assembly language program for simulating following memory reference instructions using INDIRECT ADDRESSING:

i. ADD\_I

The screenshot shows the MACHINE 3-2 simulator interface. The main window is divided into three panes: ADD\_I, RAM MAIN, and Registers. The ADD\_I pane contains the following assembly code:

```
INP
STA 300
INP
STA 1350
INP
ADD I 300
OUT
HLT
```

The RAM MAIN pane shows the memory contents:

Addr.	Data	Comments
0	-8	INP
1	0	
2	49	STA 300
3	44	
4	-8	INP
5	0	
6	53	STA 1350
7	70	
8	-8	INP
9	0	
10	-111	ADD_I 300
11	44	
12	-12	OUT
13	0	
14	112	HLT
15	1	
16	0	
17	0	
18	0	
19	0	
20	0	
21	0	
22	0	

The Registers pane shows the current state of the registers:

name	width	value
AC	16	540
AR	12	14
DR	16	28673
E	1	0
INPR	8	0
IR	16	28673
OUTR	8	0
PC	12	16
S	1	-1

The IO Console shows the input and output values:

```
Enter an integer: 1350
Enter an integer: 120
Enter an integer: 420
Output: 540
```

ii. AND\_I

The screenshot shows the MACHINE 3-2 simulator interface. The main window is divided into three panes: AND\_I, RAM MAIN, and Registers. The AND\_I pane contains the following assembly code:

```
INP
STA 30
INP
STA 35
INP
AND I 30
OUT
HLT
```

The RAM MAIN pane shows the memory contents:

Addr.	Data	Comments
0	-8	INP
1	0	
2	48	STA 30
3	30	
4	-8	INP
5	0	
6	48	STA 35
7	35	
8	-8	INP
9	0	
10	-128	AND_I 30
11	30	
12	-12	OUT
13	0	
14	112	HLT
15	1	
16	0	
17	0	
18	0	
19	0	
20	0	

The Registers pane shows the current state of the registers:

name	width	value
AC	16	48
AR	12	14
DR	16	28673
E	1	0
INPR	8	0
IR	16	28673
OUTR	8	0
PC	12	16
S	1	-1

The IO Console shows the input and output values:

```
Enter an integer: 35
Enter an integer: 6
Enter an integer: 8
Output: 48
```

### iii. LDA\_I

MACHINE 3-2

File Edit Modify Execute View Text Help

LDA\_I\_STA\_I

```

INP
STA 50
INP
STA_I 70
INP
OUT
LDA_I 70
OUT
LDA_I 50
OUT
HALT

```

RAM MAIN

Address:	Decimal	Data:	Decimal	Row size:
0		0	INP	
1		33		
2		48	STA 50	
3		50		
4		-8	INP	
5		0		
6		-80	STA_I 70	
7		70		
8		-8	INP	
9		0		
10		-12	OUT	
11		0		
12		-96	LDA_I 70	
13		70		
14		-12	OUT	
15		0		
16		-96	LDA_I 50	
17		50		
18		-12	OUT	
19		0		
20		112	HALT	

Registers

name	width	value
AC	16	0
AR	12	20
DR	16	28673
E	1	0
INPR	8	0
IR	16	28673
OUTR	8	0
PC	12	22
S	1	-1

IO Console

```

Enter an integer: 70
Enter an integer: 33
Enter an integer: 55
Output: 55
Output: 33
Output: 0

```

### iv. STA\_I

MACHINE 3-2

File Edit Modify Execute View Text Help

STA\_I

```

INP
STA 50
INP
STA_I 70
INP
OUT
LDA 50
OUT
LDA 70
OUT
HALT

```

RAM MAIN

Address:	Decimal	Data:	Decimal	Row size:
0		0	INP	
1		5		
2		48	STA 50	
3		50		
4		-8	INP	
5		0		
6		-80	STA_I 70	
7		70		
8		-8	INP	
9		0		
10		-12	OUT	
11		0		
12		32	LDA 50	
13		50		
14		-12	OUT	
15		0		
16		32	LDA 70	
17		70		
18		-12	OUT	
19		0		
20		112	HALT	

Registers

name	width	value
AC	16	0
AR	12	20
DR	16	28673
E	1	0
INPR	8	0
IR	16	28673
OUTR	8	0
PC	12	22
S	1	-1

IO Console

```

Enter an integer: 70
Enter an integer: 5
Enter an integer: 7
Output: 7
Output: 70
Output: 0

```

### v. BUN\_I

MACHINE 3-2

File Edit Modify Execute View Text Help

BUN\_I

```

INP
STA 20
BUN I 20
INP
OUT
INC
OUT
CMA
OUT
HALT

```

RAM MAIN

Address: Decimal Data: Decimal Row size:

Addr...	Data	Comments
0	-8	INP
1	0	
2	48	STA 20
3	20	
4	-64	BUN_I 20
5	20	
6	-8	INP
7	0	
8	-12	OUT
9	0	
10	112	INC
11	32	
12	-12	OUT
13	0	
14	114	CMA
15	0	
16	-12	OUT
17	0	
18	112	HALT
19	1	
20	0	

Registers

Base: Decimal

name	width	value
AC	16	-12
AR	12	18
DR	16	28673
E	1	0
INPR	8	0
IR	16	28673
OUTR	8	0
PC	12	20
S	1	-1

IO Console

```

Enter an integer: 20
Enter an integer: 10
Output: 11
Output: -12

```

## vi. ISZ\_I

MACHINE 3-2

File Edit Modify Execute View Text Help

ISZ\_I

```

INP
STA 300
INP
STA 1350
ISZ I 300
INC
OUT
CMA
OUT
HALT

```

RAM MAIN

Address: Decimal Data: Decimal Row size:

Addr...	Data	Comments
0	-8	INP
1	0	
2	49	STA 300
3	44	
4	-8	INP
5	0	
6	53	STA 1350
7	70	
8	-31	ISZ_I 300
9	44	
10	112	INC
11	32	
12	-12	OUT
13	0	
14	114	CMA
15	0	
16	-12	OUT
17	0	
18	112	HALT
19	1	
20	0	

Registers

Base: Decimal

name	width	value
AC	16	-57
AR	12	18
DR	16	28673
E	1	0
INPR	8	0
IR	16	28673
OUTR	8	0
PC	12	20
S	1	-1

IO Console

```

Enter an integer: 1350
Enter an integer: 55
Output: 56
Output: -57

```

## 2. Write an assembly language program for simulating BUN instruction (memory reference) :

The screenshot displays the MACHINE 3-2 simulator interface, which includes a menu bar (File, Edit, Modify, Execute, View, Text, Help) and four main panels:

- BUN Panel:** Contains the assembly program:

```
INP  
OUT  
BUN 20  
INP  
OUT  
CLA  
OUT  
INP  
INC  
OUT  
HALT
```
- RAM MAIN Panel:** A table showing memory addresses, data, and comments.

Addr...	Data	Comments
0	-8	INP
1	0	
2	-12	OUT
3	0	
4	64	BUN 20
5	20	
6	-8	INP
7	0	
8	-12	OUT
9	0	
10	120	CLA
11	0	
12	-12	OUT
13	0	
14	-8	INP
15	0	
16	112	INC
17	32	
18	-12	OUT
19	0	
20	112	HALT
- Registers Panel:** A table showing register names, widths, and values.

name	width	value
AC	16	10
AR	12	20
DR	16	28673
E	1	0
INPR	8	0
IR	16	28673
OUTR	8	0
PC	12	22
S	1	-1
- IO Console Panel:** Displays the input and output of the program.

```
Enter an integer: 10  
Output: 10
```