0237

National University of Computer and Emerging Sciences

FAST School of Computing | Fall-2022 | Islamabad Campus

EE-2003 Computer Organization and Assembly Language (CS)

Serial No:

Sessional Exam-II

Total Time: 1 Hour

Total Marks: 60

Friday, 18th November, 2022.

Signature of Invigilator

Course Instructors

Dr. Niaz Ahmed, Ms. Sobia Rasheed, Ms. Shehr Bano, Mr. Rohail Gulbaz, Mr. Shams Farooq

Student Name | Roll No. | Course Section | Student Signature

DO NOT OPEN THE QUESTION BOOK OR START UNTIL INSTRUCTED.

Instructions:

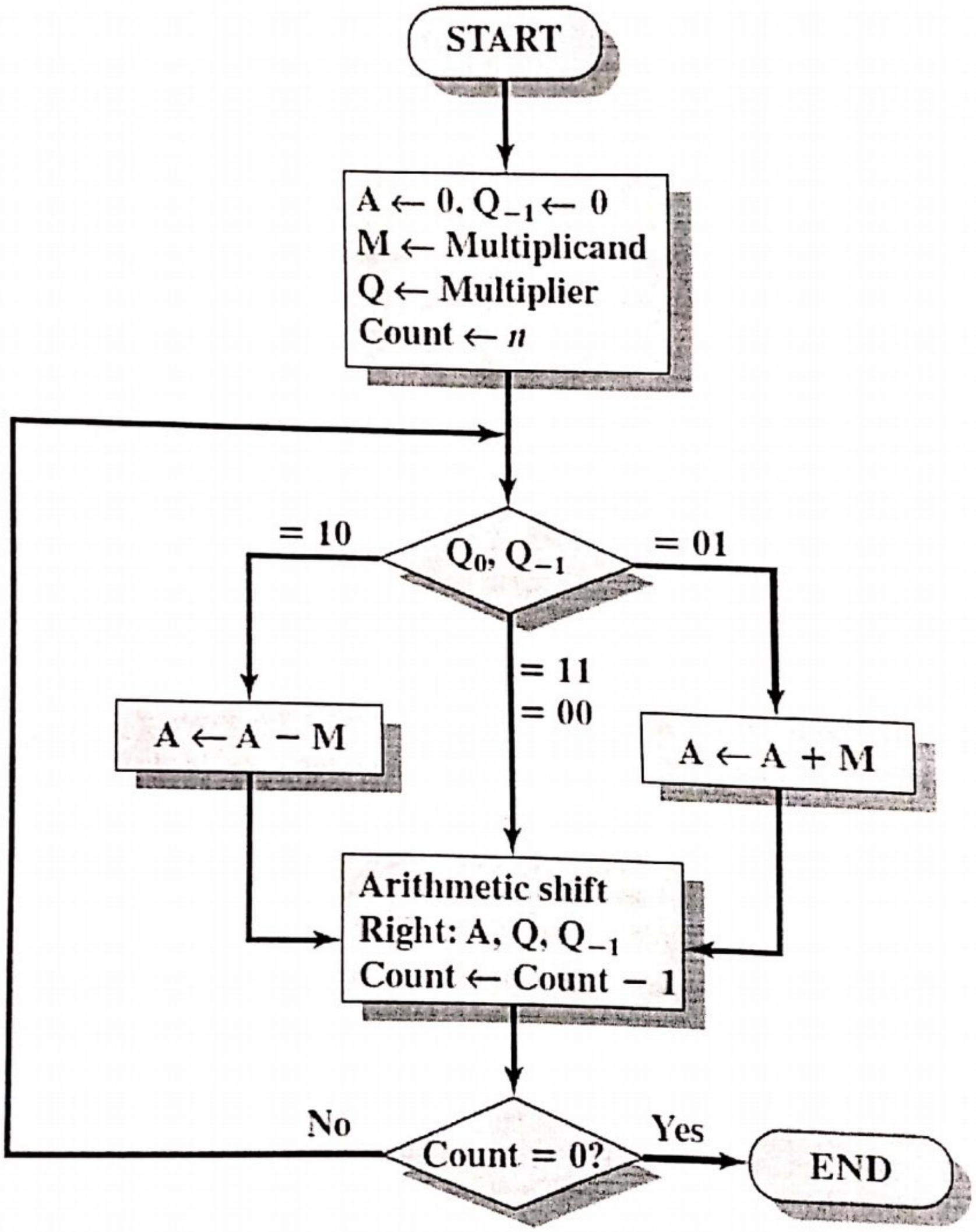
1. Attempt on question paper. Attempt all of them. Read the question carefully, understand the question, and then attempt it.
2. No additional sheet will be provided for rough work.
3. After being asked to commence the exam, please verify that you have TEN(10) different printed pages including this title page. There are a total of **6** questions.
4. Calculator sharing is strictly prohibited.
5. Use permanent ink pens only. Any part done using soft pencil will not be marked and cannot be claimed for rechecking.
6. Write your instructors name on top of the paper and share something good in the end of paper to score extra 3 marks.

	Q-1	Q-2	Q-3	Q-4	Q-5	Q-6	Total
Marks Obtained							
Total Marks	**10**	**10**	**10**	**10**	**10**	**10**	**60**

02

Question 1 [10 Marks]

Use Booth's Multiplication Algorithm to multiply 23 (take it as Q) by -9 (take it as M). Show all steps considering your computer's data width equal to 6-bits.



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M (Multiplicand)
110111

001001
1 1 0 1 1 1 = -9
M

16 8 4 2 1
0 1 0 1 1 1 = 23
Q

A (Accumulator)	Q (Multiplier)	Q_{-1}	Operation	
000000	010111	0	Initial Values	
001001	010111	0	A-M	(1)
000100	101011	1	Shift	
000010	010101	1	Shift	(2)
000001	001010	1	Shift	(3)
111000	001010	1	A+M	(4)
111100	000101	0	Shift	
000101	000101	0	A-M	(5)
000010	100010	1	Shift	
111001	100010	1	A+M	(6)
111100	110001	0	Shift	
	↓			
000011	011111		23 x -9 = -207	
128 64	8 4 2 1 = 207			

0-(-9)

1+(-9)
001000
111000
000100
-8+9=5

2-9
000111
111001

=-207

Question 2 [10 Marks]

Dry run the program given below and update the table for each iteration.

```
.model small
.data
    array db -5, 1, 0, 3
    swap db 0
.code
    mov ax, @data
    mov ds, ax

    mov cx, lengthof array
    dec cx

start:
    mov swap, 0
    mov bx, 0
loop1:
    mov dl, bl
    add dl, 48
    mov ah, 02
    int 21h

    mov al, [bx+array]
    cmp al, [bx+array+1]
    jbe noswap

    mov dl, [bx+array+1]
    mov [bx+array+1], al
    mov [bx+array], dl
    mov swap, 1

noswap:

    add bx, 1
    cmp bx, cx
    jne loop1

    cmp swap, 1
    je start

mov ah,4ch
int 21h
end
```

0 0 0 0 0 1 0 1

1 1 1 1 1 0 1 1 = -5

128 64 32 16 8 2 1 = 255-4 = 251

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Iteration #	Value in array after each iteration.					
	251					
Initial	(-5)	1	0	3		
1	1	-5	0	3		
2	1	0	-1	3		
3	1	0	3	-5		
4	0	1	3	-5		
5	0	1	3	-5		
6	0	1	3	-5		
7	0	1	3	-5		
8	0	1	3	-5		
9	0	1	3	-5		

Question 3 [10 Marks]

Carefully dry run the given program and write the output in Decimal. Also show complete traces of runtime stack for both fill and clear phases by writing the actual offset and values.

Offset	Code
	.model small
	.data
	n db 45, 49, 52, 51, 53
	.stack 0100h
0000	.code
0001	mov ax, @data
	mov ds, ax
0002	
	jmp start
	MySub PROC uses dx cx
0003	
0004	push bp
	mov bp,sp
0005	
0006	sub sp, 4
0007	mov word ptr [bp-4], 59
	mov word PTR [bp-2], 57
0008	
0009	mov dl, [bp-2]
000A	mov ah, 02
	int 21h
000B	
000C	mov dx, [bp+4]
000D	mov ah, 02
	int 21h
000E	
000F	mov bx, [bp+10]
0010	mov dx, [bx]
0011	mov ah, 02
	int 21h
0012	
0013	mov sp, bp
	pop bp
0014	
	ret 2
	MySub ENDP
	start:
	main proc
0015	

```
0016            mov si, offset n
0017            mov word ptr [si], 48
                add si, 2
0018
0019            mov dx, [si-2]
001A            mov ah, 02
                int 21h
001B
001C            mov dx, [si]
001D            mov ah, 02
                int 21h
001E
001F            mov di, offset n
0020            push di
0021            mov cx, 49
0022            push cx
                call MySub
0023
0024            inc cl
0025            push cx
0026            mov dx, cx
0027            mov ah, 02
                int 21h

            main endp
0028
0029        mov ah, 4ch
0030        int 21h
            end
```

dx = 52

Output:

0 4 9 4 0 2

Fill Stack

Address	Content
0100	Offset n = 0000h
00FE	~~49~~ 50
00FC	~~ret add = 0029~~
00FA	~~dx = 52~~
00F8	~~cx = 49~~
00F6	~~bp = 0000~~ ← bp, sp
00F4	~~57~~
00F2	~~59~~
00F0	

Question 4 [10 Marks]

Update the values of flags after execution of each block which are part of a single program and write answers in the provided area. Rough Work is compulsory to update any flag.

```
.model small

.code

;Block 1
mov al, 10101010b
mov bl, 10101010b
add bl, al



;Block 2
mov bl, 10101010b
or al, bl



;Block 3
jne B
cmp al, 1
B:
cmp al, 0
```

;Block 1

Flags	Sign	0
	Zero	0
	Carry	1
	Overflow	1
	Parity	0
	Auxiliary	1

;Block 2

Flags	Sign	1
	Zero	0
	Carry	0
	Overflow	0
	Parity	1
	Auxiliary	1

;Block 3

Flags	Sign	1
	Zero	0
	Carry	0
	Overflow	0
	Parity	1
	Auxiliary	0

jng B True

Rough Work (Compulsory)

```
  1 1 1 1
  1 0 1 0 1 0 1 0
+ 1 0 1 0 1 0 1 0
-----------------
  0 1 0 1 0 1 0 0
```

CF=1
AF=1

```
  1 0 1 0 1 0 1 0
  1 0 1 0 1 0 1 0
-----------------
  1 0 1 0 1 0 1 0
```

```
  1 0 1 0 1 0 1 0
- 0 0 0 0 0 0 0 0
-----------------
  1 0 1 0 1 0 1 0
```

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Question 5 [10 Marks]

Find the value of AL in Decimal for the following set of instructions.

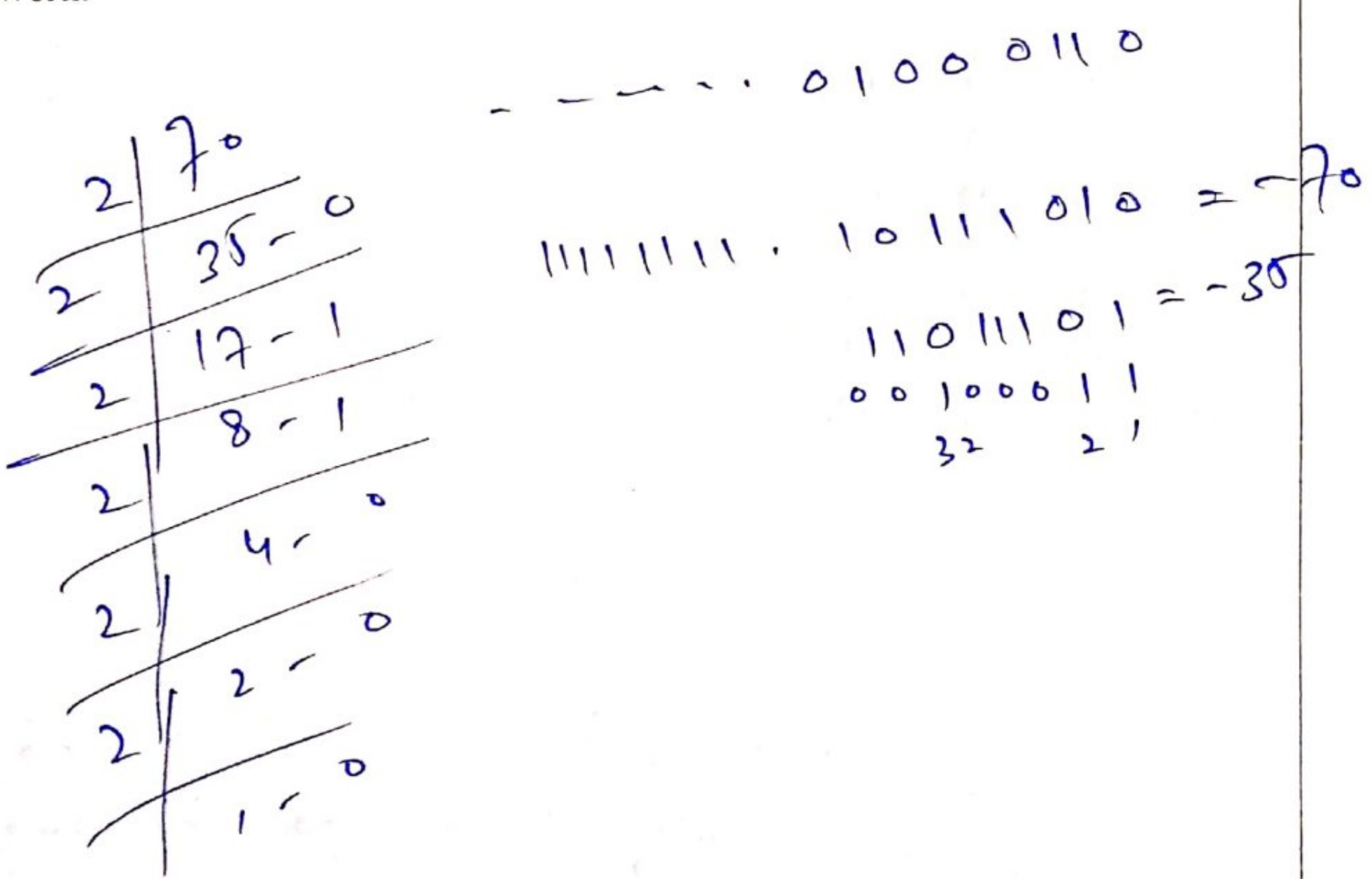
`mov ax, -70` `shr ax, 1`	**AL=** -35	`mov ax, -70` `shr al, 1`	**AL=** 93

`mov ax, 0`
`mov al, -70`
`shr ax, 1`
	AL= 93	`mov al, -70`
		`shr al, 1`
			AL= 93

`mov ax, -70` `sar ax, 1`	**AL=** -35	`mov ax, -70` `sar al, 1`	**AL=** -35

`mov ax, 0`
`mov al, -70`
`sar ax, 1`
	AL= 93	`mov al, -70`
		`sar al, 1`
			AL= -35

Rough Work:



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Question 6 [7 +3 Marks]

SHL instruction performs unsigned multiplication when the multiplier is a power of 2 and any other number can be expressed in powers of 2. Write instructions to find the product of AL by 29, where AL=4. A sample is provided below.

Sample Program: AX x 36

```
mov ax, 123
mov bx, ax
shl ax, 5
shl bx, 2
add ax, bx
```

Problem: AL=4, AL * (29) AL can have any value

```
mov al, 4
mov bl, al
mov cl, al
mov dl, al

shl bl, 4
shl cl, 3
shl dl, 2

add al, bl
add al, cl
add al, dl
```

AL x 4
29 x 4 is wrong

16 8 4 2 1
1 1 1 0 1
1 1 3 2 2
4 3 2 2
2 2 2

Good Luck....

3 marks of writing anything good more specifically about your teacher. and mentioning the name of your teacher.