B Sc. in EEE, 7th Semester

December 15, 2023 (Afternoon)

ISLAMIC UNIVERSITY OF TECHNOLOGY (JUT) ORGANISATION OF ISLAMIC COOPERATION (OIC) DEPARTMENT OF ELECTRICAL AND ELECTRONIC ENGINEERING

Semester Final Examination Course No.: EEE 4705 Course Title: Microcontroller Based System Design Winter Semester, A. Y. 2022-2023 Time: 3 Hours

There are 6 (six) questions. Answer all 6 (six) questions. The symbols have their usual meanings. Programmable calculators are not allowed. Marks of each question and corresponding COs and POs are written in the brackets.

1. a) Assume your desired output is saved in the label "MSG_1" and following is the subroutine for displaying the output on a LCD. However, the code is incomplete (CO3, and shows "?" marks in the missing places. Complete the code and show the PO3) connection between AT89C51 and LM016L based on the given subroutine. [Note:

	ORG 90H	29		LCALL DELAY
2	LCD DISPLAY:	30		CLR ?
3	MOV SP, #70H	31		RET
4	MOV PSW, #00H	32	DISPLAY:	LCALL READY
5	RS EOU P2.0	33		MOV P1, A
6	RW EQU P2.1	34		SETB ?
7	ENBL EOU P2.2	35		CLR ?
8	MOV A#38H	36		SETB ?
9	LCALL COMMAND	37		LCALL DELAY
10	LCALL DELAY	38		CLR ?
11	MOV A, #0EH	39		RET
12	LCALL COMMAND	40	READY:	SETB ?
13	LCALL DELAY	41		CLR ?
14	ACALL DELAY	42		SETB ?
15	MOV DPTR, #MSG 1	43	WAIT:	CLR ?
16	LOOP_1: CLR A	44		ACALL DELAY
17	MOVC A.@A+DPTR	45		SETB ?
18	JZ FINISH 2	46		JB 7, WAIT
19	LCALL DISPLAY	47		RET
20	LCALL DELAY	48	DELAY:	
21	INC DPTR	49	AGAIN_2:	
22	LJMP LOOP_1	50	AGAIN:	DJNZ R4, AGAIN
23	FINISH 2: SJMP \$	51		DJNZ R3, AGAIN_2
24	COMMAND: LCALL READY	52		RET
25	MOV P1, A	53	MSG_1:	DB "Output is ",0
26	CLR ?	54		RET
27	CLR ?	55		END
28	SETB ?			

b) Find the MAX1112 control byte for CH3, single-ended, unipolar, internal clock (COL and fully operational modes. PO1)

2. a) Design a binary-ASCII converter. 10 Use assembly language to convert an 8 bit binary (hex equivalent) data to (CO2, corresponding ASCII and save them following the Little-Endian convention (low PO2) digit in the lower address location and high digit in the higher address location). Assume that the binary data is available through port P1 of AT89C51. Break down your code into two subroutines; one that converts binary to decimal, and two, that converts the corresponding decimal to ASCII.

b) Explain the following:

- i. Erasable programmable ROM.
- ii. Electrically erasable programmable ROM.
- iii. Static RAM.
- iv. Non-volatile RAM.

 a) Write a program to generate the following wave pulses simultaneously on the 15 corresponding ports as shown in the Fig. 3. Given XTAL=11.0592 MHz. Justify your code. PO2)





b) State the significance of IP register.

(CO1, PO1)

10

(CO1.

- a) Design a counter for counting the palses of an input signal. The palses to be 15 counted are fed to pin P3.4 of an AT89C51. Given XTAL = 22 MHz. Justify your (CO2, design.
 - b) Justify your preference between polling and interrupts.

(CO1, PO1)

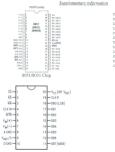
 a) Assume there are 2 doors in a noom. You have placed ADC0804 in the first door 15 and ADC0848 in the second door. The ADCs are excipted with necessary sensors (CO4, ADCs are connected to your AT89C51 in such a way that both the ADCs are active simultaneously.

Sketch the complete connection diagram to design such a system. [Note: Read Question 5(b) before you sketch your connection.]

- b) Create a complete assembly code for executing the design statucal in Question S(n). 20 Initiate the conversion process for both the ADCs and continuously monitor the (COC) status of PO7. Serve each of the ADCs whenever the conversion is finished and reinitiate for the next cycle. If at any moment you get a bit in PO7, you should terminate your program. Call the sub-routines for data conversion and data display from Question 2(a) and 1(a) requerively.
- a) Connect two external memory devices with your AT89C51; one Program ROM 15 and one Data ROM. While giving the connection address the following: (CO3, i. Justify your chosen size for each of the memory devices. PO3) ii. Based on the chosen size, justify how many address lines are required for
 - Based on the chosen size, justify how many address lines are required for accessing the memory devices.

- iii. Design your own decoder and connect the remaining pins with your decoder.
- iv. Use 74LS373 for address/data demultiplexing.
- b) Based on your connection in Question 6(a), determine the address range for each of the connected external memory devices. (CO1,

c) Assume there are 10 bytes of data stored in the external Program ROM which 15 needs to be transferred to the external Data ROM. However, only the lower multible (CO2, of all these data is useful and the rest are redundant. Create an assembly code to PO2 transfer the useful data to the Data ROM from the Program ROM. Note: Fib data in Program ROM is swered in locations of your choice and the transferred data between the store of the store



ADC0804 Chip

	1	
	1 RD	VCC 24 C
	2 CH1	CB 23 C
	3 CH2	WR 22 CI
D	4 GH3	INTR 21 CJ
	6 CH4	DBOMAD 20 CJ
		DD1MA1 19
	7 CH5	D829AA2 18
		D83MA3 17 C
		DBAMAA 16
	10 AGND	D86 16 03
	11 Wef	D86 14 C3
	12 DGND	D87 13 C3

ADC0848 Chip



LM016L

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2051 Instruction Set Summary

- Register RT-RD of the currently selected Register Earch. 8-bit interest data toolifer's addinase. This could be an inferral Data RMM bicelere (0.127) or a 55R (3.e. VD port, control register, Mithe
 - register, etc. (128-206) Debt (Herral Dess RAM Isoation (D-255) addressed indirectly frroug i u
- Signed (her)s correported () 544 offset byte. Used by SJMP and all coefficient (arrays 16 = 125 to +127 bytes relative to first byte of the biolowing instruction.
- Orect Addressed bit in Interval Data RAM or Special Function Register.



Mananala .		Desciption	-	Ovia	5618		Set cerry lieg		-
Vithweld operations	relices				GT32	2	Ext denot bit		*
100		A AT SAME AN ADDAME (MORE)			5		Complement (air) fag		-
A DESCRIPTION		a A1 Sourt hole to accumulator			Б	x	Complement direct bit	N.	-
		and indirect Date to accumulative			AM.		AND dead of tu carry flag		
and a second		a Ant increasions state in annumble			AM.		AND component of direct bit to carry		N
		A ded mandation for many reduction first a first			1MO		CPR direct bit to carry flag		
		And the state of a state state of the state of the			140		CR complement of direct bit it carry		
A A A A A A A A A A A A A A A A A A A		Part of any 1 had to 10 and 1 had to 10 and			1001		Move direct bit to cerry fied		•
		A ded incompare done pro primer a compare dans			100	Dec O	Move carry flag to direct bit		
0.00 4.04		Fahind worker in an unstand with bothow			Prepri	All and mach	ies central		
A riter		Factored Arrent byte for A with GAVY DOTON			HON	. sold-11	Absolute subcodire call		
VANA 1001		Partners indirect ROM to A with CAR's DOTON				LCALL #99/75	Long subrading call		
US3 Areter		Earliest investigate data to A with carry borrow			1.24		Peeter from subsouties		
- V 0		Incoment excuration			11.201	11.00	Rearn from interrupt		
WO IN		Preservent ingeaur			AIM	A30711	Abesive jurg		
		Increment direct byte			1.40	A30793	roud)mb		
100 040		VORTRACT INSING SAM			SUM		Short jump (relative editresk)		2
		Chorage accuración or			9	CANCOTR	Jurg indirect relative to the CPTH		-
		Decrement register			a	10	Jump If accumulation is zero		-
4C 0140		Decrement direct byte			2047	14	Jump E accumulations not zero		24
040 040		Decrement indirect PAM			8	R	Jurry Francy Rag is sed	-1	14
NC OFTR		Increment cato pointer			000	Ja.	Jurie II savy flag is not set		14
		Multiple A and 5 -> 23 hit[A k]			2	bitrel	Durry Plact is east		P4.
ON NO		Crede A by D -r Avenual, Brencharder			96	bitrel	Durrip IT Bit is not set	~	11
* 8		Decinel adjust accumulator			2007	bitrel	Jump if direct bit is set and clear bit	~	24

Ministronic	Cressingulary	ave.	Cyrole	Illeroni	Deep
1 10/	Consistent and militate			CINE ARONALI	S
N. A	Foote accuruter left			C.N.C. Recetation	8
N.C. A.	Foote accuruted wit through cerry			CINC OPARAMINE	ŝ
	Floats accurulator 6ght			CONC. Revel	Ceore
PINC A	Fooder accumulator 6ght Providy carry			DUNC deect.ml	Ceore
SAMP A	Swag róbbies within the eccemisation			×00	Als of
Logic operations				Curla transition	
AN. AM	AAD register to accumulation				More
ANL. Actent	AVE: direct byte to accumulate				No.
ANL AGM	vehilling on the second statement of the second sec			MOV AGR	N.
ANL APRAM	voteinmose si alte ateleanne CMM		-		No.
	which benefits and observations on the	~	-		ĥ
	a AVA immodiate data to dered MVM a	-			-
CHL AR	OR regaler to accumulative	-	-	NOV PLANE	-
CML Adred	OR direct byte to accumulater				
CHL AGH	OR indirect PMM to accumulator				
COL ADDA					A Second
COR clear hos			-	MCV DIACOPTIAL	MON
		-	-	MOV BRIA	Move
	Exclusive CRI direct byte to accumulator		-		Merva
	Exclusive CPI indirect RAM to accumulative	-	-	1001 0001000 ADM	MICUN
333, A.B.660	Exclusive CR immediate data to accumulative				Load
231, desitA	Exchance CR accumulator is cleard byte	N		MOVO A GANCOTR	Hiters
233, dent/\$34	a Exclusive CR immediate data to derect byte	n		MOVO A GAVEO	lifere
Distant satisfies	manipulation			MOX AGN	a line
CLK C	Clear carry flag			HIMPY YORK	
	Clear drest M			MOVA BRAN	anyou a
SATE O	Set cerry lieg	-	-		
SCTD N	Saf devol bit	~			
0 10	Complement carry flag	-	-		
	Complement client bit	N	-		
AM. C.M.		~	~	10-11 A MG	
	AND component of direct bit to carry	N	~		
	COR direct bit to carry flag	~		TANKS BUT IN WALK	
	CR complement of direct bit to carry	~	~		
	Move direct bit to cerry fleg				
MOV BUD	Move cary flag to drect bit			Distance of the	
Program and ma	chine certryl			A RANK	
	Associate autocoding call	~	~	Dame # A ver dida	
LCALL #99/75	Long subraction Call				
1.04	Means from autocounted			N Nev APTICA	
100	Person in public memory of			(much a v a cant)	
	Parameter party			Distance of the	
	Coort isn't bisting address)			A LOSS A REAL OF	
000	(3 Junio indirect relative to the DPTH)	-		Clarke A + clarke	
10 II	Jung Facomulation is perio	~		Be, pre: A.Photo.B.	
100 M	June Factoristations not zero	-		Owner A created	
10 M	Jury Feary Eag is oil	**	~	wellah A 4m/> 8043	
and ref	Jurie II savy flag is not set	~	~	(no A modificative)	2
J& blue	Jurry IT IN IN AM	n	~		
JAD bitre	Jump IT bit is not set		~		
UBC DEVE	Jurry IT Great bit is set and clear bit.	~	~		

con n
c

		Cesciption	1	Code
	A BOBA IN	Connects Investigate to A and simo # not sound		
	On determined	Compare trends to the and large if not equal		
	OPASSAN	Compare invest to not and jurg if not equal		
	Rund	Certement register and party in roll zero		
	deed.net	Cecreteed direct tyte and jump in not zero		
		Nar operation		
18	water			
	AR	More register to accurately		
	Adrect	More directively to accuraciance		
	A.020	More indirect RAM to accuraciance		
	A.6563	More investate data to accurulator		
		More econstation to tegetar		
	Ph. dract	Move direct cyte to register		
	Ph. Bolda	Mayon investigate data to register		
	drect A	More accurated to direct byte		
	drecUh	Mave regater to clead byte		
	direct.cont	Mave direct byte to direct byte		
	drei(,040	Mave indirect PAMI to climit by the		
	direct Plants	Move immediate data to deed type		
	COA.	Million securulating to indeed 9AM		
	E61.0mc	Minut cleard build to indexect PAME		
	0019280	Micros Instractistics claria to instractic RAME		
	COTR MOMPTO	Load data petriter with a 16-bit constant		
	AdM-C018	Hitror code type release to DPTR to accumulator		
	Advito	Intree code tobs relative to PC to accumulation		**
	VOV	Move enforced RAM (9:04 add) (10 A		**
	Adovtn	Move external RAM (16-bit addr.) to A.		
	DEA .	Rever A to external RAME (8-bit addr.)		~
	CPTRA 1	Move A to external RAME (19-bit add).)		
	deed	Pueh direct byte anto stack		N
	deed	Pop-devid byte from stack		14
	A.83	Exchange register to accuraciator		
	Adred	Exchange deed type to accumulate		-
	A QPL	Exchange indeed RAM to accumistance		
	A0%	Exchange tow order nibile retir. FAME with A		
	A AGO IS FORM	uald instruction		
	100 m	Con A Brids (h)		
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yas APIRIO	10 s.	Afficiel data 1) or Q	8	Autometice
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