KABARAK UNIVERSITY

UNIVERSITY EXAMINATIONS
MAIN CAMPUS

SECOND SEMESTER, 2019 ACADEMIC YEAR

EXAMINATION FOR THE DEGREE OF BACHELOR OF SCIENCE IN COMPUTER SCIENCE

COMP 415: MICROPROCESSOR-BASED SYSTEMS

STREAM: Y4S1 **TIME: 11.00-1.00 PM**

EXAMINATION SESSION: JAN-APRIL **DATE:8/04/2019**

INSTRUCTIONS:

- *Answer Question **ONE** and any other **TWO** Questions. Question One carries 30marks while each of the other Two Questions carry 20marks.*
- *The **8085** Instruction set is appended.*
- ***EXTRA** questions answered will **NOT** be marked*

QUESTION 1 (30 marks)

a) i) What is a microprocessor-based system (1mk)

ii) Outline the components required for the design of a microprocessor-based system. (2mks)

iii) Give in block diagram how the components in (ii) are organized to form the system. (2mks)

b) Differentiate between the following (4mks)

i). Static RAM and Dynamic RAM

ii). Compiler and assembler

c) Write 8085 assembly language program to AND A4H with 65H and display the results at output port 05H. (4mks)

d) State two disadvantages of EPROM. (2mks)

e) State and explain giving example in each case the classification of 8085 instruction set sizes. (6mks)

f) Write down an assembly language program to perform the following: add 245H to FBCDH subtract 34H from 66H and display results of subtraction in port 01H using 8085 instruction set (4mks)

g) Write assembly language program of XORing 8BH with 9CH and display the result in output port 02H. (2mks)

h) State the contents of the accumulator and the CY flag when the following instruction is executed. (3mks)

```
MVI A, 7AH
XRA A
RLC
```

QUESTION 2 (20 marks)

a) i) Name the three main blocks of a microprocessor unit and explain the use of each (3mks)

ii) Explain the key functions of the following units in the 8085 microprocessor. (3mks)

I.) Timing and control
II.) Program counter
III.) Instruction register

b) Write a program to load AFH and FDH in registers B and C respectively then add the numbers. If the sum has a carry, display 0FH at output port 02H, otherwise display the sum. (4mks)

c) Consider the following assembly language program of a microprocessor-based system using the 8255 PPI.

```
        MVI A, 80H
        OUT 03H
START:  MVI A, AAH
        OUT 00H
        OUT 01H
        OUT 02H
        CALL SUBX
        MVI A, 55H
        OUT 00H
        OUT 01H
        OUT 02H
        CALL SUBX
        JMP START
SUBX:   LXI D, FFDFH
AGAIN:  DCX D
        MOV A, E
        ORA D
        JNZ AGAIN
        RET
```

i.) Suggest what the first two instructions are doing (2mks)

ii.) Name the labels used in this program and state their importance (2mks)

iii.) Suggest what the whole program is doing (2mks)

iv.) Hand assembles the above program showing only two columns of address and memory contents in hex codes. Assume the first memory location is 069BH. (4mks)

QUESTION 3 (20 marks)

a) State and use flow charts to show the three standard structures used to represent the operations involved in program writing (3mks)

b) State and explain the functions of the different fields of assembly language program statements. (4mks)

c) i) What is a subroutine?. (1mk)

ii) Represent the time delay subroutine using a flow chart. (2mks)

d) Using appropriate 8085 instruction set, write a program to count continuously in hexadecimal from FFH to 00H in a system with a delay constant of 5049_{10} between each count in register pair DE and display the numbers in output port 01H Assume first memory is 20BFH. (4mks)

e) State and explain using one instruction example in each case, any four types of 8085 addressing modes. (6mks)

QUESTION 4 (20 marks)

a) i) What is interfacing? (1mk)

ii) State and explain two features that need to be considered when selecting an integrated circuit interface chip. (2mks)

iii) State and explain the two types of interfaces and state one area where each is useful. (2mks)

b) i) State and explain two modes of operation of 8255 PPI (2mks)

ii) Present the control word format of 8255 PPI (4mks)

c) A microprocessor-based system uses the 8255 PPI as its I/O device. If this system is to be used to read bit pattern from port B and output the same to port A and Port C continuously and endlessly;

i). Write an assembly language program to perform this operation using appropriate 8085 instruction set. Assume that the first memory location is 00BFH and use a delay constant of 0BDFH between the outputs in register pair BC. (6mks)

ii). State the memory address of the last byte of the instruction in (i) above (1mk)

iii). State two advantages of using mnemonics as opposed to binary values or hex codes. (2mks)

QUESTION 5 (20 marks)

a) Differentiate between the following

i.) Opcode and operand. (2mks)

ii.) Interpreter program and the editor program (2mks)

b) Write an algorithm for adding odd numbers between 30 and 60 for the 8085 microprocessor and display the results at port 05H. Develop your program as follows

i.) Outline the steps followed. Use registers A, B and C (2mks)

ii.) Assuming the first memory location is 0ABCH; write the assembly language program to perform this operation using appropriate 8085 instruction set. Show also memory contents in hex codes. (4mks)

iii.) Simply your program in (ii) using a flow chart (3mks)

c) i) Hand assemble the given assembly language program of 8085 microprocessor assuming that the first memory locations is 07FEH. (5mks)

```
START: XRA A
       MVI D, 78H
       MOV B, D
       MVI C, 8FH
       ADD C
       OUT 07H
       CALL DEL
       MVI A, 8FH
       MVI B, 68H
       SUB B
       ANI 0FH
       STA 2070H
       CALL DEL
AGAIN: IN F2H
       CMA
       ORA A
       JZ AGAIN
  DEL: LXI B, 99FFH
  REP: DCX B
       MOV A, C
       ORA B
       JNZ REP
       RET
```

ii) State and explain the results of executing the instruction XRA A (2mks)

THE 8085 INSTRUCTION SET

CE	ACI	N	3D	DCR	A	7E	MOV	A,M
8F	ADC	A	05	DCR	B	47	MOV	B,A
88	ADC	B	0D	DCR	C	40	MOV	B,B
89	ADC	C	15	DCR	D	41	MOV	B,C
8A	ADC	D	1D	DCR	E	42	MOV	B,D
8B	ADC	E	25	DCR	H	43	MOV	B,E
8C	ADC	H	2D	DCR	L	44	MOV	B,H
8D	ADC	L	35	DCR	M	45	MOV	B,L
8E	ADC	M	0B	DCX	B	46	MOV	B,M
87	ADD	A	1B	DCX	D	4F	MOV	C,A
80	ADD	B	2B	DCX	H	48	MOV	C,B
81	ADD	C	3B	DCX	SP	49	MOV	C,C
82	ADD	D	F3	DI		4A	MOV	C,D
83	ADD	E	FB	EI		4B	MOV	C,E
84	ADD	H	76	HLT		4C	MOV	C,H
85	ADD	L	DB	IN	N	4D	MOV	C,L
86	ADD	M	3C	INR	A	4E	MOV	C,M
C6	ADI	N	04	INR	B	57	MOV	D,A
A7	ANA	A	0C	INR	C	50	MOV	D,B
A0	ANA	B	14	INR	D	51	MOV	D,C
A1	ANA	C	1C	INR	E	52	MOV	D,D
A2	ANA	D	24	INR	H	53	MOV	D,E
A3	ANA	E	2C	INR	L	54	MOV	D,H
A4	ANA	H	34	INR	M	55	MOV	D,L
A5	ANA	L	03	INX	B	56	MOV	D,M
A6	ANA	M	13	INX	D	5F	MOV	E,A
E6	ANI	N	23	INX	H	58	MOV	E,B
CD	CALL	NN	33	INX	SP	59	MOV	E,C
DC	CC	NN	DA	JC	NN	5A	MOV	E,D
FC	CM	NN	FA	JM	NN	5B	MOV	E,E
2F	CMA		C3	JMP	NN	5C	MOV	E,H
3F	CMC		D2	JNC	NN	5D	MOV	E,L
BF	CMP	A	C2	JNZ	NN	5E	MOV	E,M
B8	CMP	B	F2	JP	NN	67	MOV	H,A
B9	CMP	C	EA	JPE	NN	60	MOV	H,B
BA	CMP	D	E2	JPO	NN	61	MOV	H,C
BB	CMP	E	CA	JZ	NN	62	MOV	H,D
BC	CMP	H	3A	LDA	NN	63	MOV	H,E
BD	CMP	L	0A	LDAX	B	64	MOV	H,H
BE	CMP	M	1A	LDAX	D	65	MOV	H,L
D4	CNC	NN	2A	LHLD	NN	66	MOV	H,M
C4	CNZ	NN	01	LXI	B,NN	6F	MOV	L,A
F4	CP	NN	11	LXI	D,NN	68	MOV	L,B
EC	CPE	NN	21	LXI	H,NN	69	MOV	L,C
FE	CPI	N	31	LXI	SP,NN	6A	MOV	L,D
E4	CPO	NN	7F	MOV	A,A	6B	MOV	L,E
CC	CZ	NN	78	MOV	A,B	6C	MOV	L,H
27	DAA		79	MOV	A,C	6D	MOV	L,L
09	DAD	B	7A	MOV	A,D	6E	MOV	L,M
19	DAD	D	7B	MOV	A,E	77	MOV	M,A
29	DAD	H	7C	MOV	A,H	70	MOV	M,B
39	DAD	SP	7D	MOV	A,L	71	MOV	M,C
72	MOV	M,D	E5	PUSH	H	9D	SBB	L

73	MOV	M,E	F5	PUSH	PSW	9E	SBB	M
74	MOV	M,H	17	RAL		DE	SBI	N
75	MOV	M,L	1F	RAR		22	SHLD	NN
3E	MVI	A,N	D8	RC		30	SIM	
06	MVI	B,N	C9	RET		F9	SPHL	
0E	MVI	C,N	20	RIM		32	STA	NN
16	MVI	D,N	07	RLC		02	STAX	B
1E	MVI	E,N	F8	RM		12	STAX	D
26	MVI	H,N	D0	RNC		37	STC	
2E	MVI	L,N	C0	RNZ		97	SUB	A
36	MVI	M,N	F0	RP		90	SUB	B
00	NOP		E8	RPE		91	SUB	C
B7	ORA	A	E0	RPO		92	SUB	D
B0	ORA	B	0F	RRC		93	SUB	E
B1	ORA	C	C7	RST	0	94	SUB	H
B2	ORA	D	CF	RST	1	95	SUB	L
B3	ORA	E	D7	RST	2	96	SUB	M
B4	ORA	H	DF	RST	3	D6	SUI	N
B5	ORA	L	E7	RST	4	EB	XCHG	
B6	ORA	M	EF	RST	5	AF	XRA	A
F6	ORI	N	F7	RST	6	A8	XRA	B
D3	OUT	N	FF	RST	7	A9	XRA	C
E9	PCHL		C8	RZ		AA	XRA	D
C1	POP	B	9F	SBB	A	AB	XRA	E
D1	POP	D	98	SBB	B	AC	XRA	H
E1	POP	H	99	SBB	C	AD	XRA	L
F1	POP	PSW	9A	SBB	D	AE	XRA	M
C5	PUSH	B	9B	SBB	E	EE	XRI	N
D5	PUSH	D	9C	SBB	H	E3	XTHL	