KABARAK **UNIVERSITY**

UNIVERSITY EXAMINATIONS

2010/2011 ACADEMIC YEAR

FOR THE DEGREE OF BACHELOR OF COMPUTER SCIENCE

COURSE CODE: COMP 451

COURSE TITLE: MICROPROCESSOR-BASED SYSTEMS

STREAM: **Y4S1**

DAY: **THURSDAY**

TIME: **9.00 – 11.00 A.M**

DATE: **16/12/2010**

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.*

PLEASE TURNOVER

QUESTION 1 (30 marks)

a) Perform the following arithmetic **(4mks)**
    i).   0CDFH + 0ABCH
    ii).   00001000 - 00000011

b) i) What is a microprocessor? **(1mk)**
    ii) State two basic operations of a microprocessor **(2mks)**

c) Explain briefly the functions of the following register units in the 8085 microprocessor. **(3mks)**

   i.)   Stack pointer
  ii.)   Timing and control
 iii.)   Instruction register and decoder

d) i) What is an interrupt? **(1mk)**
    ii) State any two classifications of 8085 microprocessor pins **(2mks)**

e) i) What is memory? **(1mk)**
    ii) A memory chip has a capacity of 4K byte, how many address lines does it have?
    (1mk)
    iii) State two groups of classifying memories. State one example of each class of
        memory **(3mks)**

f) Explain briefly what the following means as used with microprocessors. **(3mks)**
   i.)   Branch instructions
  ii.)   Interrupts
 iii.)   Subroutine

g) Write down an assembly language program of adding two numbers 234H and 566H
     using 8085 instruction set **(3mks)**

g) Differentiate between the following
    i).   Instruction set and addressing modes **(2mks)**
    ii).   Register addressing mode and register indirect addressing mode with
          respect to 8085 microprocessor. Write a short 8085 instruction example to
          illustrate the difference between the two addressing. **(4mks)**

QUESTION 2 (20 marks)

a) Differentiate between the following
  i.) Machine code programming and assembly language programming **(2mks)**
  ii.) The assembler program and the compiler program **(2mks)**

b) Write an algorithm for adding odd numbers between 0 and 20 for the 8085 microprocessor. Develop your program as follows

  i.) Outline the steps followed. Use registers A, B and C **(2mks)**
  ii.) Assuming the first memory location is 26DDH; 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 0066H. **(5mks)**

```
              START: MVI B, 4FH
                     MVI C, 78H
                     MOV A, 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 D, 00FFH
                REP: DCX D
                     MOV A, E
                     ORA D
                     JNZ REP
                     RET
```

ii) State the address of the following in the hand assembled program **(2mks)**
    I) DEL label
    II) STA instruction

QUESTION 3 (20 marks)

a) i) What is interfacing? **(1mk)**
   ii) State and explain two types of interfaces. **(3mks)**
   iii) State and explain two features that need to be considered when selecting an
      interface circuit **(2mks)**

b) i) State and explain two modes of operation of 8255 PPI **(2mks)**
   ii) Present the control word format of 8255 PPI **(3mks)**

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 78EFH and use a delay
   constant of FDEFH between the outputs in register pair DE.
                                         (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 4 (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) Distinguish between the following **(4mks)**
  i).   Algorithm and program
 ii).   Assembler and compiler

c) State three things that a microprocessor should do in order to communicate with a
   memory or I/O device. **(3mks)**
d) i) State and explain two way of memory expansion **(2mks)**
ii) By considering suitable memory sizes, show using a block diagram how the above
   schemes of memory expansion can be achieved **(2mks)**

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

QUESTION 5 (20 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.   **(3mks)**

c) i) What is stack? How is it specified?   **(2mks)**

   ii) What is bus contention problem? How is this situation prevented?   **(2mks)**

  d) 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 SUBTASK
                MVI A, 55H
                OUT 00H
                OUT 01H
                OUT 02H
                CALL SUBTASK
                JMP START
     SUBTASK:   LXI D, FFDFH
       AGAIN:   DCX D
                MOVA, E
                ORA D
                JNZ AGAIN
                RET
```

  i.)   Suggest what the first two instructions is 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 489EH.
                                                             (4mks)

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,NN	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	XRA	N
D5	PUSH	D	9C	SBB	H	E3	XTHL		