KENYATTA UNIVERSITY

UNIVERSITY EXAMINATIONS 2011/2012
FIRST SEMESTER EXAMINATION FOR THE DEGREE OF BACHELOR OF SCIENCE (TELECOMMUNICATION AND INFORMATION TECHNOLOGY)

SPH 312: COMPUTER ARCHITECTURE AND ORGANIZATION

DATE: Tuesday, 29th November, 2011   TIME: 8.00 a.m. – 10.00 a.m.

INSTRUCTIONS: Answer question **ONE** and any other **TWO** questions. Question **ONE** carries 30 marks while the others carry 20 marks each.

The 8085 instruction set is appended

Q1.   a) Consider an arbitrary number system with the independent digits as 0, 1, and X.
    i) What is the radix of this number system?   (1mk)
    ii) List the first 10 numbers of this system.   (2mks)

   b) Express the decimal -44 as an 8-bit number in:
    i) sign-magnitude   (2mks)
    ii) 1's complement   (1mk)
    iii) 2's complement   (1mk)

   c) i) Convert the Gray code word 11011 to binary.   (1mk)
    ii) Convert 2469_{10} to BCD code.   (1mk)
    iii) Convert 214.63_{10} to base 7.   (2mks)

   d) i) What is the difference between the stack and the stack pointer?   (2mks)
    ii) What is a flag?   (1mk)

   e)   i) Draw a well labeled block diagram of the internal architecture of the 8085 microprocessor.   (8mks)
       ii) Draw a labeled diagram showing the constituents of a microprocessor and state the function performed by each.   (4mks)

f) Use the following program to answer the questions that follow

Label	Mnemonic
Loop	MVI C, 78H
	DCR C
	JNZ Loop
	HALT

    i)   How many times (in decimal) is the DCR C executed?   (2mks)

    ii)   How many times does the program jump to loop?   (1mk)

    iii)   How can you change the program to loop 210 times?   (1mk)

Q2.   a) Convert the BCD number 00100111 to binary.   (2mks)

    b) Convert the decimal number -59.175 to IEEE 754 single precision format.
       Write your final answer as hexadecimal string.   (6mks)

    c) Use Boolean algebra to find the minimized expression for:
$$\overline{ABC} + \overline{AB}C + A\overline{B}C + ABC$$
                                                      (2mks)

    d) i) State two important uses of Karnaugh maps.   (2mks)

       ii) State two general features of Karnaugh maps.   (2mks)

       iii) Find the minimized sum-of-products expression for the following Boolean
           expression using K-map:
$$f(ABCD) = \Sigma_m(0,2,4,8,10), \text{ where (6, 12, 14) are don't cares.}$$ (6mks)

Q3.   (a) Define each of the following terms:

    (i)   RAM

    (ii)   ROM

    (iii)   Capacity

    (iv)   Volatile   (4mks)

    (b) A certain memory has a capacity of 4K x 8.

      (i) How many data input and data output lines does it have?   (2mks)

      (ii) How many address lines does it have?   (2mks)

      (iii) What is its capacity in bytes?   (3mks)

    (c) i)List four types of DRAM and two types of SRAM   (3mks)

ii) Define a bit

(1mk)

(d) i) A typical CD-ROM can store 650 megabytes of digital data. How many bits of data can such a CD-ROM hold ?

(3mks)

(e) What is the purpose of a computer bus?

(2mks)

Q4. a) What does the acronym 'PPI' stand for?

(1mk)

b) State and explain two operating modes of 8255 A PPI.

(2mks)

c) Present the control word format for 8255A PPI.

(3mks)

d) A microprocessor based system uses 8255A. It is desired to set bit of port-C in the following manner:

$PC_7 = PC_6 = PC_3 = PC_1 = 1; PC_5 = PC_4 = PC_2 = PC_0 = 0$

Write down a program using appropriate 8085 instructions for this problem. Take the first memory location to be 0FF0H.

(10mks)

e) Show using logic circuit diagram how a NAND gate can be used to implement an OR function.

(3mks)

Q5. a) State and explain the functions of the four fields of assembly language program.

(4mks)

b) State and explain three classifications of instruction sizes.

(3mks)

c) Write instructions (using 8085 assembly language) of adding two numbers; 32H and 48H, and display the sum at the LED output port 01H.

(3mks)

d) Consider the following 8085 assembly language program:

```
                MVI A, 00H
                MVI B, 0CH
                MVI C, 08H
REPEAT:         ADD B
                DCR C
                JNZ REPEAT
                HALT
```

i) Suggest what the first two instructions are doing.

(2mks)

ii) Name the label used in this program and state its importance

(2mks)

iii) Suggest what the program is doing.

(2mks)

iv) Hand assemble the foregoing program starting at address 2000H.

(4mks)

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		C8	RZ	
73	MOV	M,E		9F	SBB	A
74	MOV	M,H		98	SBB	B
75	MOV	M,L		99	SBB	C
3E	MVI	A,N		9A	SBB	D
06	MVI	B,N		9B	SBB	E
0E	MVI	C,N		9C	SBB	H
16	MVI	D,N		9D	SBB	L
1E	MVI	E,N		9E	SBB	M
26	MVI	H,NN		DE	SBI	N
2E	MVI	L,N		22	SHLD	NN
36	MVI	M,N		30	SIM	
00	NOP			F9	SPHL	
B7	ORA	A		32	STA	NN
B0	ORA	B		02	STAX	B
B1	ORA	C		12	STAX	D
B2	ORA	D		37	STC	
B3	ORA	E		97	SUB	A
B4	ORA	H		90	SUB	B
B5	ORA	L		91	SUB	C
B6	ORA	M		92	SUB	D
F6	ORI	N		93	SUB	E
D3	OUT	N		94	SUB	H
E9	PCHL			95	SUB	L
C1	POP	B		96	SUB	M
D1	POP	D		D6	SUI	N
E1	POP	H		EB	XCHG	
F1	POP	PSW		AF	XRA	A
C5	PUSH	B		A8	XRA	B
D5	PUSH	D		A9	XRA	C
E5	PUSH	H		AA	XRA	D
F5	PUSH	PSW		AB	XRA	E
17	RAL			AC	XRA	H
1F	RAR			AD	XRA	L
D8	RC			AE	XRA	M
C9	RET			EE	XRI	N
20	RIM			E3	XTHL	
07	RLC					
F8	RM					
D0	RNC					
C0	RNZ					
F0	RP					
E8	RPE					
E0	RPO					
0F	RRC					
C7	RST	0				
CF	RST	1				
D7	RST	2				
DF	RST	3				
E7	RST	4				
EF	RST	5				
F7	RST	6				
FF	RST	7				