

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: 24/03/2011

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 TURN OVER

QUESTION 1 (30 marks)

- a) i) Perform the following arithmetic
I) DF0H + 102AH (2mks)
II) $00001010_2 - 00010011_2$ (2mks)
ii) Convert $(3.625)_{10}$ into binary (2mks)
- b) State and explained any two classifications of microprocessors. (2mks)
- c) Explain briefly the functions of the following register units in the 8085 microprocessor. (3mks)
- i.) Accumulator
 - ii.) Program counter
 - iii.) Instruction register
- d) i) What is handshaking? (1mk)
ii) State any two classifications of 8085 microprocessor pins (2mks)
- e) i) A memory chip has a capacity of 32K byte, how many address lines does it have? (1mk)
ii) State two differences between static RAM and Dynamic RAM. (2mks)
- f) State and explain any four classifications of 8085 instruction set. (4mks)
- g) Write down an assembly language program of adding two numbers 234H and 546H using 8085 instruction set (3mks)
- h) Differentiate between the following
- i). Instruction 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) 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)
- b) i) What is stack? How is it specified? (2mks)
ii) What is bus contention problem? How is this situation prevented? (2mks)

- 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 SUBTASK
                MVI A, 55H
                OUT 00H
                OUT 01H
                OUT 02H
                CALL SUBTASK
                JMP START
SUBTASK:        LXI D, FFDFH
AGAIN:          DCX D
                MOV A, 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 789EH. (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) Distinguish between the following (4mks)
 - i). Algorithm and program
 - ii). Loader 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 4 (20 marks)

a) i) What is an interface? (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 C and output the same to port A and Port B 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 08DFH and use a delay constant of FDBFH 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.) High level language programming and assembly language programming. (2mks)
ii.) The assembler program and the editor program. (2mks)

b) Write an algorithm for adding even numbers between 21 and 50 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 76BEH; 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 006BH. (5mks)

```
START: IN F1H
      MOV B, A
      IN F2H
      ANI 80H
      MOV C, A
      MOV A, B
      ANI 80H
      ANA C
      JNZ SHTDWN
      MOV A, B
      ANI 1FH
      OUT F3H
      JMP START
SHTDWN: MVI A, 40H
      OUT F3H
      HLT
```

- ii) State the address of the following in the hand assembled program (2mks)
- I) SHTDWN label
 - II) JMP instruction

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,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 | |