FACULTY OF ELECTRICAL ENGINEERING
UNIVERSITY TEKNOLOGI MARA

FINAL TEST

COURSE : MICROPROCESSOR I (KEC346)
DATE : 27 SEPTEMBER 2003
TIME : 8.00 PM – 10.00 PM
PLACE : LECTURE THEATER CH

INSTRUCTIONS TO ALL CANDIDATES

1. **ANSWER ALL QUESTIONS (60 MARKS). TIME IS 1½ HOURS.**
2. YOU MAY USE THE **Z80 INSTRUCTION SET** TO ANSWER THE RELATED QUESTIONS.
3. **DO NOT CONVERT** THE Z80 ASSEMBLY LANGUAGE PROGRAM TO ITS MACHINE CODES UNLESS YOU ARE ASKED TO DO SO.

QUESTIONS

(A) CIRCLE THE CORRECT ANSWER

1. The microprocessor fetach-decode-execute cycle is used to get and carry out
   a. Logic work b. Arithmetic work c. Register work
   d. Instructions e. ALUs

2. You can change what a microprocessor will do by
   a. Changing the instructions in memory b. Adding more inputs
   c. Adding more outputs d. Increasing memory size

3. The microprocessor generates signals to control the ___ circuits.
   a. Memory b. Input unit
   c. Output unit d. All of above

4. A microcomputer system has at least _____ circuits.
   a. Memory (ROM or RAM) b. Input/Output unit
   c. Microprocessor d. All of the above

5. The microprocessor's instructions are stored in the _____ circuits.
   a. Memory (ROM or RAM) b. Input/Output unit
   c. Microprocessor d. All of the above

6. The microprocessor uses the stored-program concept. This means the instructions are stored in the _____ along with the data.
   a. Serial I/O b. Power supply c. Register array
   d. Microprocessor e. Memory

7. The main purpose of a microcomputer's system bus is to

a. Allow the computer industry to built standard products
b. Allow different units of the microcomputer system to communicate using a well-defined signal path
c. Be a standard mechanical connection for the microcomputer system
d. Be sure that signals of 2MHz and higher are properly transmitted

8. The microprocessor's fetch-decode-execute cycle time depends on its
   a. Address range b. Bus size
   c. Clock frequency d. All of the above

9. The B, C, D and E registers can be used as
   a. A program counter b. A memory address register
   c. General purpose register d. A BD register pair

10. The instruction register is loaded with the contents of the memory location pointed to by the
   a. Accumulator b. Microprocessor
   c. Previous instruction d. Program counter

11. A certain 8-bit microprocessor can address 65,536 memory addresses. This microprocessor should have ___ address bus lines.
   a. 8 b. 32
   c. 16 d. 64

12. During the execution of an instruction, the program counter (PC) register holds the _____ instruction.
   a. previous b. next
   c. current d. All of the above

13. The memory addressing mode that takes the fastest time is
   a. Direct memory addressing b. Register indirect addressing
   c. Immediate addressing d. Index addressing

14. The ALU is not shown together with the programming model because
   a. Programmers do not use the ALU
   b. Programmming cannot change what the ALU does
   c. The programmer cannot store any data in the ALU
   d. All of the above

15. The HL register pair can be used as a memory pointer because
   a. It is near the program counter
   b. It is near the memory address register
   c. It can be used as two independent 8-bit registers
   d. 16 bits will address all of the memory

<u>(B) ANSWER THE FOLLOWING QUESTIONS</u>

1. Draw the **block diagram of a microprocessor chip** and its components. Briefly describe the **functions** of each component.

(6 marks)

2. Describe the **three cycles** of the instruction cycle.

(5 marks)

3. Explain briefly the following :-

a) Read Only Memory

b) Input/Output Unit

c) System bus

(6 marks)

4. Fill up the following table with respect to each of the instructions given on the left column. All the numbers are in hexadecimal notation.

(6 marks)

Instructions	**Reg. A**	**Reg. B**	**Reg. C**	**Reg. D**
Initial values	69	5B	F4	96
ADD A,B				
SET 3,D				
XOR C				
LD B,A				
SRL A				
SUB D				

5. Shown below is part of the RAM address of the Z80 microcomputer system which is used by the programs in part a) and b) below. The data and address shown is in hexadecimal notation.

1900 23
1901 5B
1902 AC
1903 8E
1904 36
1905 71
1906 49

a) If the following program is fully executed, what are the data (contents) in the register A, register C, register H and register L ? Show how you derive the answers.

```
LD    HL, 1900H
LD    B, (HL)
INC   HL
```

```
LD    C, (HL)
LD    A,B
ADD   A,C
```

(5 marks)

b) If the following program is fully executed, what are the data (contents) in register A and register IX ? Show how you derive the answers.

```
LD    IX, 1902H
LD    A, (IX+01)
SUB   (IX+02)
```

(4 marks)

6. Answer the following questions by referring to this program.

```
      LD    A, 64H
LOOP: NOP
      DEC   A
      JR    NZ, LOOP
```

a) Convert the above program to its machine codes (op-codes), with starting address 1820H. Show clearly how you calculate the displacement for the JR instruction.

(4 marks)

b) Calculate the total time taken for the program to be fully executed if the Z80 CPU has a clock of 1 Mhz.

(4 marks)

c) If the time taken is to be increased, what are the necessary modifications you need to make to the program ?

(2 marks)

7. Derive the contents (data) of the SP and the stack memory (i.e. memory address 19FCH – 19FFH) if the following program is fully executed.

```
LD    SP, 19FFH
LD    BC, 3479H
```

```
LD      DE, 258BH
PUSH BC
```

(5 marks)

a) If the program in above is continued with the following instruction, what is the contents (data) in register BC and register DE ?

```
POP   DE
```

(3 marks)

8. Write an assembly language program that will find the largest number in an array. The array starts at memory address 1850H and ends at 1859H. The largest number found must be stored in register D. Use looping technique and show the flowchart of your program.

(6 marks)

9. Refer to the diagram of the Z80 – PIO below. The addresses for the PIO is as follows :

Port A Data Register = 80H
Port B Data Register = 81H
Port A Control Register = 82H
Port B Control Register = 83H

a) Write a series of instructions that initialise the ports so that port A becomes an input port (Mode 1) and port B becomes output port (Mode 0).

(4 marks)

b) Write a program that reads the data at port A, add the data obtained with 40H and then output it at port B to light up the LEDs.

(6 marks)