إسم الطالب: ..... رقم القيد: .....

Group: Communications **Midterm I** **Date:** 27 / 08 / 2019

Important Notes:

- This paper contains **FIVE** questions in **TWO** pages.
- Attempt **ALL** questions.
- Total time allowed **ONE AND HALF HOURS.** Total Marks: **30**
- Enhance your answers with proper sketches whenever applicable.

Q.1 Multiple Choice Questions (**MCQ**): **(10 Marks)**

1. Which of the following is not a data transfer instruction.

a. LDI. ( ) c. MOV. ( )
b. SBC. (√) d. POP. ( )

2. To configure all pins of port D as inputs, we must

a. Set all bits of PIND. ( ) c. Clear all bits of PIND. ( )
b. Set all bits of DDRD. ( ) d. Clear all bits of DDRD. (√)

3. ..... of ATmega328 is used to hold the address of instruction to be fetched.

a. Instruction register. ( ) c. PC register. (√)
b. PORT register. ( ) d. X register. ( )

4. In which addressing mode data is addressed by a 16 bit pointer register.

a. Immediate. ( ) c. Register. ( )
b. Direct. ( ) d. Indirect. (√)

5. The microprocessor is a microcomputer system in a single chip.

a. True. ( ) b. False. (√)

Reason (if false):

Microprocessor is only a part of a microcomputer system, we must add other components such as RAM, ROM, I/O ports and other peripherals to have a complete microcomputer system. **Microcontroller**, on the other hand, is a microcomputer system in a single chip.

6. The C flag is set whenever the result is too large.

a. True. ( ) b. False. (√)

Reason (if false):

V flag or bit is set to indicate an overflow which means the result of current operation is too large to be stored in the destination.

7. DDRD is used to hold data read from port D.

a. True. ( ) b. False. (√)

Reason (if false):

DDRD (Data Direction Register of port D) is used to configure port D as either digital input or digital output port. Once is set as digital input port, we can use **PIND** register to hold input data read from input devices connecter to port D.

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Q.2 For ATmega328, explain the purpose of the following: **(4 Marks)**

a) Data pointer registers.
b) Reset pin.

Q.3 Briefly explain the following: **(4 Marks)**

a) The main advantage of EEPROM over SRAM.
b) The differences between RISC and CISC.

Q.2 & Q.3 Solutions: See lecture notes.

Q.4 Referring to ATmega328 instruction set, translate the following code extracts to equivalent ATmega328 instructions: **(6 Marks)**

a)
```
Sum = 0;
A=5;
B=7;
Sum=A+B;
```

b)
```
pinMode(3,OUTPUT);
pinMode(4,INPUT);
```

Variable	Address
A	0x100
B	0x101
Sum	0x102

Arduino pin	ATmega328
3	PD3
4	PD4

Q.4 Solutions:

a)
```
CLR r16; OR LDI r16, 0
STS [0x102], r16; store direct to address 0x102 (Sum=0)
LDI r16, 5
STS [0x100], r16; A=5
LDI r17, 7
STS [0x101], r16; B=7
ADD r16, r17; A+B
STS [0x102], r16; Sum=A+B
```

b) pinMode(3,OUTPUT); Arduino Pin3 = ATmega PD3. To make it output, PD3 =1

pinMode(4,INPUT); Arduino Pin4 = ATmega PD4. To make it input, PD4 = 0

D7	D6	D5	D4	D3	D2	D1	D0
0	0	0	0	1	0	0	0

DDRD register

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Solution 1:

LDI r16, 0b00001000; value in binary

OUT DDRD, r16

OR

LDI r16, 0x08; value in hexadecimal

OUT DDRD, r16

Solution 2:

CLR r16 ; clear register r16, all bits =0

SBI r16,3 ; set bit number 3 (forth bit)

OUT DDRD, r16

Q.5 Referring to ATmega328 instruction set, what errors are in the following? Write the correct form. **(6 Marks)**

a) **MOV DDRB, R16**
b) **LDI R18, 0x128**
c) **SUB 16 , R7**
d) **SEI R1, 5**

Q.5 Solution:

No.	Error	Reason	Correction
a)	**MOV**	DDRB is one of I/O registers so we can only use OUT instruction	**OUT DDRB, R16**
	DDRB	MOV instruction is used to transfer data between GPRs (R0-R31).	**MOV R17, R16**
b)	**0x128**	This immediate value is larger than register R18 size.	**LDI R18, 0x28**
c)	**16**	The destination must be a register to store the result.	**SUB R16 , R7**
d)	**R1, 5**	SEI takes no operand. It is used to enable global interrupt by setting I bit in status register.	**SEI**

End of questions
Good luck!