



SUMMER- 19 EXAMINATION

Subject Name : Microcontroller and Application Model Answer

Subject 17509

1

Important Instructions to examiners:

- 1) The answers should be examined by key words and not as word-to-word as given in the model answer scheme.
- 2) The model answer and the answer written by candidate may vary but the examiner may try to assess the understanding level of the candidate.
- 3) The language errors such as grammatical, spelling errors should not be given more importance (Not applicable for subject English and Communication Skills).
- 4) While assessing figures, examiner may give credit for principal components indicated in the figure. The figures drawn by candidate and model answer may vary. The examiner may give credit for any equivalent figure drawn.
- 5) Credits may be given step wise for numerical problems. In some cases, the assumed constant values may vary and there may be some difference in the candidate's answers and model answer.
- 6) In case of some questions credit may be given by judgement on part of examiner of relevant answer based on candidate's understanding.
- 7) For programming language papers, credit may be given to any other program based on equivalent concept.

Q. No.	Sub Q. N.	Answers	Marking Scheme
1	(A)	Attempt any FIVE:	20- Total Marks
	(a)	List any four feature of 8051 microcontroller	4M
	Ans:	Features Of 8051 Microcontroller: (Any Four) <ul style="list-style-type: none"> • It is an 8bit microcontroller. • 8bit accumulator, 8bit Register and 8bit ALU. • On chip RAM 128 bites (data memory). • On chip ROM 4 Kbytes (program memory). • Two 16bit counter/ timer. • A 16 bit DPTR(data pointer) • Two levels of interrupt priority. • 4 byte bi-directional input/ output port. • Power saving mode (on some derivatives). • 16bit address bus:-it can access 2^{16} memory locations:-64kb (65536) each of RAM and ROM. 	Each Feature:1 M



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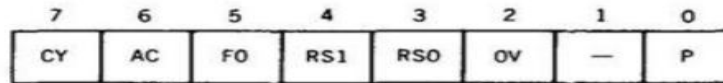
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- It is an inclusion of Boolean processing system, have an ability to allow logic operations to be carried out on registers and RAM.
- 8bit data bus:-it can access 8bit of data in one operation.
- It also consist of 3 internal and two external interrupts
- UART (this serial communication port makes chip to use simply as a serial communication interface).
- It has four separate Register set. (Each contains 8 Registers (R0 to R7)).

(b) Draw the format of PSW of 8051 and state the function of each bit

4M

Ans: PSW:



THE PROGRAM STATUS WORD (PSW) SPECIAL FUNCTION REGISTER

Bit	Symbol	Function															
7	CY	Carry flag; used in arithmetic, JUMP, ROTATE, and BOOLEAN instructions															
6	AC	Auxilliary carry flag; used for BCD arithmetic															
5	FO	User flag 0															
4	RS1	Register bank select bit 1															
3	RS0	Register bank select bit 0															
		<table border="0"> <tr> <td>RS1</td><td>RS0</td><td></td></tr> <tr> <td>0</td><td>0</td><td>Select register bank 0</td></tr> <tr> <td>0</td><td>1</td><td>Select register bank 1</td></tr> <tr> <td>1</td><td>0</td><td>Select register bank 2</td></tr> <tr> <td>1</td><td>1</td><td>Select register bank 3</td></tr> </table>	RS1	RS0		0	0	Select register bank 0	0	1	Select register bank 1	1	0	Select register bank 2	1	1	Select register bank 3
RS1	RS0																
0	0	Select register bank 0															
0	1	Select register bank 1															
1	0	Select register bank 2															
1	1	Select register bank 3															
2	OV	Overflow flag; used in arithmetic instructions															
1	—	Reserved for future use															
0	P	Parity flag; shows parity of register A: 1 = Odd Parity															

Bit addressable as PSW.0 to PSW.7

P - Parity bit. If a number stored in the accumulator is even then this bit will be automatically set (1), otherwise it will be cleared (0). It is mainly used during data transmit and receive via serial communication.

- Bit 1. This bit is intended to be used in the future versions of microcontrollers.

OV: Overflow This flag is set whenever the result of a signed number operation is too large, causing the high-order bit to overflow into the sign bit. In general, the carry flag is used to detect errors in unsigned arithmetic operations. The overflow flag is only used to detect

Format:2
M
Function
2M



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errors in signed arithmetic operations

RS0, RS1 - Register bank select bits. These two bits are used to select one of four register banks of RAM. By setting and clearing these bits, registers R0-R7 are stored in one of four banks of RAM.

RS1	RS0	SPACE IN RAM
0	0	Bank0 00h-07h
0	1	Bank1 08h-0Fh
1	0	Bank2 10h-17h
1	1	Bank3 18h-1Fh

F0 - Flag 0. This is a general-purpose bit available for user.

AC - Auxiliary Carry Flag is used for BCD operations only. If there is a carry from D3 and D4 during an ADD or SUB operation, this bit is set.

CY - Carry Flag is set whenever there is a carry out from D7 bit. It is affected after all arithmetical operations and shift instructions. It also can be set to 1 or 0 using instructions SETB c and CLR c

(c) Describe the following assembler directive with one example each:

(i) ORG

(ii) DB

(iii) EQU

(iv) END

4M

Ans:

i. **ORG:** Origin

It is used to indicate the beginning of address.

Syntax: ORG Address

The address can be given in either hex or decimal there should be a space of at least one character between ORG & address fields. Some assemblers use ORG should not begin in label field.

ii. **DB:** (Data Byte)

Syntax: LABEL: DB BYTE

Each
Directive:
1M



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Where byte is an 8-bit number represented in either binary, Hex, decimal or ASCII form. There should be at least one space between label & DB. The colon (:) must present after label. This directive can be used at the beginning of program. The label will be used in program instead of actual byte. There should be at least one space between DB & a byte. Following are some DB examples:

```

                ORG 500H
DATA1:  DB  28           ;DECIMAL(1C in hex)
DATA2:  DB  00110101B   ;BINARY (35 in hex)
DATA3:  DB  39H         ;HEX
                ORG 510H
DATA4:  DB  "2591"      ;ASCII NUMBERS
                ORG 518H
DATA6:  DB  "My name is Joe" ;ASCII CHARACTERS
    
```

iii. **EQU:** Equate

It is used to define constant without occupying a memory location.

Syntax: Name EQU Constant

By means of this directive, a numeric value is replaced by a symbol.

For e.g. MAXIMUM EQU 99 After this directive every appearance of the label "MAXIMUM" in the program, the assembler will interpret as number 99 (MAXIMUM=99).

iv. **END:**

This directive must be at the end of every program, meaning that in the source code anything after the END directive is ignored by the assembler. This indicates to the assembler the end of the source file (asm). Once it encounters this directive, the assembler will stop interpreting program into machine code.

e.g. END ; End of the program

(d) State any four data types in "C" with their value range

4M

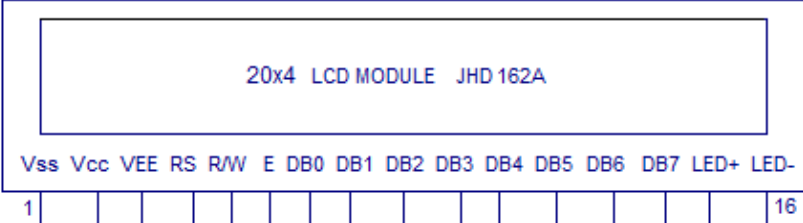


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<p>Ans:</p>	<table border="1"> <thead> <tr> <th>Data Type</th> <th>Size in Bits</th> <th>Data Range/Usage</th> </tr> </thead> <tbody> <tr> <td>Unsigned char</td> <td>8-bit</td> <td>0 to 255</td> </tr> <tr> <td>Signed char</td> <td>8-bit</td> <td>-128 to + 127</td> </tr> <tr> <td>Unsigned int</td> <td>16-bit</td> <td>0-65535</td> </tr> <tr> <td>signed int</td> <td>16-bit</td> <td>-32768 to + 32767</td> </tr> <tr> <td>sbit</td> <td>1-bit</td> <td>SFR bit-addressable only</td> </tr> <tr> <td>bit</td> <td>1-bit</td> <td>RAM bit-addressable only</td> </tr> <tr> <td>sfr</td> <td>8-bit</td> <td>RAM addresses 80 –FFH only</td> </tr> </tbody> </table>	Data Type	Size in Bits	Data Range/Usage	Unsigned char	8-bit	0 to 255	Signed char	8-bit	-128 to + 127	Unsigned int	16-bit	0-65535	signed int	16-bit	-32768 to + 32767	sbit	1-bit	SFR bit-addressable only	bit	1-bit	RAM bit-addressable only	sfr	8-bit	RAM addresses 80 –FFH only	<p>Any Four Data types. Each data type with value:1M</p>
Data Type	Size in Bits	Data Range/Usage																								
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bit	1-bit	RAM bit-addressable only																								
sfr	8-bit	RAM addresses 80 –FFH only																								
<p>(e)</p>	<p>Draw the pin diagram of 20 X 4 LCD display and state the function of RS,EN & R/W pins</p>																									
<p>Ans:</p>	<p><u>LCD Module - PIN Out Diagram</u></p>  <p>Pin 16 - Ground - Backlight LED Pin 15 - +5V - Connect through a current limiting resistor DB0 - DB7 - Data Pins - Use only 4 Data pins in 4 Bit Mode E - Enable Pin R/W - Read/Write Mode RS - Register Select VEE - Contrast Adjustment - Connect through a Potentiometer Vcc - +5V - Power to LCD Vss - Ground</p> <p>Note: This pin out diagram is same and common for many line LCD modules like 16x1, 16x2, 16x4, 8x1, 8x2, 20x1, 20x2, 20x4, 40x2, and other types of Line LCD Modules making use of the Hitachi Driver.</p>	<p>Pin Diagram: 2M Function of RS:1M EN: ½M R/W: ½ M</p>																								



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RS: RS is the register select pin used to write display data to the LCD (characters), this pin has to be high when writing the data to the LCD. During the initializing sequence and other commands this pin should low.

R/W: Reading and writing data to the LCD for reading the data R/W pin should be high (R/W=1) to write the data to LCD R/W pin should be low (R/W=0).

EN: Enable pin is for starting or enabling the module. A high to low pulse of about 450ns pulse is given to this pin.

(f) List the alternate pin function of port 3

Ans:

Pin	Name	Alternate Function
P3.0	RXD	Serial input line(Receive)
P3.1	TXD	Serial output line(Transmit)
P3.2	$\overline{\text{INT0}}$	External interrupt 0
P3.3	$\overline{\text{INT1}}$	External interrupt 1
P3.4	T0	Timer 0 external input
P3.5	T1	Timer 1 external input
P3.6	$\overline{\text{WR}}$	External data memory write strobe
P3.7	$\overline{\text{RD}}$	External data memory read strobe

Each pin function:
½ M

(g) Describe the function of following instructions :

(i) MOV A , @ A + D PTR

(ii) DA A

Ans

1. MOV A,@A+DPTR:

The instruction moves data from the external code memory to the accumulator. The address of operand in this example is formed by adding the content of the DPTR register to the accumulator value. Here the DPTR value is referred to as the base address and the accumulator value is referred to as the index address.

Each instruction:
2M



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No of bytes: 1 byte

Addressing mode: register

2. DAA

Decimal Adjust Accumulator. DA adjusts the contents of the Accumulator to correspond to a BCD (Binary Coded Decimal) number after two BCD numbers have been added by the ADD or ADDC instruction.

If the auxiliary carry bit is set or if the value of bits 0-3(lower nibble) exceed 9, 0x06 is added to the accumulator. If the carry bit is set or if the value of bits 4-7 (higher nibble) exceeds 9, 0x60 is added to the accumulator.

No of bytes: 1 byte

Addressing mode: register

For eg. A=0Ch after execution A=12 BCD

Q. No.	Sub Q. N.	Answers	Marking Scheme								
2		Attempt any FOUR:	16- Total Marks								
	a)	Compare microprocessor and microcontroller (any four points)	4M								
	Ans:	<table border="1"> <thead> <tr> <th>Sr. No.</th> <th>Parameter</th> <th>Microprocessor</th> <th>Microcontroller</th> </tr> </thead> <tbody> <tr> <td>1</td> <td>No. of instructions used</td> <td>Many instructions to read/write data to/ from external memory</td> <td>Few instruction to read/ write data to/ from external memory</td> </tr> </tbody> </table>	Sr. No.	Parameter	Microprocessor	Microcontroller	1	No. of instructions used	Many instructions to read/write data to/ from external memory	Few instruction to read/ write data to/ from external memory	Each Point:1M
Sr. No.	Parameter	Microprocessor	Microcontroller								
1	No. of instructions used	Many instructions to read/write data to/ from external memory	Few instruction to read/ write data to/ from external memory								



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2	Memory	Do not have inbuilt RAM or ROM.	Inbuilt RAM /or ROM	
3	Registers	Microprocessor contains general purpose registers, Stack pointer register, Program counter register	Microcontroller contains general purpose registers, Stack pointer register, Program counter register additional to that it contains Special Function Registers (SFRs) for Timer , Interrupt and serial communication etc.	
4	Timer	Do not have inbuilt Timer.	Inbuilt Timer	
5	I/O ports	I/O ports are not available requires extra device like 8155 or 8255.	I/O ports are available	
6	Serial port	Do not have inbuilt serial port, requires extra devices like 8250 or 8251.	Inbuilt serial port	
7	Multifunction pins	Less Multifunction pins on IC.	Many multifunction pins on the IC	
8	Boolean Operation	Boolean operation is not possible directly.	Boolean Operation i.e. operation on individual bit is possible directly	
9	Applications	General purpose, Computers and Personal Uses	Single purpose(dedicated application), Automobile companies, embedded systems, remote control devices.	
b)	Describe four timer modes of 8051 microcontroller			4M
Ans	<p>1. Mode 0 : 13 bit timer/counter</p> <p>In mode 0, the timer/counter is configured as a 13-bit timer/counter. The upper 8 bits of the count are in TH .The lower 5 bits are in the lower 5 bits of TL. The upper 3 bits of TL are not used. The TFX flag will be set when the timer /counter Overflows from all 1's to all 0's. The</p>			Each Mode:1M

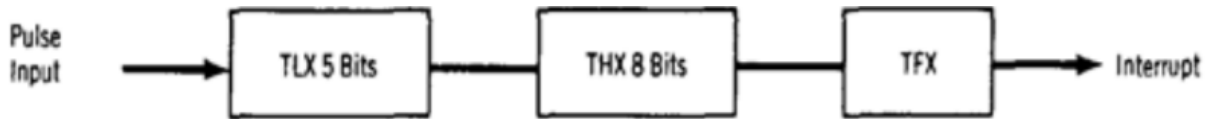
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timer continues to count.



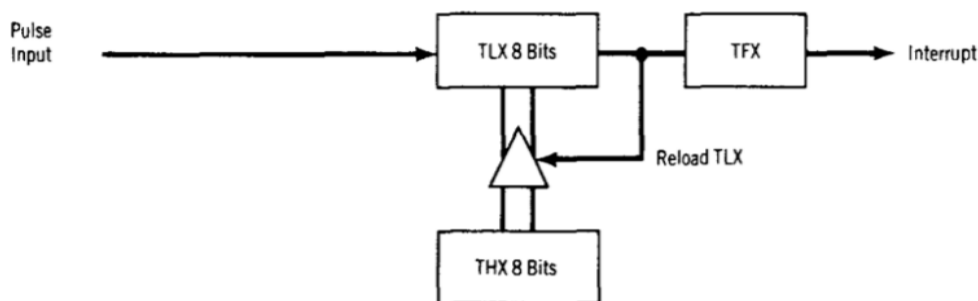
2. Mode 1 : 16 bit timer / counter

In mode 1, the timer/counter is configured as a 16-bit timer/counter. The upper 8 bits of the count are in TH & The lower 8 bits are in TL. The TFX flag will be set when the timer / counter overflows from all 1's to all 0's. The timer continues to count.



3. Mode 2 : 8bit Auto Reload

TL operates as an 8-bit Timer / counter. TH holds a reload value. When TL overflows (reached FFH), the TFX flag is set, TL is reloaded from the value in TH and counting continues.



4. Mode 3 : Split mode

Timer 0 is split into two independent 8-bit timers. TL0 acts as 8 bit Timer / Counter When TL0 overflows, it sets the TF0 flag. TH0 acts as 8 bit Timer, When TH0 overflows, it sets the TF1 flag. Timer 1 is stopped in mode 3. It can be switched independently to a different mode. However, when it overflows it will NOT set the TF1 flag.



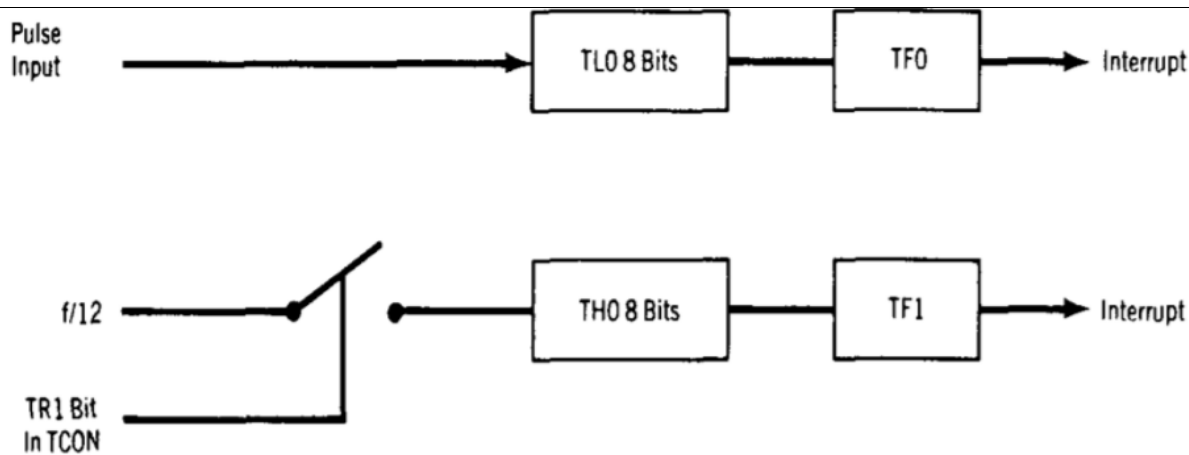
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c) Write an assembly language program to transfer the external memory location content of address 2400 H to internal RAM location 42 H

4M

Ans

(Consider Any other Correct Logic)

ORG 0000

MOV DPH, #24H; Move higher byte of external memory address to DPH

MOV DPL, #00H; Move lower byte of external memory address to DPL

MOV R0, #42H; Move address of internal RAM in register

MOVX A, @DPTR; Move content of location pointed by DPTR into Accumulator

MOV @R0, A; Move content of Accumulator into memory location pointed by register

END

Program:
3M

Comment
:1M

d) Write the instructions to perform following task using "C" operators:

4M

(i) Shift data bitwise 3 times to right

(ii) Shift data bitwise 4 times to left

Ans

(i) P0= 0x56 >>3; shift 3 times to right

Each
instructio
n: 2M



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(ii) $P0 = 0x56 \ll 4$; shift 4 times to left

e) Draw the format of SCON register and describe each bit

4M

Ans:

SM0	SM1	SM2	REN	TB8	RB8	TI	RI
-----	-----	-----	-----	-----	-----	----	----

SM0 SCON.7 Serial port mode specifier AND SM1 SCON.6 Serial port mode specifier.

SM0 SM1

0	0	Serial Mode 0
0	1	Serial Mode 1, 8-bit data, 1 stop bit, 1 start bit
1	0	Serial Mode 2
1	1	Serial Mode 3

SM2 SCON.5 Used for multiprocessor communication (Make it 0.)

REN SCON.4 Set/ cleared by software to enable/ disable reception. When the REN =1, it allows the 8051 to receive data on the RxD pin of the 8051. As a result if we want the 8051 to both transfer and receive data, REN must be set to 1. By making REN=0, the receiver is disabled.

TB8 SCON.3 TB8 (transfer bit 8) is bit D3 of SCON. It is used for serial modes 2 and 3. We make TB8=0 since it is not used in our applications.

RB8 SCON.2 Not widely used. RB8 (receive bit 8) is bit D2 of the SCON register. In serial mode 1, this bit gets copy of the stop bit when an 8 bit data is received.

TI SCON.1 Transmit interrupt flag. Set by hardware at the beginning of the stop Bit in mode 1. Must be cleared by software. This is an extremely important flag bit in the SCON register. When the 8051 finishes the transfer of the 8 bit character, it raises the T1 flag to indicate that it is ready to transfer another byte. The TI bit is raised at the beginning of the stop bit.

RI SCON.0 Receive interrupt flag. Set by hardware halfway through the stop bit time in mode 1. Must be cleared by software. When the 8051 receives data serially via RxD, it gets rid of the start and stop bits and places the byte in the SBUF register. Then it raises the RI flag bit to indicate that a byte has been received and picked up before it is lost. RI is raised

Format:1
M

Each pin
Description:
1/2 M



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		halfway through the stop bit.													
	(f)	Write any four assembly language instructions to make accumulator contents to zero	4M												
	Ans:	<ol style="list-style-type: none"> 1. MOV A, #00H 2. ANL A, A 3. XRL A, A 4. SUB A, A 	Each instruction: 1M												
Q. No.	Sub Q. N.	Answers	Marking Scheme												
3		Attempt any FOUR :	16- Total Marks												
	a)	<p>Convert :</p> <p>(i)(542)₁₀into Hex</p> <p>(ii)(4FDA)₁₆into Binary</p>	4M												
	Ans:	<p>(i)(542)₁₀into Hex</p> <table border="1" style="margin-left: auto; margin-right: auto;"> <tr> <td>16</td> <td>542</td> <td></td> </tr> <tr> <td></td> <td>33</td> <td>14(E)</td> </tr> <tr> <td></td> <td>2</td> <td>1</td> </tr> <tr> <td></td> <td></td> <td>2</td> </tr> </table> <p>=(21E)₁₆</p> <p>(ii)(4FDA)₁₆into Binary</p> <p>(4 F D A)₁₆</p> <p>=(0100 1111 1101 1010)₂</p>	16	542			33	14(E)		2	1			2	2M-Each correct Answer.
16	542														
	33	14(E)													
	2	1													
		2													
	b)	List interrupts in 8051 microcontroller with their priorities and vector address	4M												



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<p>Ans:</p>	<table border="1" data-bbox="326 436 1281 884"> <thead> <tr> <th>Interrupt Source</th> <th>Vector address</th> <th>Interrupt priority</th> </tr> </thead> <tbody> <tr> <td>External Interrupt 0 –INT0</td> <td>0003H</td> <td>1</td> </tr> <tr> <td>Timer 0 Interrupt</td> <td>000BH</td> <td>2</td> </tr> <tr> <td>External Interrupt 1 –INT1</td> <td>0013H</td> <td>3</td> </tr> <tr> <td>Timer 1 Interrupt</td> <td>001BH</td> <td>4</td> </tr> <tr> <td>Serial Interrupt</td> <td>0023H</td> <td>5</td> </tr> </tbody> </table> <p data-bbox="391 913 1005 947">(List -1 mark, priorities and address—3 marks)</p>	Interrupt Source	Vector address	Interrupt priority	External Interrupt 0 –INT0	0003H	1	Timer 0 Interrupt	000BH	2	External Interrupt 1 –INT1	0013H	3	Timer 1 Interrupt	001BH	4	Serial Interrupt	0023H	5	
Interrupt Source	Vector address	Interrupt priority																		
External Interrupt 0 –INT0	0003H	1																		
Timer 0 Interrupt	000BH	2																		
External Interrupt 1 –INT1	0013H	3																		
Timer 1 Interrupt	001BH	4																		
Serial Interrupt	0023H	5																		
<p>c)</p>	<p>List any four addressing modes of 8051 microcontroller with one example of each</p>	<p>4M</p>																		
<p>Ans:</p>	<p>There are a number of addressing modes available to the 8051 instruction set, as follows:</p> <ol style="list-style-type: none"> 1. Immediate Addressing mode 2. Register Addressing mode 3. Direct Addressing mode 4 Register Indirect addressing mode 5. Relative Addressing mode 6. Absolute addressing mode 7. Long Addressing mode 8. Indexed Addressing mode <p>1) Immediate Addressing mode: Immediate addressing simply means that the operand (which immediately follows the Instruction op. code) is the data value to be used. For example the instruction: MOV A, #25H ; Load 25H into A Moves the value 25H into the accumulator. The # symbol tells the assembler that the immediate addressing mode is to be used.</p> <p>2) Register Addressing Mode: One of the eight general-registers, R0 to R7, can be specified as the instruction Operand. The</p>	<p>1M—Each addressing mode with example</p>																		



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assembly language documentation refers to a register generically as Rn.
For example, instruction using register addressing is :
ADD A, R5 ; Add the contents of register R5 to contents of A (accumulator)
Here the contents of R5 are added to the accumulator. One advantage of register addressing is that the instructions tend to be short, single byte instructions.

3) Direct Addressing Mode:

Direct addressing means that the data value is obtained directly from the memory location specified in the operand.

For example consider the instruction:

MOV R0, 40H; Save contents of RAM location 40H in R0.

The instruction reads the data from Internal RAM address 40H and stores this in the R0.

Direct addressing can be used to access Internal RAM, including the SFR registers.

4) Register Indirect Addressing Mode:

Indirect addressing provides a powerful addressing capability, which needs to be appreciated.

An example instruction, which uses indirect addressing, is as follows:

MOV A, @R0; move contents of RAM location whose address is held by R0 into A

Note the @ symbol indicated that the indirect addressing mode is used. If the data is inside the

CPU, only registers R0 & R1 are used for this purpose.

5) Relative Addressing Mode:

This is a special addressing mode used with certain jump instructions. The relative address, often

referred to as an offset, is an 8-bit signed number, which is automatically added to the PC to make the address of the next instruction. The 8-bit signed offset value gives an address range of +127 to -128 locations.

Consider the following example: SJMP LABEL_X

An advantage of relative addressing is that the program code is easy to relocate in memory in that the addressing is relative to the position in memory.

6) Absolute addressing Mode:

Absolute addressing within the 8051 is used only by the AJMP (Absolute Jump) and ACALL (Absolute Call) instructions.

7) Long Addressing Mode:

The long addressing mode within the 8051 is used with the instructions LJMP and LCALL. The address specifies a full 16 bit destination address so that a jump or a call can be made to a



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	<p>location within a 64KByte code memory space (216 = 64K). An example instruction is: LJMP 5000h; full 16 bit address is specified in operand</p> <p>8) Indexed Addressing Mode: With indexed addressing a separate register, either the program counter, PC, or the data pointer DPTR, is used as a base address and the accumulator is used as an offset address. The effective address is formed by adding the value from the base address to the value from the offset address. Indexed addressing in the 8051 is used with the JMP or MOVC instructions. Look up tables are easy to implement with the help of index addressing. Consider the example instruction: MOVC A, @A+DPTR MOVC is a move instruction, which moves data from the external code memory space. The address operand in this example is formed by adding the content of the DPTR register to the accumulator value. Here the DPTR value is referred to as the base address and the accumulator value is referred to as the index address.</p>	
<p>d)</p>	<p>Write a "C" language program to toggle pin P1.2 continuously with some delay</p>	<p>4M</p>
<p>Ans:</p>	<p>Program: #include<reg51.h> sbit bit=P1^2; //make P1.2 as bit void delay(unsigned int); void main () { bit=1; delay(50); bit=0; while(1); } void delay (unsigned int itime) { unsigned int x,y; for(x=0; x<itime; x++) for (y=0; y<1275; y++); }</p>	<p>Relevant program- 4 M</p>
<p>e)</p>	<p>Draw the interfacing diagram for temperature measurement using LM35 ADC 0808 with microcontroller 8051</p>	<p>4M</p>

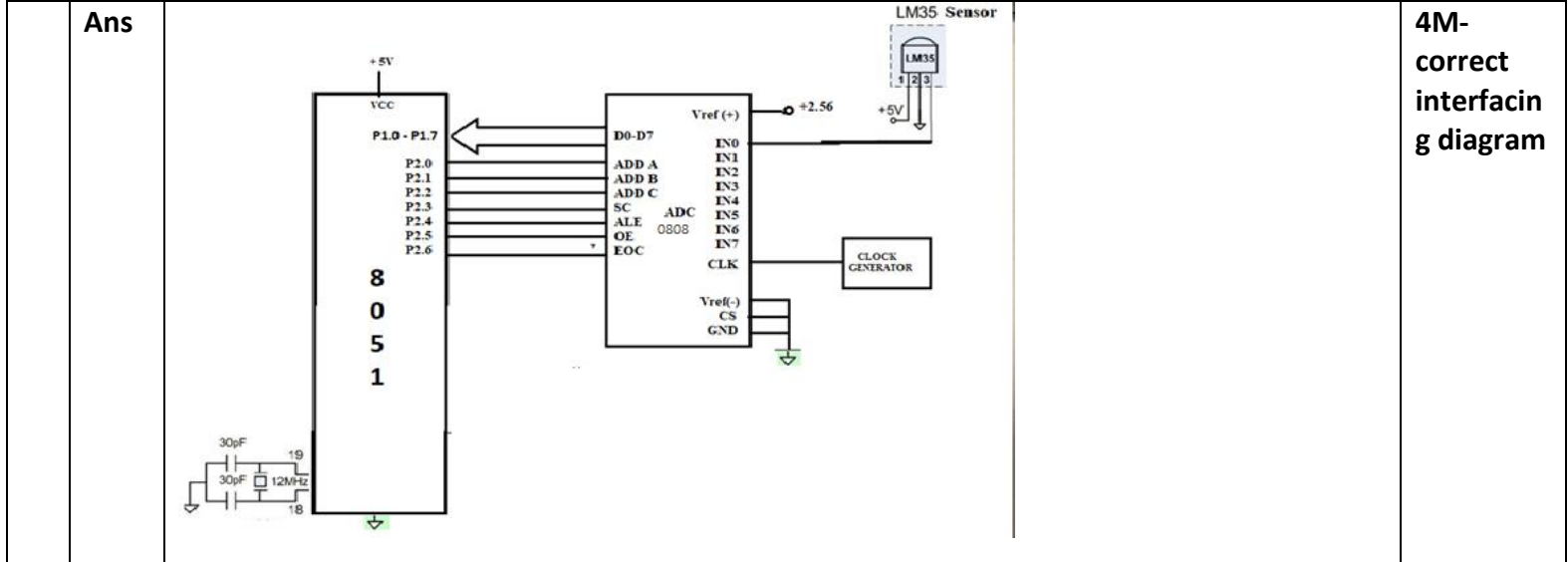


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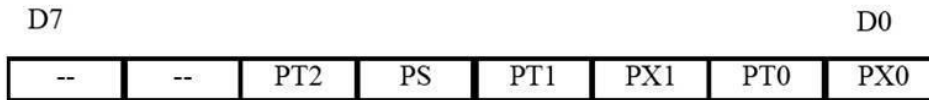


4M-
correct
interfacin
g diagram

f) Draw the format of IP register of 8051 microcontroller and state the function of each bit

4M

Ans:



Priority bit = 1 assigns high priority. Priority bit = 0 assigns low priority.

- IP.7 Reserved
- IP.6 Reserved
- PT2** IP.5 Timer 2 interrupt priority bit (8052 only)
- PS** IP.4 Serial port interrupt priority bit
- PT1** IP.3 Timer 1 interrupt priority bit
- PX1** IP.2 External interrupt 1 priority bit
- PT0** IP.1 Timer 0 interrupt priority bit
- PX0** IP.0 External interrupt 0 priority bit

2M-
format,
2M –
explanati
on

Q. N. o.	Sub Q. N.	Answers	Marking Scheme
4	A)	Attempt any TWO :	16- Total Marks



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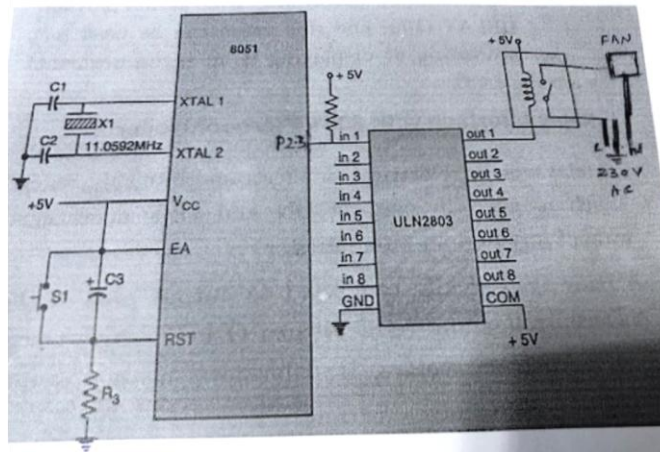
	<p>Using TIMER 1 in MODE 1, $COUNT = 2^{16} - 100$ $COUNT = 65536 - 100 = 65436 = FF9CH$ Therefore TH1 = FFH & TL1 =9CH</p> <p>Program is as follows :</p> <pre> MOV TMOD, #10H ; timer 1, mode 1 AGAIN : MOV TL1, #9CH ; TL1 = 1A, low byte of timer MOV TH1, #0FFH ; TH1 = FF, higher byte of timer SETB TR1 ; Start the timer 1 BACK : JNB TF1, BACK ; stay until timer rolls over CLR TR1 ; Stop timer 1 CPL P2.4 ; Complement P2.4 to get high, low CLR TF1 ; Clear timer flag 1 SJMP AGAIN ; reload the timer </pre>	
(c)	<p>Draw the interfacing diagram where P2.3 pin of 8051 microcontroller is used to control relay which in turn controls the fan connected to 230 V. Describe operations of this circuit.</p>	8M
Ans:	<p>Microcontroller are intelligent devices but they can't switch ON or OFF your room fan as they can't handle heavy current so we use relays to do so.</p> <p>Microcontroller can power ON or OFF an Relay's Electromagnet.</p> <p>When Electromagnet is turned on or off you can easily hear a sound of 'tick' just like a practical room switch. However, there is a glitch here: Relays electromagnet requires heavy current to operate which Microcontroller can't possible handle.</p> <p>A relay takes 70mA or 50mA current to excite the inductor coil.</p> <p>The current sinking capability of each port pin of 8052 is only 20mA.</p> <p>Hence port pin to which relay is connected may get damaged.To avoid this problem ULN2003/ULN2803 driver is used.</p> <p>In the figure Port 2 pin P2.3 is connected to in1pin of ULN2803.The out1 pin of ULN2803 is connected to the relat which is connected to the fan.</p>	4 M— correct diagram,4 M— Operation of the circuit

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After execution of the program the fan can be controlled .



Q. No.	Sub Q. N.	Answers	Marking Scheme
5.		Attempt any FOUR:	16- Total Marks
	a)	Draw the interfacing diagram of stepper motor to Port 1 pins of 8051. Use ULN 2003 driver IC	4M
	Ans:		4M

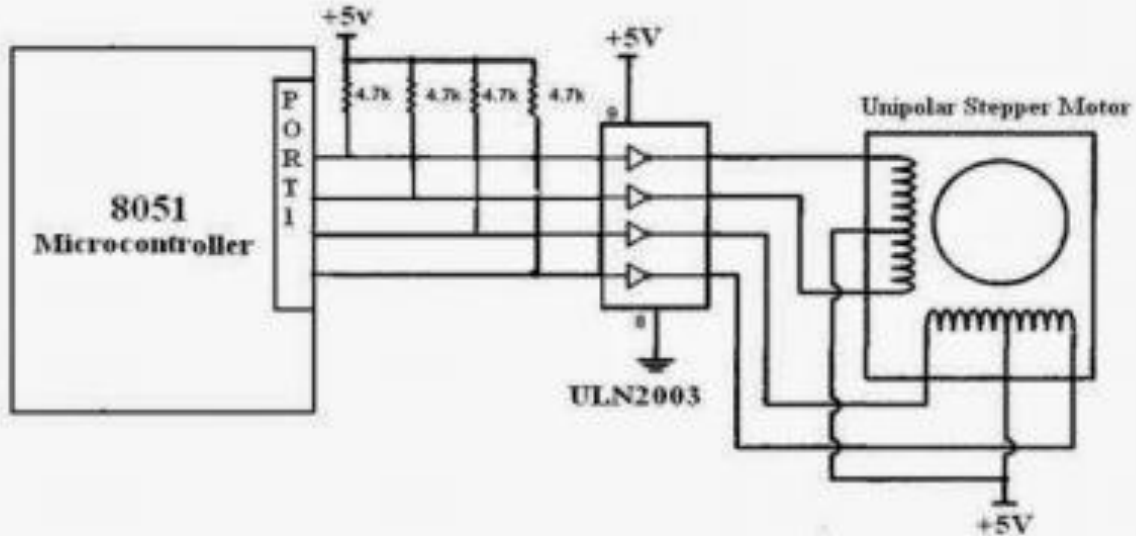
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20



b) State the function of following pins of 8051 microcontroller :

(i) \overline{PSEN}

(ii) ALE

(iii) \overline{EA}

(iv) RST

4M

Ans (i) \overline{PSEN} : It is active low output control signal used to activate enable signal of external ROM/ EPROM . it is activated every six oscillator periods while reading the external memory.

(ii) ALE : There are two ALE pulses per machine cycle. The Ale pulse, which is primarily used as a timing pulse for external memory access, indicates when every instruction byte is fetched.

(iii) \overline{EA} : It is active low output control signal. When $EA = 1$, μc accesses internal and external program memory when $EA = 0$, μc accesses only external program memory.

(iv) RST : It is a RESET pin, which is used to reset the microcontroller to its initial values.

1M- EACH

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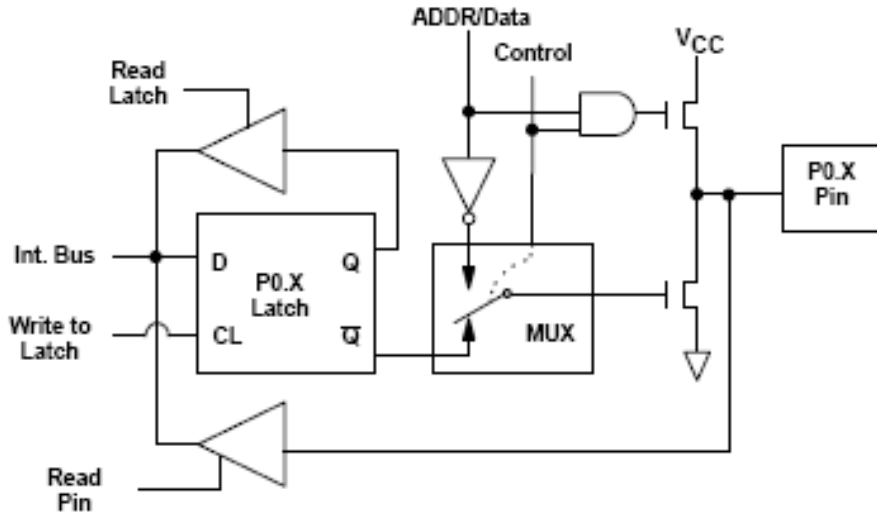
C)	Draw the labelled interfacing diagram of ADC 0809 with 8051 microcontroller	4M
Ans		4M
d)	Describe the dual function of port 0 in brief	
Ans	<p>Port 0 can be used as</p> <ol style="list-style-type: none"> Simple I/O Port and Bidirectional low order address and data bus (AD0 – AD7) for external memory access. <p>Port -0 has 8 pins (P0.0-P0.7). The structure of a Port-0 pin is shown in fig below</p>	<p>Function:2 M Diagram:2 M</p>

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When the control is '0', the port can be used as a normal bidirectional I/O port. When the port is used as an input port, '1' must be written to the latch and to output 0 on the pin „0“ must be written to the latch. When the control is '1', the port can be used as address/data bus(AD0 – AD7)for external data transfer.

e) Describe any four tools of IDE

4M

Ans: Components of IDE:

- Compiler
- Cross assembler
- Cross compiler
- Linker/ Locators
- Loaders
- Simulators
- Debugger

Function: (Any four component)

Compiler:

It is a computer program that transforms the source code written in a programming or source language into another computer language i.e. target language i.e. binary code known as object code.

Cross assembler:

It is useful to convert object codes for microcontrollers or processor to other codes for another microcontrollers or processor and vice versa.

Cross compiler:

It is used to create executable code other than one on which the compiler is run.

1M EACH



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They are used to generate executable for embedded systems or multiple platforms.

Linker/Locator:
It is used for relocation process.
It is done during compilation also it can be done at run time by a relocating loader.
It is a program that takes one or more objects generated by compiler and combines them into a single executable program.

Simulators:
A simulator is the software that simulates an hardware unit like emulator, peripheral, network and I/O devices on a PC. It defines a processor or processing device as well as various versions for the target system. It also monitors the detailed information as source code part with labels and symbols during the execution for each single step.
It provides the detailed information of the status of memory RAM and simulated ports, simulated peripheral devices of the defined target system.

Debugger:
It is a program that is used to test and debug the target program. Debugger allows to download code to the Emulator's memory and then control from PC. It also allows the programmer to examine and modify the On-chip register and program memory data.

Q. N o.	Sub Q. N.	Answers	Marking Scheme
6.		Attempt any FOUR :	16- Total Marks
	a)	Draw internal RAM organization of 8051 microcontroller	4M
	Ans:		4M

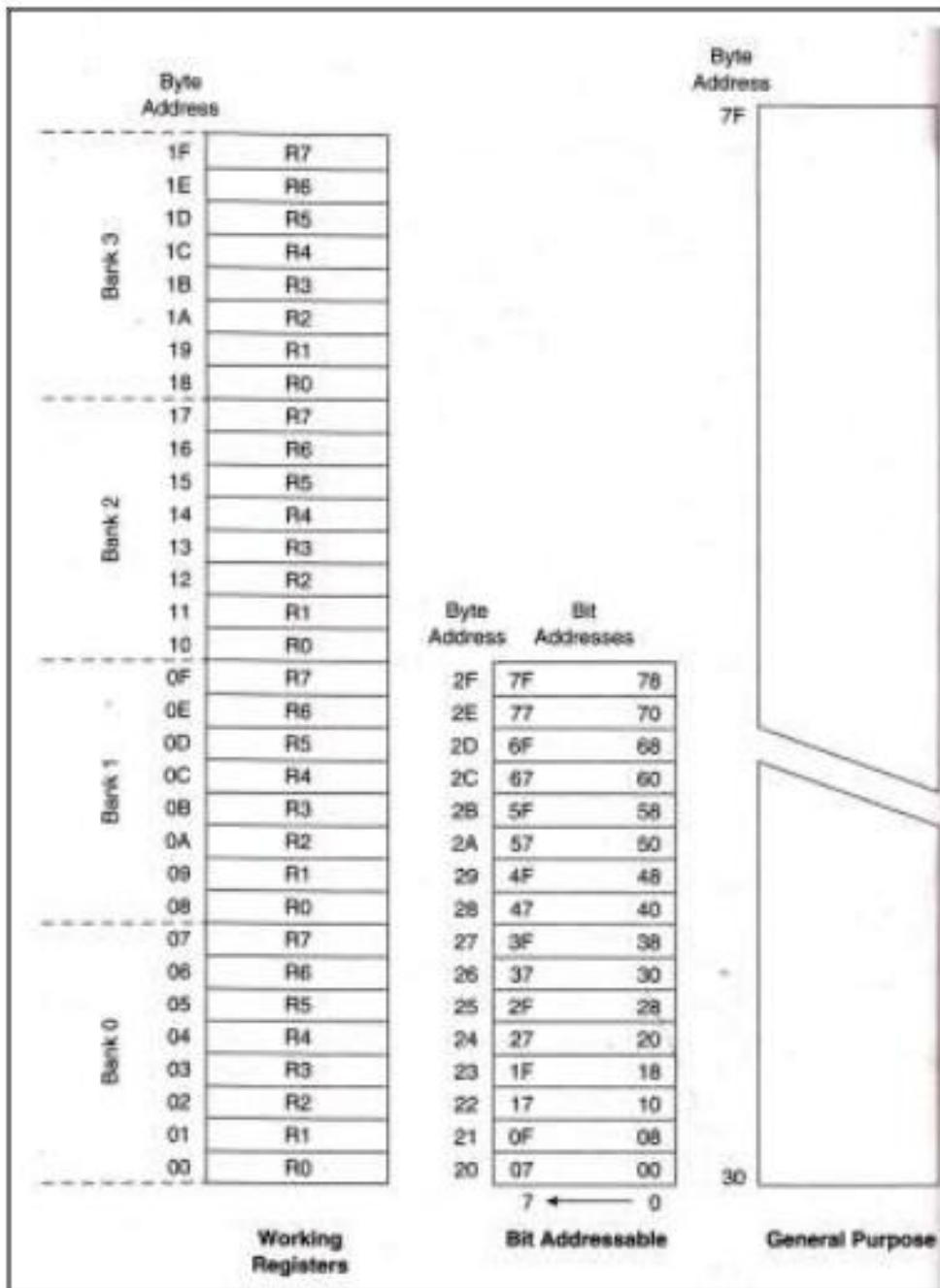


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b) Describe stack and stack pointer of 8051 microcontroller

4M

Ans:

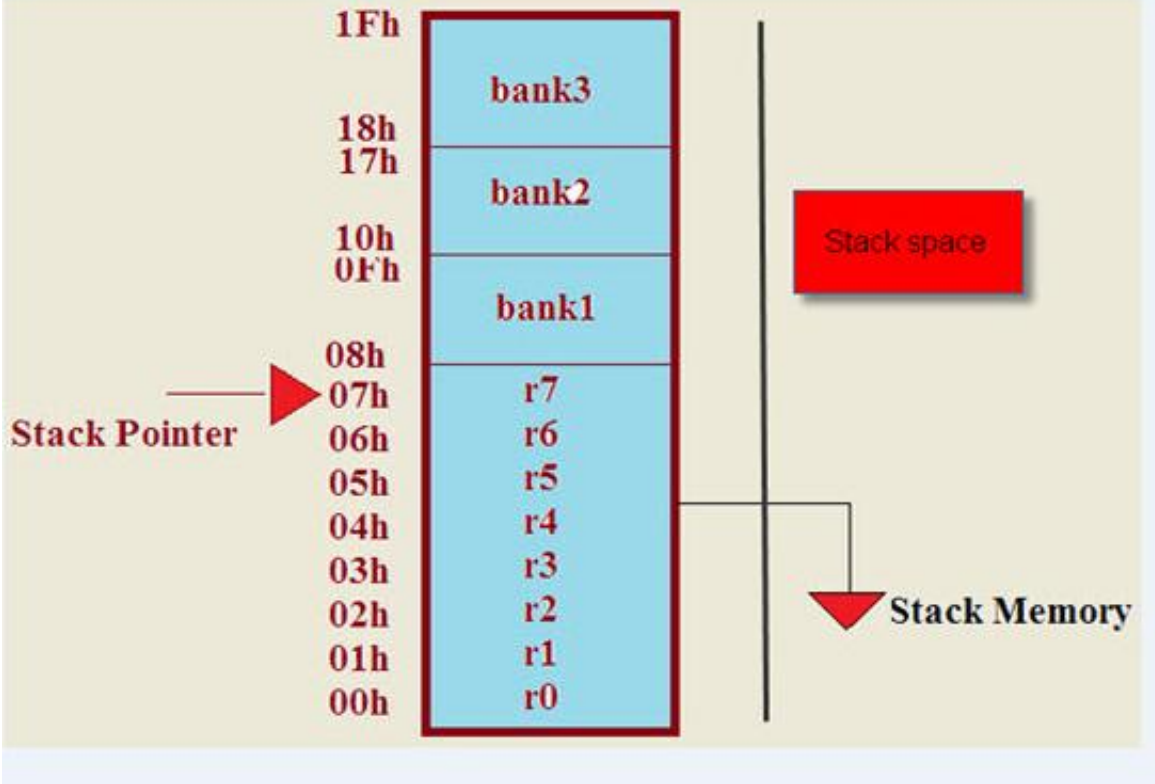
2M
DIAGRAM,
1M STACK,

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1M
stackpointer

Stack: The stack is a section of a RAM used by the CPU to store information such as data or memory address on temporary basis. The CPU needs this storage area considering limited number of registers. The register used to access the stack is known as the stack pointer register.

Stack pointer: The 8-bit stack pointer (SP) register is used to hold an internal RAM address that is called the top of stack. The address held in the SP register is the location in internal RAM where the last byte of data was stored by a stack operation.

c) Draw the interfacing diagram to interface 3 X 3 key matrix to 8051 microcontroller

4M



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<p>Ans:</p>		<p>4M</p>
<p>d)</p>	<p>Write "C" language program to transfer the character "A" serially at baud rate 9600 , 8 bit data. 1 stop bit. Assume crystal frequency 11.0592 MHz</p>	<p>4M</p>
<p>Ans:</p>	<p>(For any other relevant logic, marks can be given)</p> <pre>#include<reg51.h> void main(void) { TMOD=0x20; //use timer1, mode 2 TH1=0xfd; // 9600 baudrate</pre>	<p>3M-PROGRAM, 1M-COMMENTS</p>

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```

SCON=0x50h;

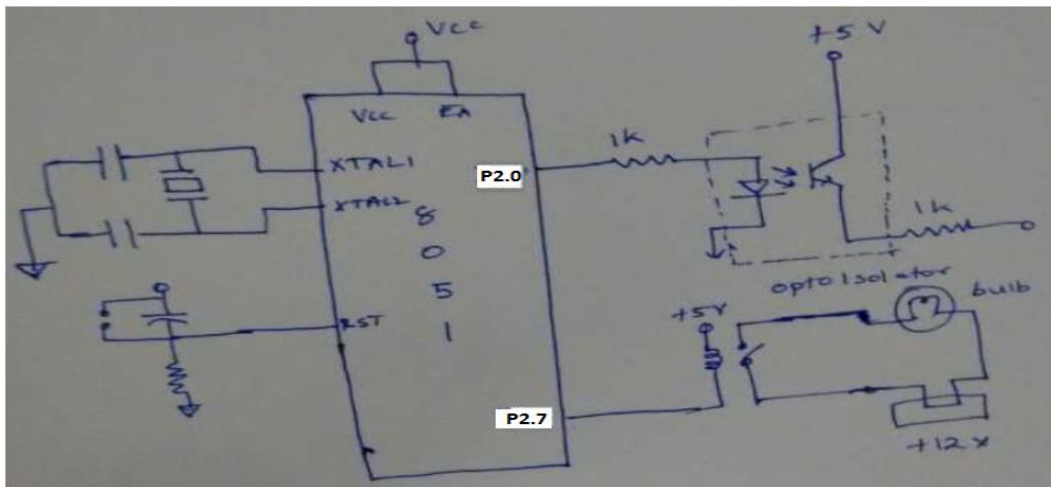
tr1=1;

while(1)
{
SBUF='A';           // place value in buffer
while(TI==0);
TI=0;
}
}
    
```

e) Draw interfacing diagram to interface relay at P2 and opt-isolator at P2.7

4M

Ans:



4M

f) Draw the interfacing diagram of 7 segment display to port P1 of 8051 microcontroller

4M

Ans

4M



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