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INTERNAL ASSESSMENT TEST – II

Sub:	Microcontroller							Code:	BEC405A
Date:	10/07/24	Duration:	90 mins	Max Marks:	50	Sem:	V	Branch:	ECE

Answer any 5 full questions

		Marks	**CO**	**RBT**
1	Differentiate between a counter and timer. Explain the timer modes of operation in 8051.	[10]	CO3	L2
2	With a diagram, explain the different steps that take place on execution of CALL and RET instruction.	[10]	CO2	L2
3	1. Differentiate between Jump and Call instructions 2. Discuss the working of PUSH and POP instructions for stack operation in 8051.	[05] [05]	CO2	L2
4	Five hex numbers are stored in RAM locations 50H onwards. Write a program to find the biggest number in the set. The biggest number should finally be saved in 60H.	[10]	CO2	L3

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5	What is serial data communication? Explain the significance of SCON register in detail.	[10]	CO3	L2
6	Write an 8051 C program to transmit a message ‘India’ serially at a Baud rate of 9600. Use 8 bit data with one start and one stop.	[10]	CO3	L3
7	Write an ALP program to generate a square wave of 2KHz frequency on pin p1.5. Assume that XTAL=11.0592 MHz.	[10]	CO3	L3
8	Write an 8051 program to receive data bytes serially and send to P1. Use baud rate of 4800.	[10]	CO3	L3

CI CCI HoD/ECE

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CI CCI HoD/ECE

1. Differentiate between a counter and timer. Explain the timer modes of operation in 8051.

- The 8051 has two timers/counters, they can be used either as

    1. Timers to generate a time delay or as

    2. Event counters to count events happening outside the microcontroller

    3. To generate baud rate for serial communication

    4. Both Timer 0 and Timer 1 are 16 bits wide and are accessed as two separate registers of low byte and high byte.

    The low byte register is called TL0/TL1 and The high byte register is called TH0/TH1

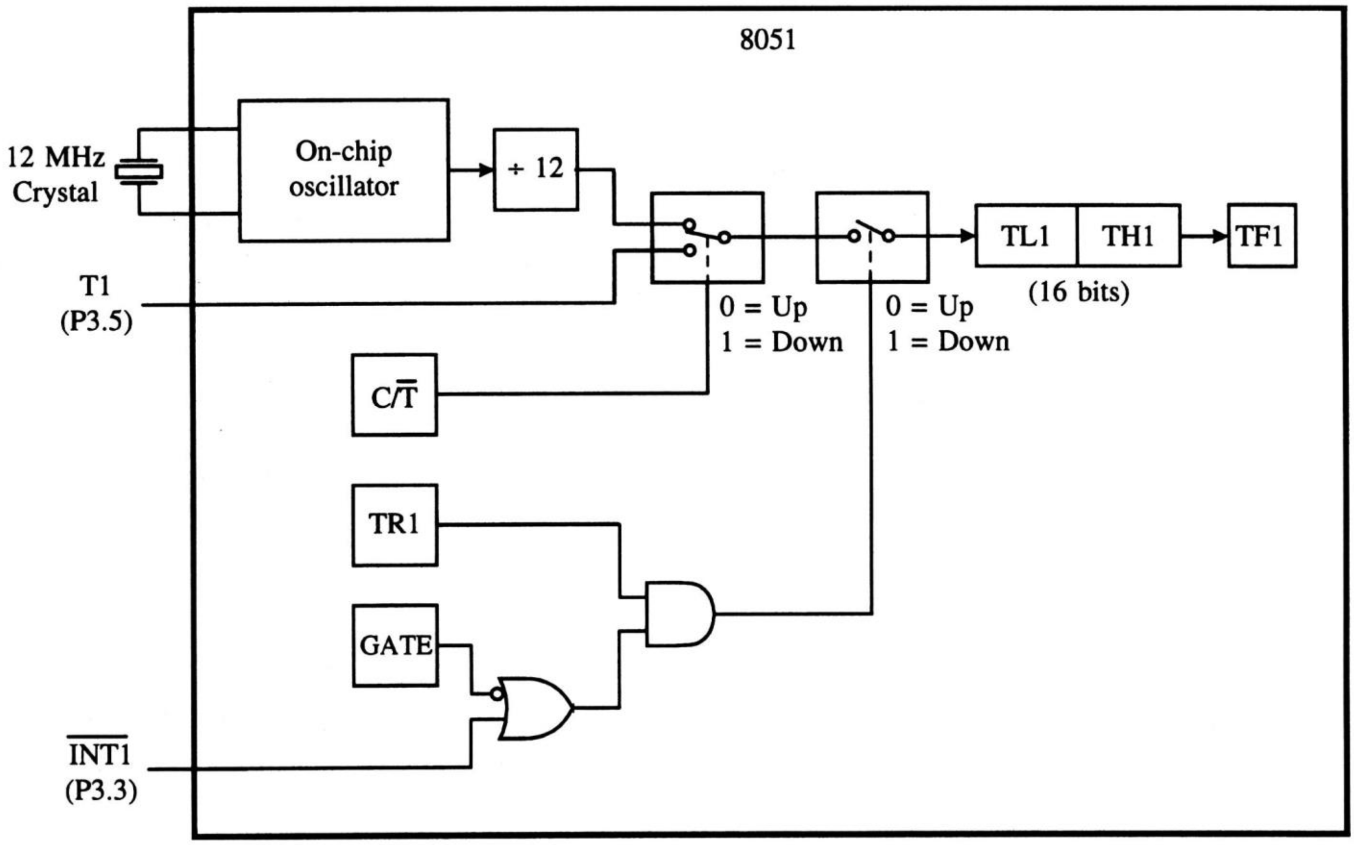
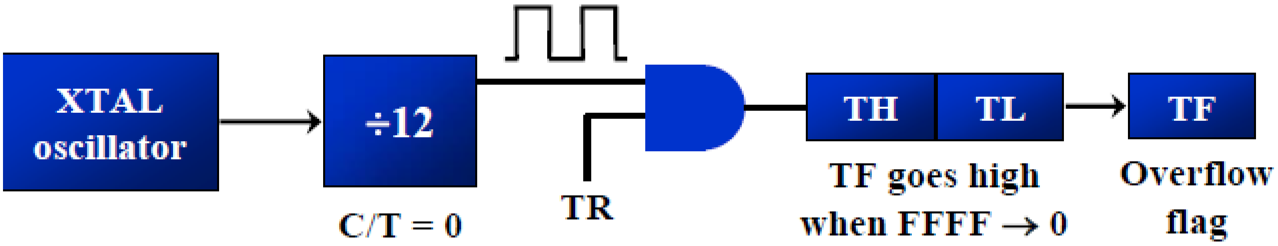
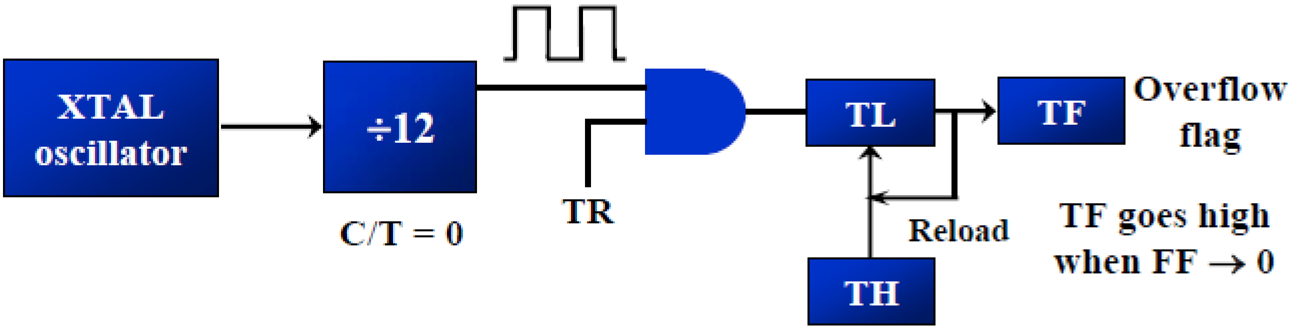


FIGURE 4–5
Timer 1 operating in mode 1



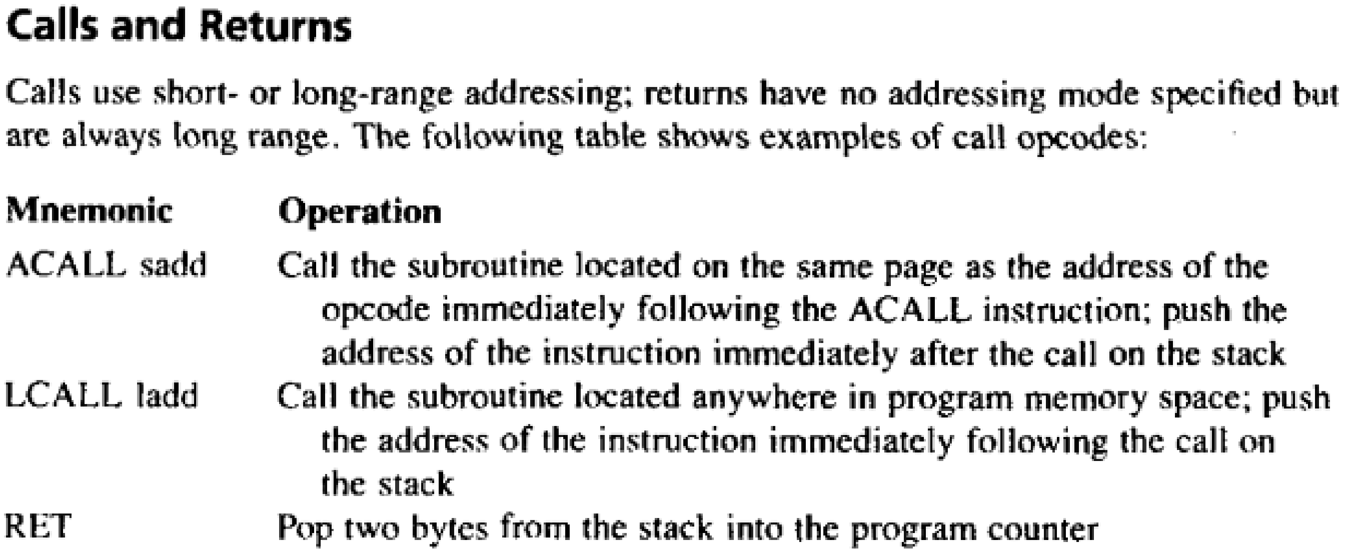


Mode 0 is similar to mode 1 except it is 13 bit mode here THx and lower 5 bits of TLx are used for Time delay generation

Mode 3 is split mode where Timer 0 is used for time delay generation it works as 2 bit timer circuit TL0 is controlled by TR0 and TH0 is controlled by TR1

2. With a diagram, explain the different steps that take place on execution of CALL and RET instruction.

Calls and Return



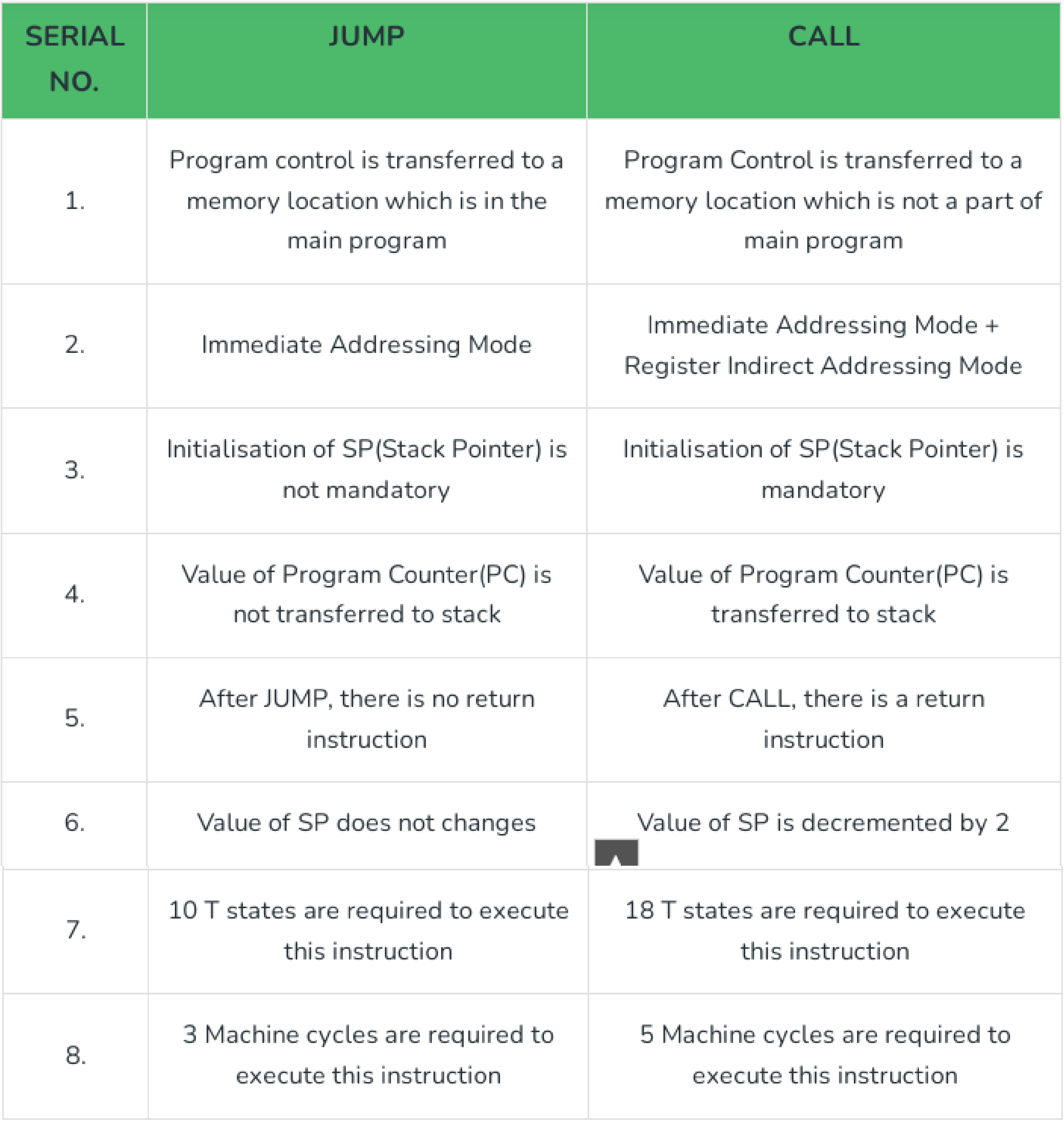
Calls and Returns

Calls use short- or long-range addressing; returns have no addressing mode specified but are always long range. The following table shows examples of call opcodes:

Mnemonic	Operation
ACALL sadd	Call the subroutine located on the same page as the address of the opcode immediately following the ACALL instruction; push the address of the instruction immediately after the call on the stack
LCALL ladd	Call the subroutine located anywhere in program memory space; push the address of the instruction immediately following the call on the stack
RET	Pop two bytes from the stack into the program counter

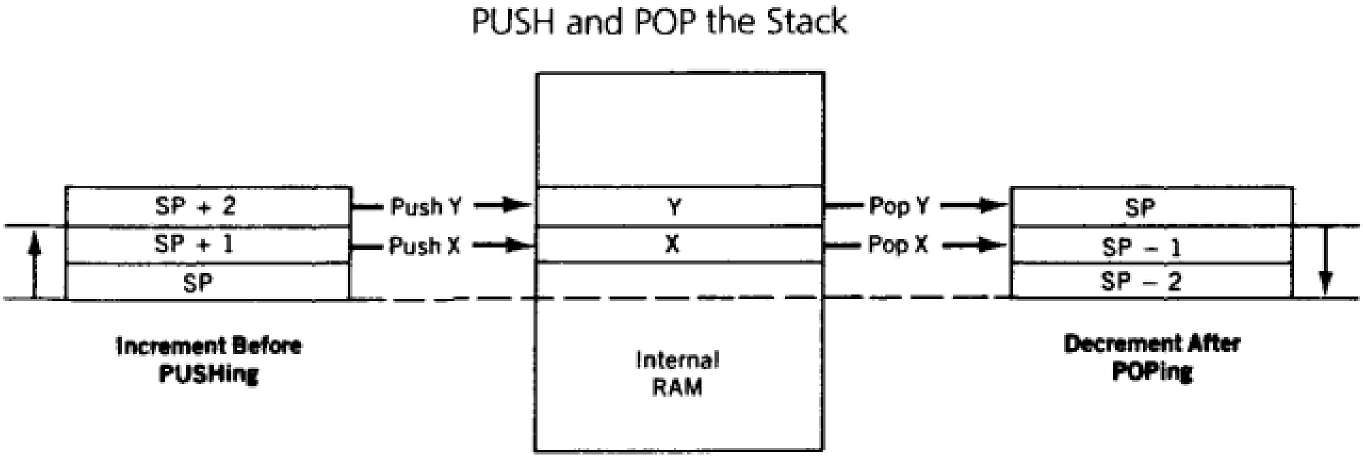
3. (a) Differentiate between Jump and Call instructions
   (b) Discuss the working of PUSH and POP instructions for stack operation in 8051

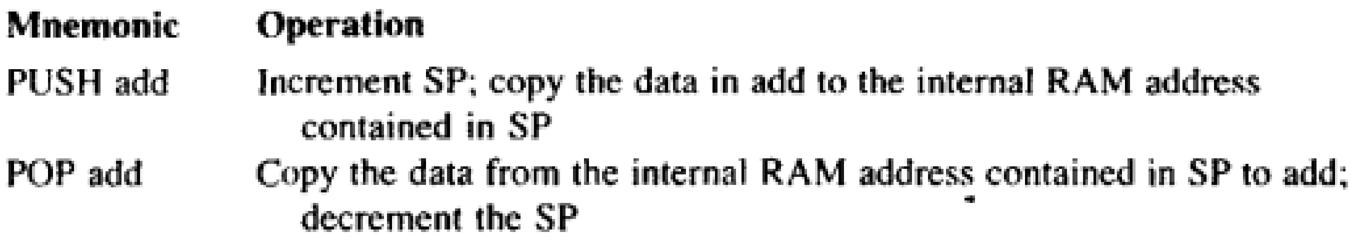
(a) Differentiate between Jump and Call instructions



SERIAL NO.	JUMP	CALL
1.	Program control is transferred to a memory location which is in the main program	Program Control is transferred to a memory location which is not a part of main program
2.	Immediate Addressing Mode	Immediate Addressing Mode + Register Indirect Addressing Mode
3.	Initialisation of SP(Stack Pointer) is not mandatory	Initialisation of SP(Stack Pointer) is mandatory
4.	Value of Program Counter(PC) is not transferred to stack	Value of Program Counter(PC) is transferred to stack
5.	After JUMP, there is no return instruction	After CALL, there is a return instruction
6.	Value of SP does not changes	Value of SP is decremented by 2
7.	10 T states are required to execute this instruction	18 T states are required to execute this instruction
8.	3 Machine cycles are required to execute this instruction	5 Machine cycles are required to execute this instruction

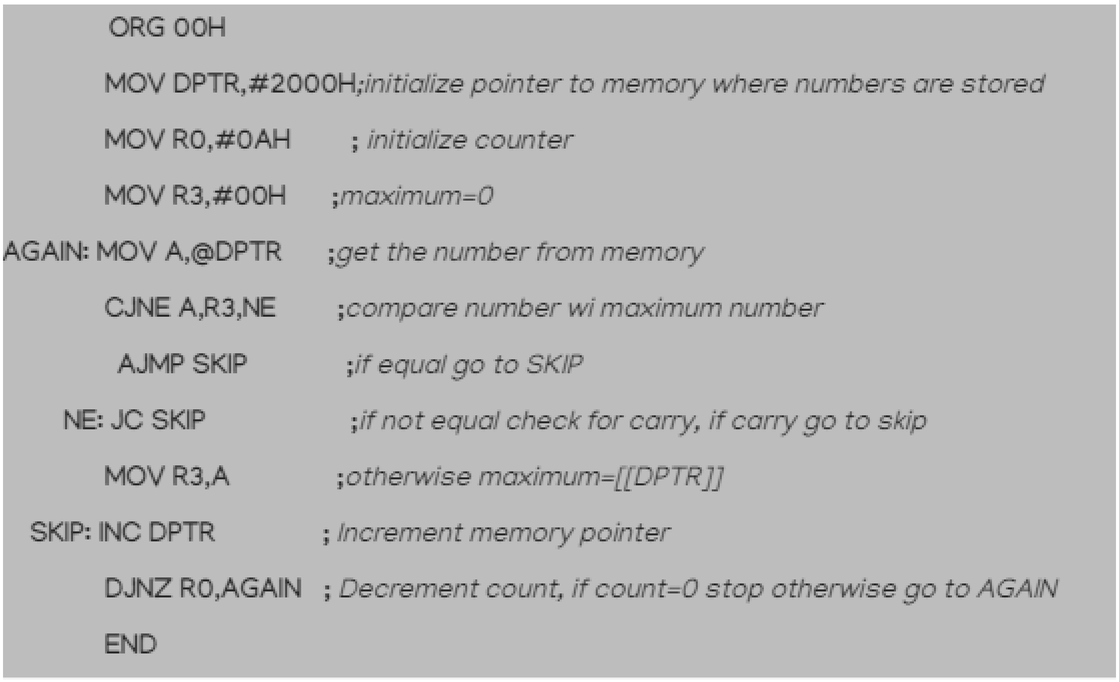
(b)





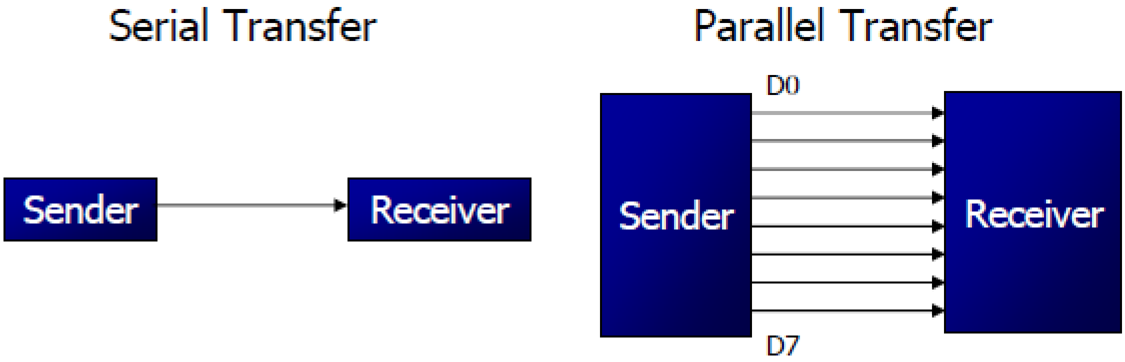
Mnemonic	Operation
PUSH add	Increment SP; copy the data in add to the internal RAM address contained in SP
POP add	Copy the data from the internal RAM address contained in SP to add; decrement the SP

4. Five hex numbers are stored in RAM locations 50H onwards. Write a program to find the biggest number in the set. The biggest number should finally be saved in 60H



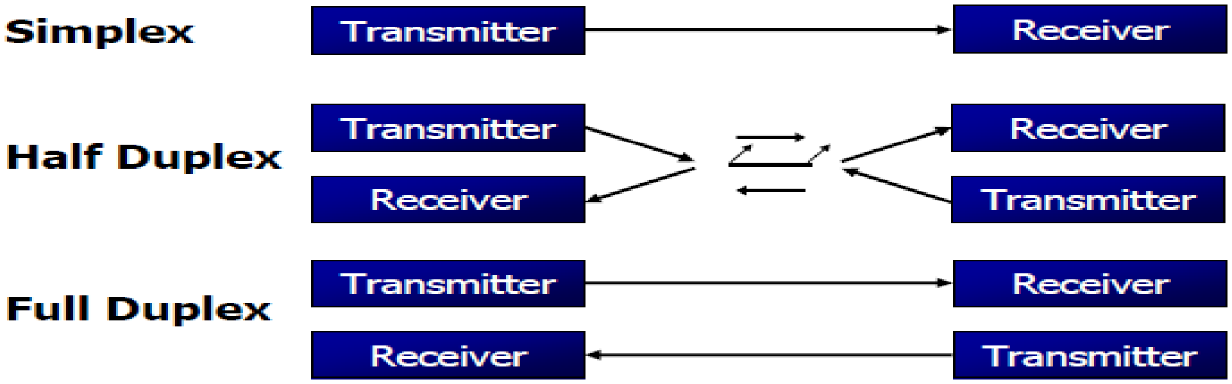
```
            ORG 00H
            MOV DPTR,#2000H;initialize pointer to memory where numbers are stored
            MOV R0,#0AH        ; initialize counter
            MOV R3,#00H       ;maximum=0
AGAIN: MOV A,@DPTR       ;get the number from memory
            CJNE A,R3,NE        ;compare number wi maximum number
              AJMP SKIP           ;if equal go to SKIP
      NE: JC SKIP                ;if not equal check for carry, if carry go to skip
            MOV R3,A            ;otherwise maximum=[[DPTR]]
   SKIP: INC DPTR             ; Increment memory pointer
            DJNZ R0,AGAIN   ; Decrement count, if count=0 stop otherwise go to AGAIN
            END
```

5. What is serial data communication? Explain the significance of SCON register in detail.



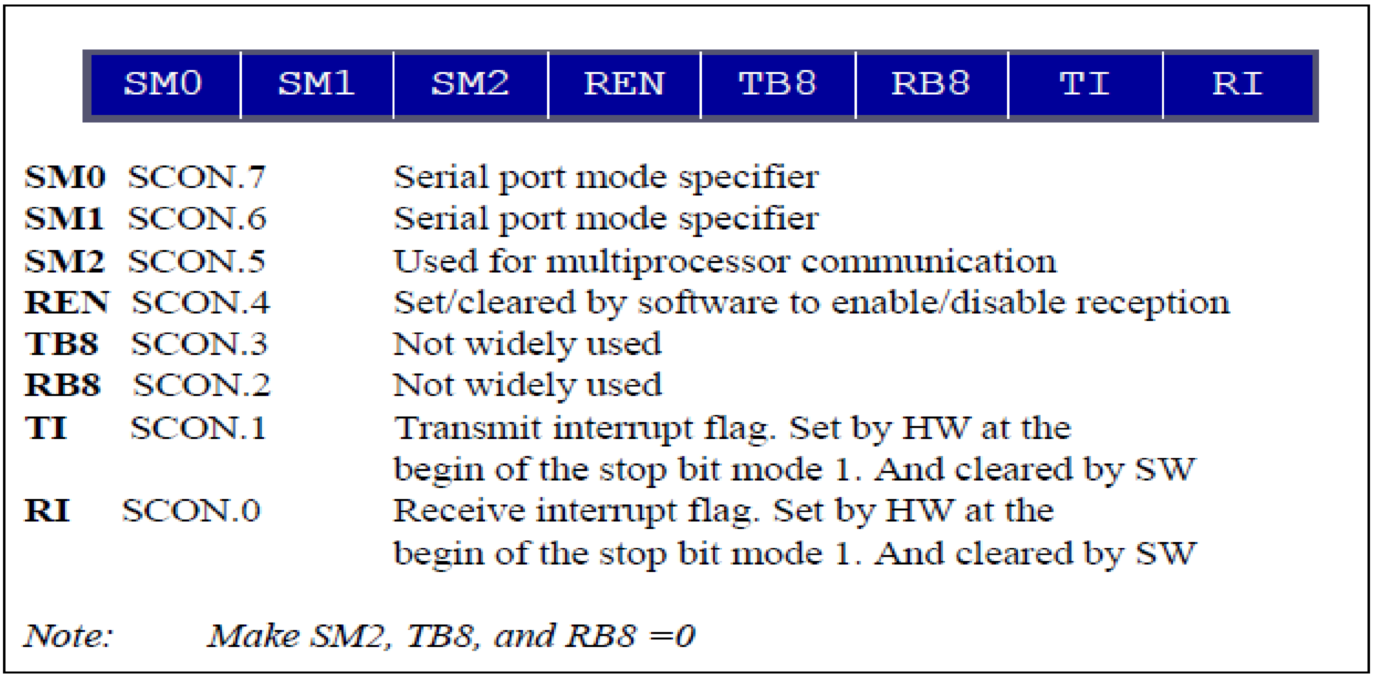
1. At the transmitting end, the byte of data must be converted to serial bits using parallel-in-serial-out shift register
2. At the receiving end, there is a serial-in-parallel-out shift register to receive the serial data and pack them into byte
3. When the distance is short, the digital signal can be transferred as it is on a simple wire and requires no modulation
4. If data is to be transferred on the telephone line, it must be converted from 0s and 1s to audio tones
5. This conversion is performed by a device called a modem, "Modulator/demodulator"

- If data can be transmitted and received, it is a *duplex* transmission
  - If data transmitted one way a time, it is referred to as *half duplex*
  - If data can go both ways at a time, it is *full duplex*
- This is contrast to *simplex* transmission



- A *protocol* is a set of rules agreed by both the sender and receiver on
  - How the data is packed
  - How many bits constitute a character
  - When the data begins and ends
- Asynchronous serial data communication is widely used for character-oriented transmissions
  - Each character is placed in between start and stop bits, this is called *framing*
  - Block-oriented data transfers use the synchronous method
- The start bit is always one bit, but the stop bit can be one or two bits

- SCON is an 8-bit register used to program the start bit, stop bit, and data bits of data framing, among other things

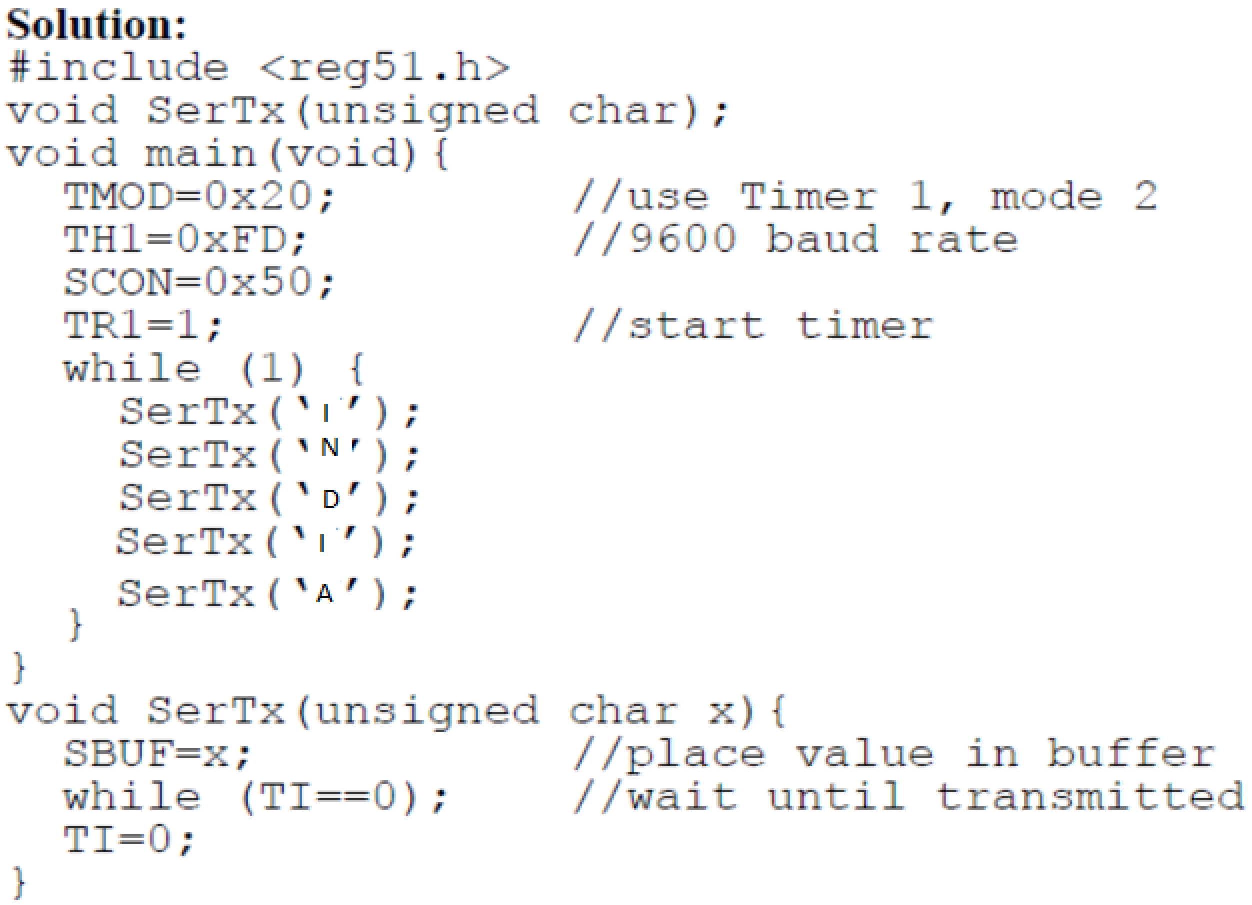


SM0	SM1	SM2	REN	TB8	RB8	TI	RI

SM0	SCON.7	Serial port mode specifier
SM1	SCON.6	Serial port mode specifier
SM2	SCON.5	Used for multiprocessor communication
REN	SCON.4	Set/cleared by software to enable/disable reception
TB8	SCON.3	Not widely used
RB8	SCON.2	Not widely used
TI	SCON.1	Transmit interrupt flag. Set by HW at the begin of the stop bit mode 1. And cleared by SW
RI	SCON.0	Receive interrupt flag. Set by HW at the begin of the stop bit mode 1. And cleared by SW

Note: *Make SM2, TB8, and RB8 =0*

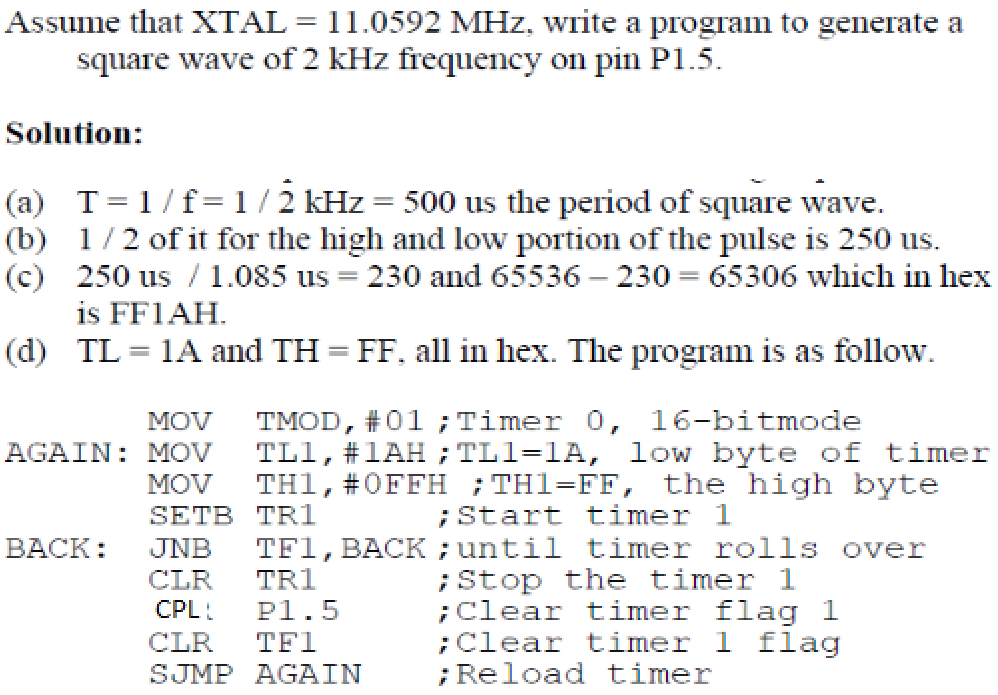
6. Write an 8051 C program to transmit a message ‘India’ serially at a Baud rate of 9600. Use 8 bit data with one start and one stop.



Solution:

```
#include <reg51.h>
void SerTx(unsigned char);
void main(void){
  TMOD=0x20;           //use Timer 1, mode 2
  TH1=0xFD;            //9600 baud rate
  SCON=0x50;
  TR1=1;               //start timer
  while (1) {
    SerTx(‘I’);
    SerTx(‘N’);
    SerTx(‘D’);
    SerTx(‘I’);
    SerTx(‘A’);
  }
}
void SerTx(unsigned char x){
  SBUF=x;              //place value in buffer
  while (TI==0);       //wait until transmitted
  TI=0;
}
```

7. Write an ALP program to generate a square wave of 2KHz frequency on pin p1.5. Assume that XTAL=11.0592 MHz.



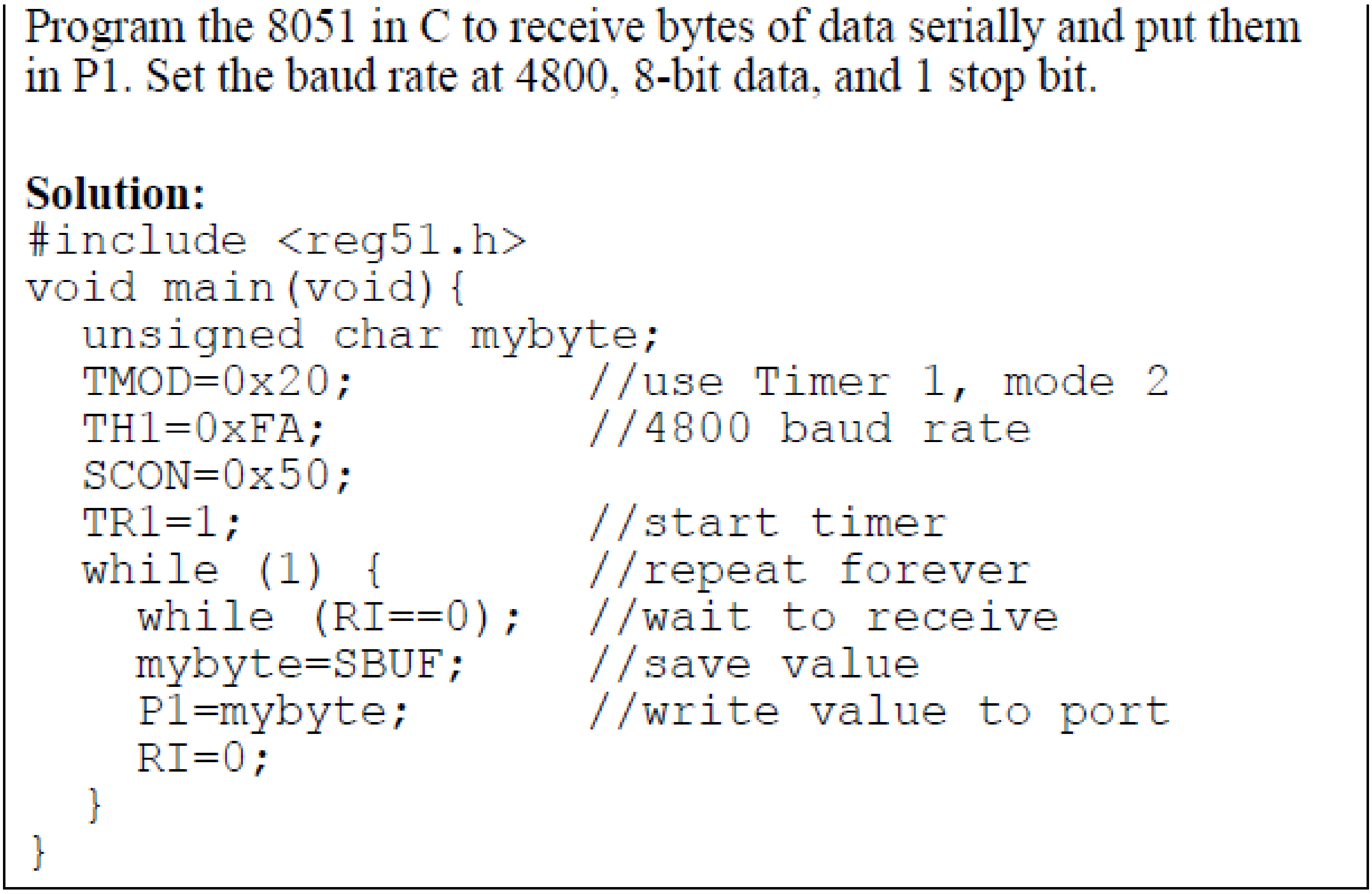
Assume that XTAL = 11.0592 MHz, write a program to generate a square wave of 2 kHz frequency on pin P1.5.

Solution:

(a) T = 1 / f = 1 / 2 kHz = 500 us the period of square wave.
(b) 1 / 2 of it for the high and low portion of the pulse is 250 us.
(c) 250 us / 1.085 us = 230 and 65536 – 230 = 65306 which in hex is FF1AH.
(d) TL = 1A and TH = FF, all in hex. The program is as follow.

```
       MOV   TMOD,#01 ;Timer 0, 16-bitmode
AGAIN: MOV   TL1,#1AH ;TL1=1A, low byte of timer
       MOV   TH1,#0FFH ;TH1=FF, the high byte
       SETB  TR1      ;Start timer 1
BACK:  JNB   TF1,BACK ;until timer rolls over
       CLR   TR1      ;Stop the timer 1
       CPL   P1.5     ;Clear timer flag 1
       CLR   TF1      ;Clear timer 1 flag
       SJMP  AGAIN    ;Reload timer
```

8. Write an 8051 program to receive data bytes serially and send to P1. Use baud rate of 4800.



Program the 8051 in C to receive bytes of data serially and put them in P1. Set the baud rate at 4800, 8-bit data, and 1 stop bit.

Solution:

```
#include <reg51.h>
void main(void){
  unsigned char mybyte;
  TMOD=0x20;          //use Timer 1, mode 2
  TH1=0xFA;           //4800 baud rate
  SCON=0x50;
  TR1=1;              //start timer
  while (1) {         //repeat forever
    while (RI==0);    //wait to receive
    mybyte=SBUF;      //save value
    P1=mybyte;        //write value to port
    RI=0;
  }
}
```