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8051 Viva Questions

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Examiner

8051 is called a _____ bit μ C?

Justify your answer!

Question 1:

You

8051 is called an 8 bit μ C

It has an 8-bit ALU.

That means it can perform 8-bit arithmetic and logic operations in one cycle. Hence it is a 8-bit μ C.

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Examiner

Explain address bus and data bus of 8051?

Question 2:

You

8051 has a 16 bit address bus. Hence it can access 2^16 = 64 KB of memory.
8051 has an 8-bit data bus. This means it can access 8-bit data in one cycle.

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Examiner

Explain clock of 8051?

Question 3:

You

8051 operates on a clock frequency of 12 MHz obtained from a crystal oscillator connected on pins XTAL1 and XTAL2. One machine cycle of 8051 consists of 12 clock cycles and hence is typically of 1 μ sec.

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Examiner

How many pins are present in 8051?

Question 4:

You

8051 has 40 pins.
They mainly constitute the three buses: Address, Data and Control, the I/O ports, Power and clock supply, and reset.

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Examiner

What is an instruction cycle?

Question 5:

You

It is the total process of Fetching an instruction from the memory, decoding the instruction and then finally executing the instruction.

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Examiner

Give features of 8051?

Question 6:

You

Internal Processor: 8-bit
Internal RAM: 128 Bytes
Internal ROM: 4KB
External RAM: Up to 64 KB
External ROM: Up to 64 KB
I/O Ports: 4 x 8-bit
Timers: 2 x 16-bit
Interrupts: 5 (incl. 2 ext. h/w ints.)
Serial Port, Power saving modes etc.

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Examiner

Why did you choose engineering? To mug up answers or to understand the subject?

You

_____

(You have to answer this one Yourself!)

Lets "Understand" the subject!

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8051 Microprocessor
VIVA Questions
Edition: 2019

Microcontroller
8051

List of Video topics

- Introduction
- Architecture
- Flag Register - PSW
- Memory Organisation
- Internal RAM
- SFRs
- Addressing Modes
- Instruction set (All instructions with Examples)
- Short, Long and Absolute jumps
- Boolean - Bit wise operations
- Programmers Model
- Assembly level programs (Several Videos)
- Timer section (Theory and Programs)
- Serial Port (Theory and Programs)
- Interrupt Structure
- Power Saving Features
- Full system designing
- Matrix Keyboard Interfacing with program
- ADC Interfacing with program
- DAC Interfacing with program
- LCD Interfacing with program
- Many more...

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Internal Examiner

What are the alternate functions of the I/O ports of 8051?

Question 7:

You

P0: Multiplexed AD7-AD0
P1: No alternate function
P2: Higher Order A15-A8
P3: Serial Port, Ext. Interrupts, Timer Clock Inputs, Control Signals.

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Examiner

Explain flags of 8051?

Question 8:

You

8051 has an 8 bit flag register, PSW.
It has 7 flags and a X bit.
CF: 1 = Result has carry out of MSB
AC: 1 = Carry from lower to higher nibble
PF: 1 = Result has odd parity
OV: 1 = Result has signed overflow
F0: User defined flag
RS1, RS0: Register Bank Select.
00…11 selects Bank0…Bank3 respectively.

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Examiner

Explain General Purpose registers of 8051?

Question 9:

You

8051 has 32, 8-bit GPRs divided into 4 banks, each having 8 registers R0…R7. The banks are selected by RS1 and RS0 of PSW. Default Bank is Bank0.

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Internal Examiner

Why are the 32 registers divided into 4 banks?

Question 10:

You

This is done to reduce the number of opcodes. With every new register, there is an additional opcode for the same instruction. Having 32 register names would tremendously increase the number of opcodes.

Didn't understand, No worries!
Watch this video for complete explanation.

Refer Video: 8051 | PSW – Flag register
www.BharatAcharyaEducation.com

Examiner

What is PC register of 8051?

Question 11:

You

PC | Program Counter
It is a 16-bit register.
It contains address of the next instruction.
It is incremented as soon as every instruction byte is fetched.

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Examiner

What is SP register of 8051?

Question 12:

You

SP | Stack Pointer
It is a 8-bit register.
It contains address of the top of stack.
It is incremented during Push
It is decremented during Pop
Its default Value is 07H

Refer Video: 8051 | Memory Organization
www.BharatAcharyaEducation.com

Examiner

Explain some of the main addressing modes?

Question 13:

You

Immediate: Data given in the instruction. *E.g.: MOV A, #25H*

Register: Data given in a register . *E.g.: MOV A, R0*

Direct: Address given in the instruction. *E.g.: MOV A, 25H*

Indirect: Address given in a register. *E.g.: MOV A, @R0*

Indexed: Address given as base plus index register. *E.g.: MOVC A, @A+DPTR*

Refer Video: 8051 | Addressing Modes
www.BharatAcharyaEducation.com

Microcontroller 8051

List of Video topics

- Introduction
- Architecture
- Flag Register - PSW
- Memory Organisation
- Internal RAM
- SFRs
- Addressing Modes
- Instruction set (All instructions with Examples)
- Short, Long and Absolute jumps
- Boolean - Bit wise operations
- Programmers Model
- Assembly level programs (Several Videos)
- Timer section (Theory and Programs)
- Serial Port (Theory and Programs)
- Interrupt Structure
- Power Saving Features
- Full system designing
- Matrix Keyboard Interfacing with program
- ADC Interfacing with program
- DAC Interfacing with program
- LCD Interfacing with program
- Many more...

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Examiner

Explain SJMP, AJMP, LJMP instructions of 8051 briefly?

Question 14:

You

SJMP | Short jump
Range: -128…+127 locations

AJMP | Absolute jump
Range: 2KB max, in the same page!

LJMP | Long jump
Range: 64KB, Full Program Memory.

Refer Video: 8051 | SJMP, AJMP, LJMP
www.BharatAcharyaEducation.com

Examiner

What does AJMP instruction have 8 opcodes?

Question 15:

You

3 bits form the opcode of AJMP provide the missing bits in the address. Since 3 bits can have 8 combinations, AJMP has 8 opcodes.

Refer Video: 8051 | SJMP, AJMP, LJMP
www.BharatAcharyaEducation.com

Examiner

What is the difference between ADD and ADDC instructions?

Question 16:

You

Both perform addition. ADD is a half adder. ADDC is a full adder, as in, it will also include the carry of the previous operation. It is used to add large numbers. It is used to add large sized numbers so that the carry of the lower byte propagates into the higher byte.

Ref Video: 8051 | Arithmetic Instrs
www.BharatAcharyaEducation.com

Examiner

Explain the following instructions:
DA A, MUL AB, DIV AB, Push 25H,
CJNE, DJNZ, JBC, XCHD of 8051?

Question 17:

You

Though any instruction can be asked,
the ones above are the MOST
FREQUENTLY asked instructions.
Their explanations are very long.
All instructions are covered in full detail
on my website

www.BharatAcharyaEducation.com

Examiner

What is the significance of A register in 8051?

Question 18:

You

A is the Accumulator.
It holds the First operand and the Result in most arithmetic and logic operation.
It also is the ONLY register that can be used to transfer DATA with external RAM and ROM using instructions like MOVX and MOVC

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Examiner

What is the signed value of this binary number 1000 0011?

Question 19:

You

Most people answer that it is -03H.
That's wrong!
This number is -7DH.
Negative numbers are ALWAYS stored in their 2's complement form.

For detailed explanation on this topic
Refer video: **8051 | Flag register**
www.BharatAcharyaEducation.com

Examiner

What lines are multiplexed in 8051 μ C and why?

Question 20:

You

A0-A7 and D0-D7 are multiplexed to produce AD0-AD7. This is done to reduce the number of lines. ALE decides if they carry address (1) or data (0).

Ref Video: **8051 | Pin Diagram**
www.BharatAcharyaEducation.com

Microcontroller 8051

List of Video topics

- Introduction
- Architecture
- Flag Register - PSW
- Memory Organisation
- Internal RAM
- SFRs
- Addressing Modes
- Instruction set (All instructions with Examples)
- Short, Long and Absolute jumps
- Boolean - Bit wise operations
- Programmers Model
- Assembly level programs (Several Videos)
- Timer section (Theory and Programs)
- Serial Port (Theory and Programs)
- Interrupt Structure
- Power Saving Features
- Full system designing
- Matrix Keyboard Interfacing with program
- ADC Interfacing with program
- DAC Interfacing with program
- LCD Interfacing with program
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Examiner

What is the difference between JMP and CALL ?

Question 21:

You

Both will take the program to a new location.
JMP will continue from there on.
Call will execute the subroutine at that new location and then Return to the main program at the next instruction upon getting RET.

Ref Video: **8051 | Branch Instructions**
www.BharatAcharyaEducation.com

Examiner

What is the difference between MOVX and MOVC?

Question 22:

You

MOVX works on External RAM.
Address can be given by DPTR or RO/R1.

MOVC works on ROM.
Address is given by A+PC or A+DPTR.
It can work on Int. or Ext. ROM depending on the address and EA (bar).

If Address > 0FFFH, Ext. ROM.
Else If EA (bar) = 0, Ext. ROM
Else Int. ROM

Don't be confused…
Its much simpler than you think!
Ref Video: **8051 | Addressing Modes**
www.BharatAcharyaEducation.com

Examiner

What is the difference between a subroutine (procedure) and a macro?

Question 23:

You

When we CALL a subroutine, the program control shifts from the main program to the subroutine, and after execution, returns to the next instruction after CALL.
When we invoke a macro, the macro code is pasted into our program at the location where the macro was invoked.

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Examiner

List the interrupts of 8051 in order of priority and Vector address?

Question 24:

You

$\overline{\text{INT0}}$ – Highest Priority - 0003H
Timer 0 - … - 0000B
$\overline{\text{INT1}}$ – … - 0013H
Timer 1 - … - 0001B
Serial Port – Lowest Priority – 0023H

These are the default Priorities. They can be altered using IP SFR

Ref Video: **8051 | Interrupts**
www.BharatAcharyaEducation.com

Examiner

What is the Use of IE and IP SFRs in 8051?

Question 25:

You

IE | Interrupt Enable

Used to globally and individually enable/disable interrupts.

IP | Interrupt Priority

Used to decide high or low priority of interrupts.

Ref Video: **8051 | Interrupts**

www.BharatAcharyaEducation.com

Examiner

What is the use of TCON and TMOD SFRs of 8051?

Question 26:

You

TCON | Timer Control
Starts timers, determines overflow, triggering of interrupts, tells if ext. interrupts occurred.

TMOD | Timer Modes
Decides modes of times, selects timer or counter operation, enables Gate feature

Ref Video: **8051 | Timer Section**
www.BharatAcharyaEducation.com

Internal Examiner

What is the use of TL0, TH0, TL1, TH1 SFRs of 8051?

Question 27:

You

TL0, TH0 | Timer0 Count
Hold the 16 bit count of Timer 0.

TL1, TH1 | Timer1 Count
Hold the 16 bit count of Timer 1.

Ref Video: **8051 | Timer Section**
www.BharatAcharyaEducation.com

Microcontroller 8051

List of Video topics

- Introduction
- Architecture
- Flag Register - PSW
- Memory Organisation
- Internal RAM
- SFRs
- Addressing Modes
- Instruction set (All instructions with Examples)
- Short, Long and Absolute jumps
- Boolean - Bit wise operations
- Programmers Model
- Assembly level programs (Several Videos)
- Timer section (Theory and Programs)
- Serial Port (Theory and Programs)
- Interrupt Structure
- Power Saving Features
- Full system designing
- Matrix Keyboard Interfacing with program
- ADC Interfacing with program
- DAC Interfacing with program
- LCD Interfacing with program
- Many more...

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Examiner

Name timer Modes of 8051?

Question 28:

You

Mode 0 | 13 bit Timer/ Counter

Max Counts = 2^{13}

Mode 1 | 16 bit Timer/ Counter

Max Counts = 2^{16}

Mode 2 | 8 bit T/C with auto reload

Max Counts = 2^{8}

Mode 3 | 2, 8 bit Timers using Timer0

Max Counts = 2^{8}

Ref Video: **8051 | Timer Section**

www.BharatAcharyaEducation.com

Examiner

What is the Reset Vector Address of 8051?

Question 29:

You

On reset, PC becomes 0000H
This is the Reset Vector address
From here 8051 executes the monitor program

Ref Video: **8051 | Memory Designing**
www.BharatAcharyaEducation.com

Examiner

What is the role of these signals: $\overline{\text{RD}}$, $\overline{\text{WR}}$ & $\overline{\text{PSEN}}$ of 8051?

Question 30:

You

$\overline{\text{RD}}$ | Read

Acts as a Read signal for Ext RAM

$\overline{\text{WR}}$ | Write

Acts as a Write signal for Ext RAM

$\overline{\text{PSEN}}$ | Program Status Enable

Acts as a Read signal for Ext ROM

Ref Video: **8051 | Pin Diagram**
www.BharatAcharyaEducation.com

Examiner

What is the role of $\overline{\mathbf{EA}}$ in 8051?

Question 31:

You

$\overline{\mathbf{EA}}$ **| Enable External Access**

It is used to decide if the Internal ROM of 8051 will be used or discarded.

If $\overline{\mathbf{EA}}$ = 0: Interrupt ROM is discarded

If $\overline{\mathbf{EA}}$ = 1: Interrupt ROM is used

Ref Video: **8051 | Memory Organization**
www.BharatAcharyaEducation.com

Examiner

Describe Serial Port Mode 0 briefly?

Question 32:

You

Mode 0 | Shift Register
Format: 8-bit data, no start/stop bits
Baud Rate: Fixed.
BR = fosc ÷ 12
Type: Synchronous, half duplex

Ref Video: **8051 | Serial Port**
www.BharatAcharyaEducation.com

Examiner

Describe Serial Port Mode 1 briefly?

Question 33:

You

Mode 1 | 8-bit UART

Format: 1 start, 8-bit data, 1 stop bit

Baud Rate: Variable.

BR = (2^{SMOD} x Timer1 overflow rate) ÷ 32

Type: Asynchronous, full duplex

Ref Video: **8051 | Serial Port**

www.BharatAcharyaEducation.com

Examiner

Describe Serial Port Mode 2 briefly?

Question 34:

You

Mode 2 | 9-bit UART

Format: 1 start, 8-bit data, 9th programmable bit, 1 stop bit

Baud Rate: Fixed.

BR = (2^{SMOD} x fosc) ÷ 64

Type: Asynchronous, full duplex

Ref Video: **8051 | Serial Port**

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Microcontroller 8051

List of Video topics

- Introduction
- Architecture
- Flag Register - PSW
- Memory Organisation
- Internal RAM
- SFRs
- Addressing Modes
- Instruction set (All instructions with Examples)
- Short, Long and Absolute jumps
- Boolean - Bit wise operations
- Programmers Model
- Assembly level programs (Several Videos)
- Timer section (Theory and Programs)
- Serial Port (Theory and Programs)
- Interrupt Structure
- Power Saving Features
- Full system designing
- Matrix Keyboard Interfacing with program
- ADC Interfacing with program
- DAC Interfacing with program
- LCD Interfacing with program
- Many more...

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Examiner

Describe Serial Port Mode 3 briefly?

Question 35:

You

Mode 3 | 9-bit UART

Format: 1 start, 8-bit data, 9th programmable bit, 1 stop bit

Baud Rate: Variable.

BR = (2^{SMOD} x Timer1 overflow rate) ÷ 32

Type: Asynchronous, full duplex

Ref Video: **8051 | Serial Port**

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Examiner

What is the use of ANL, ORL, XRL instructions?

Question 36:

You

ANL: To clear a bit from a register.
ORL: To set a bit from a register.
XRL: To complement a bit from a register.

Ref video: **8051 | Logic Instructions**
www.BharatAcharyaEducation.com

Examiner

What is an instruction cycle, machine cycle and T-state?

Question 37:

You

Instruction cycle: Total process of fetching, decoding and executing an instruction. **Machine cycle**: One complete operation of the system bus. **T-state**: One clock cycle.

Instruction cycle has several machine cycles. Machine cycle of 8051 has 12 T-states.

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Examiner

A has a value 35H. How can you make it 53H?

Question 38:

You

SWAP A

We can also do the same by Rotating A 4 times in any one direction.

Ref video: **8051 | Logic Instructions**
www.BharatAcharyaEducation.com

Examiner

What are the uses of stacks?

What is the default value of SP and why?

Question 39:

You

1) To store data
2) To store return address during Call
3) To pass parameters to subroutines

The Reset value (default value) of SP is 07H. This causes the first push at 08H without affecting Bank0.

Don’t waste such a wonderful subject by simply mugging up the answers!

Ref video: **8051 | Memory Organization**
www.BharatAcharyaEducation.com

Examiner

How many SFRs does 8051 have?
Which of them are bit addressable?

Question 40:

You

There are 21, 8-bit SFRs
The bit addressable ones are:
A, B, PSW, P0, P1, P2, P3, TCON, SCON, IE and IP.

Ref video: **8051 | SFRs**
www.BharatAcharyaEducation.com

Examiner

What are the addresses of the SFRs?

Question 41:

You

SFRs are allotted addresses so that they do not increase the number of opcodes. The address allotted are **80H…FFH** so that they do not interfere with the addresses of the internal RAM (00H…7FH)

Ref video: **8051 | SFRs**
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8051 Microprocessor
VIVA Questions
Edition: 2019

Microcontroller 8051

List of Video topics

- Introduction
- Architecture
- Flag Register - PSW
- Memory Organisation
- Internal RAM
- SFRs
- Addressing Modes
- Instruction set (All instructions with Examples)
- Short, Long and Absolute jumps
- Boolean - Bit wise operations
- Programmers Model
- Assembly level programs (Several Videos)
- Timer section (Theory and Programs)
- Serial Port (Theory and Programs)
- Interrupt Structure
- Power Saving Features
- Full system designing
- Matrix Keyboard Interfacing with program
- ADC Interfacing with program
- DAC Interfacing with program
- LCD Interfacing with program
- Many more...

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Examiner

Why is the Baud rate in Mode 1 and 3 of serial port called “Variable”?

Question 42:

You

Because they are based on Timer 1 overflow rate which can be altered by changing the count. Every different count can produce a new Baud rate. Hence variable. You can use real world examples from the videos.

Ref Video: **8051 | Serial Port Programs**
www.BharatAcharyaEducation.com

Examiner

What are the counts for the standard 8051 Baud rates?

Question 43:

You

Using a crystal of 11.0592 MHz…

Baud rate: **9600** | Count: **FD**H
Baud rate: **4800** | Count: **FA**H
Baud rate: **2400** | Count: **F4**H
Baud rate: **1200** | Count: **E8**H
And so on…

Ref Video: **8051 | Serial Port Programs**
www.BharatAcharyaEducation.com

Examiner

What is the use of SMOD?

Where is it present?

Question 44:

You

SMOD is s bit present in the PCON register, at the MSB. It is used to “double” the Baud Rates in serial port modes 1,2,3.

Ref Video: **8051 | Serial Port**
www.BharatAcharyaEducation.com

Examiner

Describe idle mode?

Question 45:

You

Description

It is a power saving mode

Clock supply to the CPU is cut off.

Clock to remaining circuit is active.

Activation

Make IDL bit ←1 in PCON

Termination

Interrupt or Reset.

Ref Video: **8051 | Power Saving Modes**

www.BharatAcharyaEducation.com

Examiner

Describe Power Down Mode?

Question 46:

You

Description

It is a stronger power saving mode

Clock supply to the entire system is cut off.

Activation

Make PD bit ←1 in PCON

Termination

Reset.

Ref Video: **8051 | Power Saving Modes**

www.BharatAcharyaEducation.com

Examiner

How do you turn the ports into input ports?

Question 47:

You

By sending FFH on a port, we convert them into input ports. The $\overline{\mathbf{Q}}$ disables the FET and hence allows the Port line to be read via the input buffer.

Ref Video: **8051 | I/O Ports**
www.BharatAcharyaEducation.com

Examiner

Port 0 is called TRUE bidirectional whereas Port 1,2,3 are called QUASI bidirectional. Justify?

Question 48:

You

Port 0 | True Bidirectional

As there is no Internal Pull Up on Port 0, the lines are Floating (Neither 0 nor 1) in input mode. Hence true bidirectional.

Port 1,2,3 | Quasi Bidirectional

Internal Pull Up keeps a default logic 1 on the port lines even in input mode. Hence Quasi bidirectional.

Learn this amazing answer at…

Ref Video: **8051 | I/O Ports**
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8051 Microprocessor
VIVA Questions
Edition: 2019

Microcontroller 8051

List of Video topics

- Introduction
- Architecture
- Flag Register - PSW
- Memory Organisation
- Internal RAM
- SFRs
- Addressing Modes
- Instruction set (All instructions with Examples)
- Short, Long and Absolute jumps
- Boolean - Bit wise operations
- Programmers Model
- Assembly level programs (Several Videos)
- Timer section (Theory and Programs)
- Serial Port (Theory and Programs)
- Interrupt Structure
- Power Saving Features
- Full system designing
- Matrix Keyboard Interfacing with program
- ADC Interfacing with program
- DAC Interfacing with program
- LCD Interfacing with program
- Many more...

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Examiner

What is the advantage of $\overline{\textbf{PSEN}}$?

Question 49:

You

8051 has a 16-bit address bus. That should allow it to access a max of 64 KB memory. But with the inclusion of $\overline{\textbf{PSEN}}$ signal we can actually access 64 KB of ext ROM and a separate 64 KB of ext RAM.

Ref Video: **8051 | Pin Diagram**
www.BharatAcharyaEducation.com

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Examiner

How much MAX memory can be accessed by 8051 using RAM and ROM?

Question 50:

You

ROM | Program Memory

Total 64KB (including internal and external)

RAM | Data Memory

Total 64KB External RAM + 128 Bytes Internal RAM

Ref Video: 8051 | Memory organization

www.BharatAcharyaEducation.com

Examiner

What is the significance of indexed addressing mode in ROM?

Question 51:

You

It is ideally suited to access Look Up Tables stored in ROM. DPTR acts as the base and A acts as an index.

You may want to give the Real World example of 7 segment displays from the video lectures.

Ref Video: **8051 | Addressing Modes**
www.BharatAcharyaEducation.com

Examiner

What is simplex, half duplex and full duplex communication?

Question 52:

You

Simplex: One direction, life-long.
E.g.:: TV Remote, always a transmitter

Half duplex: One direction at a time.
E.g.:: Walkie Talkie.

Full Duplex: Both directions, same time.
E.g.:: Mobile Phone.

Ref Video: **8051 | Serial Port**
www.BharatAcharyaEducation.com

Examiner

What is the difference between Von Neumann and Harvard Model?

Question 53:

You

Von Neumann Model

Common memory used to store programs and data. E.g.:: 8085, 8086.

Harvard Model

Separate program memory and data memory. E.g.:: 8051.

Ref Video: **8051 | Architecture**
www.BharatAcharyaEducation.com

Examiner

Give the size and address range of all four memories of 8051?

Question 54:

You

Internal RAM | 128 bytes
Address range: 00H… 7FH

Internal ROM | 4KB bytes
Address range: 0000H… 0FFFH

External RAM | 64 KB (max)
Address range: 0000H… FFFFH

External ROM | 64 KB (max)
Address range: 0000H… FFFFH

Ref Video: **8051 | Architecture**
www.BharatAcharyaEducation.com

Examiner

What is the role of power on reset circuit?

Question 55:

You

It activates the reset signal when we power on (also called cold start). On reset PC becomes 0000H to execute the monitor program.

Video Ref: 8051 | Designing
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8051 Microprocessor
VIVA Questions
Edition: 2019

Microcontroller 8051

List of Video topics

- Introduction
- Architecture
- Flag Register - PSW
- Memory Organisation
- Internal RAM
- SFRs
- Addressing Modes
- Instruction set (All instructions with Examples)
- Short, Long and Absolute jumps
- Boolean - Bit wise operations
- Programmers Model
- Assembly level programs (Several Videos)
- Timer section (Theory and Programs)
- Serial Port (Theory and Programs)
- Interrupt Structure
- Power Saving Features
- Full system designing
- Matrix Keyboard Interfacing with program
- ADC Interfacing with program
- DAC Interfacing with program
- LCD Interfacing with program
- Many more...

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Examiner

Compare software delay and hardware delays?

Question 56:

You

Software delay | Produced by a program, cheaper, more flexible, keeps μ C busy

Hardware delay | Produced by a timer, costlier, less flexible, keeps μ C free

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Examiner

What is the difference between a timer and a counter?

Question 57:

You

Timer: Uses internal clock of fosc/12. Works at fixed frequency and is generally used to produced delays.

Counter: Uses external clock at T1 or T0. Works at a variable frequency and is generally used to count events.

Use real world examples of "Visitor counter" at malls, from video lectures.

Ref Video: 8051 | Timing Diagram Part 1
www.BharatAcharyaEducation.com

Examiner

What are the Boolean operations of 8051?

Question 58:

You

SETB | CLR | CPL | ANL | ORL | JB | JNB | JBC are the Boolean operations of 8051.
They work on (i) any bit from the bit addressable region of internal RAM (ii) any bit from a bit addressable SFR (iii) Carry Flag

Ref Video: **8051 | Boolean Instructions**
www.BharatAcharyaEducation.com

Examiner

What is the difference between 8051, 8751 and 8031?

Question 59:

You

They are all from the same MCS51 family, most parts are the same.

8051 – 4KB Internal ROM
8751 – 4KB Internal EPROM
8031 – No Internal ROM

Ref Video: **8051 | Designing**
www.BharatAcharyaEducation.com

Examiner

During loops, how many Iterations will we get for these counts
01H, 10H, FFH, 00H?

Question 60:

You

Count: 01H | Iterations: 1
Count: 10H | Iterations: 16
Count: FFH | Iterations: 255
Count: 00H | Iterations: 256

Ref Video: **8051 | Branch Instructions**
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