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8051 Microcontroller Interview Questions for Beginners

What is 8051 Microcontroller?

The 8051 microcontroller is a general-purpose, 8-bit microcontroller. It was originally developed by Intel in 1980. It is based on the original 8048 microcontrollers and designed to be compatible with most of the instruction set and pinout of the 8048. Nowadays, It is one of the most popular microcontrollers and is used in a wide variety of applications, including industrial control systems, consumer electronics, and automotive systems. It has an on-chip ROM, RAM, timers, counters, serial communication interfaces, and I/O ports, and can be programmed in assembly or C language.

Q1. What is 8051 Microcontroller ?

The **Intel 8051 microcontroller** is one of the most popular general-purpose microcontrollers in use today. It is an 8-bit family of microcontroller developed by Intel in the year 1981. This microcontroller was also referred to as “system on a chip” because it has 128 bytes of RAM, 4Kbytes of ROM, 2 Timers, 1 Serial port, and four ports on a single chip. 8051 microcontroller allows CPU to work on 8bits of data at a time. In case the data is larger than 8 bits then it has to be broken into parts so that the CPU can process conveniently.

Q2. What are registers in Microcontroller ?

Register provides a fast way to collect and store data using microcontrollers and processors. If we want to manipulate data with a controller or processor by performing tasks like addition, subtraction, and so on, we cannot do that directly in the memory, in order to perform these tasks we need registers to process and store the data. Microcontrollers contain several types of registers that can be classified according to their content or instructions that operate on them.

The 8051 microcontroller contains mainly two types of registers:

- General purpose registers (Byte addressable registers)
- Special function registers (Bit addressable registers)

The 8051 microcontroller consists of 256 bytes of RAM memory, which is divided into two ways, such as 128 bytes for **general purpose** and 128 bytes for **special function registers (SFR)** memory. The memory which is used for general purpose is called as RAM memory, and the memory used for SFR contains all the peripheral related registers like Accumulator, ‘B’ register, Timers or Counters, and interrupt related registers.

Q3. What is an interrupt? List various types of interrupts available in 8051 Microcontroller?

Interrupt: An interrupt is a signal to the processor emitted by hardware or software indicating an event that needs immediate attention. An interrupt alerts the processor to a high-priority condition requiring the interruption of the current code the processor is executing. The processor responds by suspending its current activities, saving its state, and executing a function called an interrupt handler (or an interrupt service routine, ISR) to deal with the event. This interruption is temporary, and, after the interrupt handler finishes, the processor resumes normal activities. There are two types of interrupts: hardware interrupts and software interrupts. (source: <https://en.wikipedia.org/wiki/Interrupt>)

Q4. List Interrupts available in 8051 Microcontroller

- External interrupt 0 (IE0) has highest priority among interrupts.
- Timer interrupt 0 (TF0)
- External interrupt 1 (IE1)
- Timer interrupt 1 (TF1) has lowest priority among other interrupts.
- Serial port Interrupt
- Reset

Q5. What is stack pointer in 8051 Microcontroller?

In 8051 a stack pointer is 8 bits wide register to access stack. The stack is a section of RAM used by the CPU to store information temporarily information could be data or an address.

Generally, 8051 used bank 1 of internal RAM as the stack so the default stack pointer is 07H. The stack is used for PUSH, POP, CALL, RET instructions and work on the principle of last in first output (LIFO)

Q6. Explain architecture of 8051 Microcontroller?

8051 Microcontroller is based on Harvard Architecture and developed primarily for use in embedded systems technology. Its architecture consists of following units

- Central Processor Unit (CPU)
- Interrupts
- Memory
- BUS
- Oscillator
- Input/Output Port
- Timers/Counters

Q7. What is Address Bus, Data Bus and Control Bus in Microprocessor 8051 ?

Address Bus: Address Bus is used for address memory locations and to transfer the address from CPU to Memory of the microcontroller. Microcontroller 8051 has a **16 bit** address bus for transferring the data. 8051 have four addressing modes they are

- Immediate addressing modes.
- Bank address (or) Register addressing mode.
- Direct Addressing mode.
- Register indirect addressing mode.

Data Bus: Data Bus is used to transfer data within Microprocessor and Memory/Input or Output devices. It is bi-directional as Microprocessor requires to send or receive data. The data bus also works as address bus when multiplexed with lower order address bus. 8051 has 8 bits of the data bus, which is used to carry data of particular applications

Control Bus: Control bus manages the information flow between components indicating whether the operation is a read or a write and ensuring that the operation happens at the right time.

Q8. Which interrupt has highest priority in Microcontroller ?

Trap interrupt has the highest priority. A trap is an abnormal condition detected by the CPU, which indicates an unknown I/O device is accessed, etc

Q9. List some 8051 Microcontroller applications in embedded systems ?

The applications of 8051 Microcontroller is involved in 8051 based projects. Below are the list of 8051 projects .

- Arduino Managed High Sensitive based Power Saver for Street Light Control System
- The Temperature Humidity Monitoring System of Soil Based on Wireless Sensor Networks using Arduino
- RFID based Electronic Passport System for Easy Governance using Arduino
- Arduino based RFID Sensed Device Access
- Arduino based DC Motor Speed Control
- Arduino Based Line Following Robot
- Zigbee based Automatic Meter Reading System
- GSM based Electricity Energy Meter Billing with Onsite Display
- Android Phone Speech Recognition Sensed Voice Command based Notice Board Display
- Parking Availability Indication System
- Voice Controlled Home Appliances
- Remote Control Home Appliances
- PC Mouse operated Electrical Load Control Using VB Application
- Solar Highway Lighting System with Auto Turn Off in Daytime
- 8051 Microcontroller based Wireless Energy Meter
- Farmer Friendly Solar Based Electric Fence for Deterring Cattles

- Vehicle Movement Sensed Streetlight with Daytime auto off Features

Q10. List some features of 8051 Microcontroller.

Below is the list for some **features of the 8051 Microcontroller.**

- 64K bytes on-chip program memory (ROM)
- 128 bytes on-chip data memory (RAM)
- Four register banks
- 128 user-defined software flags
- 8-bit bidirectional data bus
- 16-bit unidirectional address bus
- 32 general purpose registers each of 8-bit
- 16-bit Timers (usually 2, but may have more or less)
- Three internal and two external Interrupts
- Four 8-bit ports,(short model have two 8-bit ports)
- 16-bit program counter and data pointer

Q11. What is an Interrupt service routine in Microcontroller?

When Microcontroller is under sudden interrupt, it will call ISR (Interrupt service routine) that will store the address of the current memory address, and takes control of the new interrupt memory address. After the interrupt, the control will transfer back to its previous address.

Q12. What are applications of 8051 microcontrollers?

The constant growth in information technology has provided many benefits of making use of a microcontroller, integrated circuits, embedded chips, microprocessors, etc. With these technologies, work is done faster and complexity is reduced. The 88051 microcontrollers are used in electronic and electrical circuits. You can also find its application in robotics and artificial intelligence.

Q13. What is the difference between microprocessor and microcontroller?

Microprocessor differs from microcontrollers in different areas. Based on external peripheral, storage locations like ROM (Read-only memory), RAM (Random access memory) and EEPROM are embedded in microcontroller while external circuits are used in the microprocessor. Every peripheral is on one chip but they are bulky in the microprocessor. The microcontroller is less expensive than microprocessors and devices manufactured with microprocessors are cheaper too because of the metal oxide semiconductor technology used. Microprocessors are faster than microcontrollers.

Q14. What is a PIC microcontroller?

PIC Microcontrollers (Programmable Interface Controllers Microcontrollers) are programmable circuits that perform many functions. Pic microcontroller can be programmed to function as a timer, production line controller, and other tasks. You can see programmable interface controllers in applications such as computer control systems, electronic phones, alarm systems, and every other electronic device. PIC controllers exist in different types though ones found in the GENIE range are considered the best and they are cheap to buy.

Q15. What is the use of PIC microcontroller?

There are different uses of the programmable interface controller. Some of the applications are video games, peripherals, audio accessories and many more. Since this circuit is programmable, it can be used for many functions like timer and to control the production line.

Q16. What is ARM microcontroller?

The **ARM microcontroller** is considered by many as the most popular microcontroller existing in the world of the digital embedded system. Many industries prefer to make use of ARM microcontrollers because of the many exciting features. With ARM microcontroller, such industries can easily implement high performing products. The ARM microcontroller is cost-sensitive and its applications range to sensors, wireless networking, automotive body system, and others.

Q17. Where ARM chips are used?

Arm processors or chips are used in different electronic applications or devices. Devices, where the ARM chips are used, include tablets, multimedia players, smartphones, wearables, and other mobile devices. Arm chips need little transistors because of their instruction set. The use of ARM chips to the devices mentioned above and those not mentioned will keep on increasing because of the small size, little consumable power, and reduced complexity.

Q18. List some 8051 microcontroller interrupts?

There are 5 major sources of interrupt an 8051 microcontroller passes through. An interrupt is when the microprocessor stops its operation on a present task to look for signals from another task. It performs its operation on the new task before going back to the first task. The 8051 microcontroller interrupts are:

- TF0 which stands for Timer 0 overflow interrupt
- TFI which stands for Timer 1 overflow interrupt
- INT0 or External hardware interrupt

- Int1 or External hardware interrupt
- Serial communication interrupt- RI/TI

Q19. List some microcontroller examples?

There are many examples of the microcontroller. Some of the examples are Altera, Atmel, Espressif system, ELAN microelectronics Corp., Maxim Integrated, Cypress Semiconductor, Analog Devices, Intel, Holtek, National Semiconductor, NEC, Freescale Semiconductor, Fujitsu, Panasonic, Microchip technology, Hyperstone, Infineon, Parallax, Nuvoton technology, Sony, Toshiba, Spansion, Rockwell, XMOS, Rabbit semiconductor, Silicon Motion, Redpine signals, Ubicom, Sortable table and many more.

Q20. What is a data pointer in 8051 Microcontrollers?

Data pointer in the 8051 microcontrollers is one of the storage registers. Other storage registers in an 8051 microcontroller are the accumulator, the stack pointer (SP), R register, B register and the program counter (PC). The Data Pointer in 8051 microcontrollers in short form DPTR is the only 2-byte register a user can access. Other registers like the B register and accumulator are 1-byte register. This data pointer just like the name implies is for data pointing. With it, the 8051 can access memory outside the system.

Q21. What is embedded Microcontroller?

A microcontroller is an integrated circuit that governs one particular task in an embedded system. Every typical microcontroller has a memory, a processor and input and output peripheral all on a single chip. In some cases, it is called an embedded controller and it is used in vending machines, vehicles, medical devices, home appliances, robots, and mobile radio transceivers. They are small personal computers used for controlling small features of a bigger component.

Q22. List major components of microcontroller?

A microcontroller has many components. Some of the major components of a microcontroller are Central processing unit(CPU), Input and output ports, Digital analog converters, Random Access Memory(RAM), Serial interfacing ports, Read-Only Memory(ROM), Oscillatory circuits, interrupt controls, Timers and Counters and Analog to digital converters. Every microcontroller has one or more of the components mentioned above.

Q23. What are different types of Microcontrollers?

There are different types of microcontrollers. They include:

- **PIC Microcontroller:** PIC microcontroller stands for a programmable interface controller used for developing computer robotics, electronics, and similar devices. The PIC controller is made up of data bus, dedicated processor and built-in data memory that plays a role in preparing input and output methods
- **ARM Microcontroller:** It is more popular than other microcontrollers. The ARM means Advanced RISC Machine and widely used by industries because of its unique features. Sensor and wireless networks are some of the devices produced with ARM microcontrollers.
- **8051 Microcontroller:** This is another type of microcontroller developed by Intel in the year 1981. It has 40 pins and four programmable parallel 8-bit ports.
- **AVR Microcontroller:** AVR microcontroller is an advanced Harvard architecture machine. The AVR in full form is Atmel and Vegard's RISC Processor.
- **MSP Microcontroller:** The mixed-signal processor is another type of microcontroller from the Texas Instruments family. It is cost-effective and gives a good performance in the denser programming code.

Q24. Explain about the timer and counter of 8051 microcontroller?

Timers and counters are useful for measuring time intervals, generating time delays, counting events, and generating baud rates for serial communication. The 8051 microcontroller's timers and counters have some specific registers to control and configure them like TCON, TMOD, TL0, TH0, TL1, TH1, etc.

In timer mode, the timers can be used to generate time delays or time intervals, while in counter mode, they can be used to count events or pulses. The timer and counter values can be read or written to by the CPU, and their values can be used to control various operations in the microcontroller.

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