

Advanced Embedded Systems Interview Questions And Answers Guide.



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Advanced Embedded Systems Job Interview Preparation Guide.

Question # 1

Explain me in which addressing mode is the DPTR register used?

Answer:-

- * Data pointer register is used in the indexed addressing mode.
- * It is used in accessing data from the look-up table entries stored in ROM.
- * SYNTAX: `MOVC A, @A+DPTR`
- * Here c means the code (shows data elements are stored in code space of ROM).
- * The contents of A are added to 16 bit DPTR to form the 16 bit address of the needed data.

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Question # 2

What is high-end embedded processor?

Answer:-

- * The microcontroller & processor can be interchangeably used here.
- * It forms a general purpose processor .
- * High-end stands for system of greatest power.
- * Here when a microcontroller cannot do a specific task the processor does the same with higher power
- * Example: ADM 64

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Question # 3

Tell me in which registers the immediate values cannot be directly loaded?

Answer:-

- * The general purpose registers named A,B, R0-R7 can not accept the immediate data.
- * To indicate immediate value pound sign is used before it.
- * These register accept 8 bit data preceding a pound sign.
- * There are registers present in 8051 used to store data temporarily.

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Question # 4

Which register is considered as the destination register for any arithmetic operation?

Answer:-

The 'A' register called the accumulator is used as the destination register.

Example:

`ADD R2, # 12H`

This is invalid as 12 is to be added to value present in R2 and data is also stored in R2.

`ADD A,# 12H`

This is valid as 12 is to be added to the value present in accumulator. Foregoing discussion explains why register A is used as accumulator.

Explain LCALL.

- * It is called long call and is a 3 byte instruction.
- * Here 1st byte is used for opcode & 2nd & 3rd bytes are used for address of target subroutine.
- * Call subroutine can be used anywhere within 64 K- byte address space.
- * Processor automatically saves on stack the address of instruction immediately below LCALL.
- * After execution instruction return (RET) transfers control back to next instruction.

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Question # 5

Tell me how does combination of functions reduce memory requirements in embedded systems?



Answer:-

- * The amount of code that has to be dealt with is reduced thus easing the overhead and redundancy is eliminated in case if there is anything common among the functions.
- * Memory allocation is another aspect that is optimized and it also makes sense to group a set of functions related in some way as one single unit rather than having them to be dispersed in the whole program.
- * In case of interactive systems display of menu list and reading in the choices of user's could be encapsulated as a single unit.

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Question # 6

Tell me what are the differences between analytical and computational modeling?

Answer:-

- * Analytical model allows the components to deal with the concurrency that are given during the process and the quantitative constraints that might come in between the components. Whereas, computational model deal with the non-deterministic abstraction hierarchy that has computational complexity to deal with the concurrency and allow it put also the physical constraints.
- * Analytical models can't deal with the partial and incremental specifications that are non-deterministic. It is also not good in controlling the computation complexity that is used in the hardware design. Whereas, Computational model can, deal with constraints easily and it provides an upgradeable solution.
- * Analytical model is the equation based model that doesn't have the time-sharing and parallelism concepts. Whereas, time-sharing and parallelism is used, in the abstract method that provides the theories of complexity and the real time evaluation.

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Question # 7

Tell me what is the main function of Multiplexed Address/Data Bus?

Answer:-

The memory bus is used to carry the address and the data from the processor to the memory so that it can be easily accessed by the devices. These buses carry the value of the data that has to be passed for the proper functioning. The use of the technique "Time division multiplexing" is used that allow the reading and writing of the data to be done from the same bus line. This requires lots of time to be given to the bus so that it can complete the read and write operation of the data in the memory. This is very expensive process due to the data transfer technique that is used in between the processor and the memory. This also gives the concept of cache and provides algorithms to solve the problems occurring in read and writes operations.

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Question # 8

Explain what is the function of DMA controlled in embedded system?

Answer:-

DMA stands for Direct Memory Access controller that handles the allocation of the memory dynamically to the components and allows the data to be transferred between the devices. It is used for the communication between different input/output devices. It automatically detects the devices that are present for the transfer of data between the input/output devices. The interrupt can be used to complete the data transfer between the devices. It is used to give the high quality performance as, the input/output device can perform the operations that are in parallel with the code that are in execution phase. It can't be used in all the systems. It consists of 8-bit microcontrollers that are used to control the overall system in execution.

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Question # 9

Explain me what is the purpose of using critical sections?

Answer:-

Critical section allows the process to run in an area that is defined by that process only. It is a sequence of instructions that can be corrupted if any other process tries to interrupt it. This process allow the operating system to give the synchronization objects that are used to monitor the processes that are up and running so that no other process will get executed till the critical region consists of a process that is already running. The example includes removal of the data from a queue running in a critical section and if not protected then it can be interrupted and the data have chances of getting corrupted. The processes exit from the critical section as soon as they finish the execution so that the chances can be given to other processes that are waiting for their chance to come.

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Question # 10

Please explain DB?

Answer:-

- * DB is called as define byte used as a directive in the assembler.
- * It is used to define the 8 bit data in binary ,hexadecimal or decimal formats.
- * It is the only directive that can be used to define ASCII strings larger than two characters.
- * DB is also used to allocate memory in byte sized chunks.
- * The assembler always converts the numbers into hexadecimal.

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Question # 11

Explain me can single bit of a port be accessed in 8051?

Answer:-

- * Yes, 8051 has the capability of accessing only single bit of a port.
 - * Here only single bit is accessed and rest are unaltered.
- Syntax: "SETB X, Y".
- * Here X is the port number and y is the desired bit.
- Example: SETB P1.2



Here the second bit of port 1 is set to 1.

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Question # 12

List out some of the commonly found errors in Embedded Systems?

Answer:-

Some of the commonly found errors in embedded systems are

- * Damage of memory devices static discharges and transient current
- * Address line malfunctioning due to a short in circuit
- * Data lines malfunctioning
- * Due to garbage or errors some memory locations being inaccessible in storage
- * Inappropriate insertion of memory devices into the memory slots
- * Wrong control signals

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Question # 13

Tell me what is read modify write technique?

Answer:-

- * Read modify write is a technique used to access the ports.
- * Here in a single instruction all the three actions are combined.
- * Here initially the data is read from the port then modified .
- * At last the value is written back on the port.
- * This feature saves many lines of code and makes the process easier.

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Question # 14

What is parallel address space?

Answer:-

- * The two physically separate memories using the same addresses form the parallel address space.
- * Here the two memories are accessed using different access modes.
- * This parallel addressing is generally used in 8052(enhanced version of 8051) having extra 128 bytes of RAM with addresses 80 to FFH and memory is called as upper memory.
- * This distinguishes it from lower 128 bytes 00to 7FH.
- * To access lower bytes direct addressing mode is used and for higher bytes indirect addressing mode is used.

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Question # 15

Explain me how are macros different from inline functions?

Answer:-

- * Macros are normally used whenever a set of instructions/tasks have to be repeatedly performed. They are small programs to carryout some predefined actions.
- * We normally use the #define directive in case we need to define the values of some constants so in case a change is needed only the value can be changed and is reflected throughout.
- ```
#define mul(a,b) (a*b)
```
- \* The major disadvantage of macros is that they are not really functions and the usual error checking and stepping through of the code does not occur.
- \* Inline functions are expanded whenever it is invoked rather than the control going to the place where the function is defined and avoids all the activities such as saving the return address when a jump is performed. Saves time in case of short codes.

```
inline float add(float a,float b)
{
 return a+b;
}
```

- \* Inline is just a request to the compiler and it is upto to the compiler whether to substitute the code at the place of invocation or perform a jump based on its performance algorithms.

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### Question # 16

Explain significance of watchdog timer in Embedded Systems?

**Answer:-**

- \* Watchdog timer is basically a timing device that is set for predefined time interval and some event should occur during that time interval else the device generates a time out signal.
- \* One application where it is most widely used is when the mobile phone hangs and no activity takes place, in those cases watchdog timer performs a restart of the system and comes to the rescue of the users.
- \* It is used to reset to the original state whenever some inappropriate events take place such as too many commands being given at the same time or other activities that result in malfunctioning of the GUI. It is usually operated by counter devices.

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### Question # 17

Explain me what are the functional requirements that are used in the embedded systems?

**Answer:-**

Functional requirements specifies the discrete and the logic to provide the services, functionality, features and the implementation that is independent from the



components that are getting used in it. These are used to represent the constraints that are in the form of physical and define the probability to specify the components discretely from each other. The functional requirements are given for the hardware as well that gives more performance and measures the physical resources that are present like clock frequency, latency, etc. Functional requirements allow the system and hardware machines to transfer the functions with the non-deterministic probability.

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### Question # 18

Explain me what is interaction semantics used in embedded systems?

**Answer:-**

Interaction semantics allow the actions to be performed by the system components to allow it to get the global behavior. The interaction can be atomic or non-atomic dependent on the interaction between the components. These components can't be modified using the interference having the other interactions. Languages that are used, having buffered communication, and other languages, that include multi-threaded languages that use non-atomic interactions. There are two types of interactions that are used:

- \* Strong synchronization: allow the components to participate together and have strong bonding in between.
- \* Weakly synchronizing: are asymmetric that required the communication from both the objects.

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### Question # 19

Explain me what is the function of simple thread poll in embedded system?

**Answer:-**

Simple thread poll allow the ready output to be passed for checking by giving it to the bus that is free and then the output is sent along the thread. The bus can send the output depending on the time that has been given and during the transfer the user won't be able to perform any other operation. The input is given after finding out the bus is free or not and if it free then a check is made to see that the input exists or not. This thread poll is easy to understand but it is not efficient method to allow the data to be put over the bus manually. The problem of not doing multi-tasking can occur due to doing one task at a time. The method is only be used when input/output occurs at interval that are infrequent.

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### Question # 20

Do you know how does the interrupt architecture works?

**Answer:-**

Interrupt architecture allows the use of interrupt by the processor whenever an Input/output is ready for the processing. The processor in this case calls a special function to handle the request that comes and leave all the work that is getting performed at that time. The special function that is known as interrupt handler or the interrupt service routine consists of all the input, and output queries, or the interrupts handled by it. It is an efficient and simple way to handle the interrupts. It uses only one function to deal with the interrupts. There are properties of starvation that can creep in when handling the input/output requests. The data can be lost if the interrupt doesn't get handled before the time runs out. This is a technique that is use to deal with the short processes that involve input and output.

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### Question # 21

Write a program to show the functionality of Power-save super loop?

**Answer:-**

To check the loop time of the program the power-save super loop is used. If the average loop time of the program is 1ms, and it requires only few instructions to be checked every second the program will save the state and build a delay that will be caused to read the input on every loop and it saves lot of energy or the power that needs to be used. The function that is required to be performed to show the functionality is:

```
Main_Function()
Function
{
 Initialization();
 Do_Forever
 {
 Check_Status();
 Do_Calculations();
 Output_Response();
 Delay_For_Next_Loop();
 }
}
```

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### Question # 22

Tell me which register bank is used if we use the following instructions.

SETB PSW.3 A  
SETB PSW.4 B?

**Answer:-**

- \* Statement A sets 3rd bit of flag register.
- \* Statement B sets 4th bit of flag register.
- \* Therefore register bank 3 is initiated .
- \* It uses memory location 18H to 1FH.
- \* The register bank is also called as R3.

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### Question # 23



Please explain whether we can use semaphore or mutex or spinlock in interrupt context in Linux Kernel?

**Answer:-**

Semaphore or Mutex cannot be used for interrupt context in Linux Kernel. While spinlocks can be used for locking in interrupt context.

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**Question # 24**

Tell me which registers are used for register indirect addressing mode if data is on-chip?

**Answer:-**

- \* R0 and R1 are the only registers used for register indirect addressing mode.
- \* These registers are 8 bit wide.
- \* Their use is limited to accessing only internal RAM.
- \* When these registers hold addresses of RAM, they must be preceded by a @ sign.
- \* In absence of this sign it will use the contents of register than the contents of memory location pointed by the same register.

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**Question # 25**

What is the difference between statements.

MOV A, #17H -a

MOV A, 17H -b?

**Answer:-**

- \* Statement a indicates immediate data is copied into the register A.
- \* # in statement a indicates 17 is an immediate data which is moved to the destination.
- \* Here one copies the immediate data and other copies the data present at the specified address.
- \* In statement b the value present in 17H memory location is copied into A register.
- \* Absence of pound sign does not cause any error but required operation fails.

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**Question # 26**

Tell me as you know a vast majority of High Performance Embedded systems today use RISC architecture why?

**Answer:-**

- \* According to the instruction sets used, computers are normally classified into RISC and CISC. RISC stands for 'Reduced Instruction Set Computing'. The design philosophy of RISC architecture is such that only one instruction is performed on each machine cycle thus taking very less time and speeding up when compared to their CISC counterparts.
- \* Here the use of registers is optimised as most of the memory access operations are limited to store and load operations.
- \* Fewer and simple addressing modes, and simple instruction formats leads to greater efficiency, optimisation of compilers, re-organisation of code for better throughput in terms of space and time complexities. All these features make it the choice of architecture in majority of the Embedded systems.
- \* CISC again have their own advantages and they are preferred whenever the performance and compiler simplification are the issues to be taken care of.

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**Question # 27**

Explain what could be the reasons for a System to have gone blank and how would you Debug it?

**Answer:-**

Possible reasons could be:

- \* PC being overheated.
- \* Dust having being accumulated all around.
- \* CPU fans not working properly .
- \* Faulty power connections.
- \* Faulty circuit board from where the power is being drawn.
- \* Support Drivers not having being installed.

Debugging steps which can be taken are:

- \* Cleaning the system thoroughly and maintaining it in a dust-free environment. Environment that is cool enough and facilitates for easy passage of air should be ideal enough.
- \* By locating the appropriate support drivers for the system in consideration and having them installed.

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**Question # 28**

Please explain what is the need for having multibyte data input and output buffers in case of device ports?

**Answer:-**

- \* It's normally the case that some devices transfer the output either in a bursty or a sequential manner and also during input entry. If we take the example of keyboards, all the data entered is stored in a buffer and given at a time or one character at a time.
- \* In case of networking there may be several requests to access the same resource and all these are queued in a buffer and serviced in the order they are received. Hence to avoid the input/output units from getting overloaded with requests, we use multibyte buffers.

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**Question # 29**

Please explain why is it better to use multi-threading polling then single threading model?

**Answer:-**

Multi-threading allows a simple thread to be stored and polled. There is no Input/output function that is applied when it is having the poll. When there is no poll



available to spawn it makes the system to sleep for an amount of time till the request for another poll reaches. If there is one process that is running then it divides that process into multiple threads and processes it accordingly. It allows the main thread to process all the request and produce the output by combining all other. Multi-threading allows the main thread not to put off the result or the output that will be generated. It also allow the priority of the thread to be changed by allowing to set the priority of the input/output process. It also has some problems with the polling interval that can make a thread starve for some time if the request isn't handled properly.

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### Question # 30

Explain me why does pre-emptive multi-threading used to solve the central controller problem?

**Answer:-**

Multi-threading provide lot of functionality to the system to allow more than one task can be run at a time. It allows a process to execute faster with less difficulty. But, if there any problem comes in any program or the process than the entire system comes to a halt and slows down the whole system. To control the behavior of this the preemptive multi-threading is used. The control in this case is being shifted from one process to another at any time according to the requirement provided. It allows the program to give the control to another program that is having the higher priority. It includes of many problems like giving of a control by a process half way through in execution and the preemption of the process takes place then the data will be entered as corrupted in the memory location, multi-threading keeps the synchronization that is to be performed between different components of the system and the program and try to avoid the problem mentioned above.

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### Question # 31

Explain me which bit of the flag register is set when output overflows to the sign bit?

**Answer:-**

- \* The 2nd bit of the flag register is set when output flows to the sign bit.
- \* This flag is also called as the overflow flag.
- \* Here the output of the signed number operation is too large to be accommodated in 7 bits.
- \* For signed numbers the MSB is used to indicate the whether the number is positive or negative.
- \* It is only used to detect errors in signed number operations.

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### Question # 32

When one must use recursion function? Mention what happens when recursion functions are declared inline?

**Answer:-**

Recursion function can be used when you are aware of the number of recursive calls is not excessive. Inline functions property says whenever it will called, it will copy the complete definition of that function. Recursive function declared as inline creates the burden on the compilers execution.

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### Question # 33

Explain me why do we need virtual device drivers when we have physical device drivers?

**Answer:-**

Device drivers are basically a set of modules/routines so as to handle a device for which a direct way of communication is not possible through the user's application program and these can be thought of as an interface thus keeping the system small providing for minimalistic of additions of code, if any. Physical device drivers can't perform all the logical operations needed in a system in cases like IPC, Signals and so on... The main reason for having virtual device drivers is to mimic the behaviour of certain hardware devices without it actually being present and these could be attributed to the high cost of the devices or the unavailability of such devices. These basically create an illusion for the users as if they are using the actual hardware and enable them to carryout their simulation results. Examples could be the use of virtual drivers in case of Network simulators,also the support of virtual device drivers in case a user runs an additional OS in a virtual box kind of a software.

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### Question # 34

Do you know what is Endianness of a system and how do different systems communicate with each other?

**Answer:-**

- \* Endianness basically refers to the ordering of the bytes within words or larger bytes of data treated as a single entity.
- \* When we consider a several bytes of data say for instance 4 bytes of data.XYZQ the lower byte if stored in a Higher address and others in successively decreasing addresses, then it refers to the Big Endian and the vice versa of this refers to Little Endian architecture.
- \* Intel 80x86 usually follows Little Endian and others like IBM systems follow Big Endian formats.
- \* If the data is being transmitted care has to be taken so as to know as to which byte,whether the higher or the lower byte is being transmitted.
- \* Hence a common format prior to communication has to be agreed upon to avoid wrong interpretation/calculations.
- \* Usually layer modules are written so as to automate these conversion in Operating systems.

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### Question # 35

Explain me what are the different types of customizations that is used with the "volatile" keyword?

**Answer:-**

Volatile keyword is used to show that the value can be changed anytime in the program. It is used for the compiler purpose and for the customization that works with the normal variables that are stored in the memory. There are three types of optimizations associated with the "volatile" keyword:  
\* "Read" optimizations: allow the variable to be read once and put it in the register. If it is done then there is no re-reading of the variable during each and every time the program is compiled. The value can be used from the cache that is present in the register.  
\* "Write" optimizations: allow the variable to be written such that the last write of the variable will be considered and it will be processed on. This takes the normal values that are stored in the memory.





\* Instruction reordering: allow to reorder the instructions that are used by the compiler and if any modification are required after being written once. The registers are used to perform the task and keep everything together.

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### Question # 36

What is the need for an infinite loop in embedded systems?

**Answer:-**

Embedded systems require infinite loops for repeatedly processing or monitoring the state of the program. For instance, the case of a program state continuously being verified for any exceptional errors that might just happen during run-time such as memory outage or divide by zero, etc.

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### Question # 37

Please explain what does DMA address will deal with?

**Answer:-**

DMA address deals with physical addresses. It is a device which directly drives the data and address bus during data transfer. So, it is purely physical address.

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### Question # 38

What is embedded system in a computer system?

**Answer:-**

An embedded system is a computer system that is part of a larger system or machine. It is a system with a dedicated function within a larger electrical or mechanical system.

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### Question # 39

Explain how is a program executed' bit by bit' or' byte by byte'?

**Answer:-**

EXAMPLE:

ADDRESS OPCODE PROGRAM

```
1 0000 ORG 0H
2 0000 7D25 MOV R5,#25H
3 0002 7F34 MOV R7,#34H
4 0004 2D ADD A, R5
5 0005 END
```

- \* A program is always executed byte by byte.
- \* Firstly, 1st opcode 7D is fetched from location 0000 and then the value 25 is fetched from 0001 .
- \* 25 is then placed in the register R5 and program counter is incremented to point 0002.
- \* On execution of opcode 7F, value 34 is copied to register R7.
- \* Then addition of contents of R5 and accumulator takes place.
- \* Here all the opcodes are 8 bit forming a byte.

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### Question # 40

Do you know what are the rules followed by Mutexes?

**Answer:-**

Mutex is also called as Mutual Exclusion is a mechanism that is used to show the preemptive environment and allow providing security methods like preventing an unauthorized access to the resources that are getting used in the system. There are several rules that has to be followed to ensure the security policies:

- \* Mutex are directly managed by the system kernel that provides a secure environment to allow only the applications that passes the security rules and regulations. The mutex consists of objects that are allowed to be called by the kernel.
- \* Mutex can have only one process at a time in its area that is owned by the process using it. This allows less conflict between the different applications or processes that wait for their turn to execute it in the kernel area.
- \* Mutex can be allocated to another mutex that is running some task at a particular time and allow the kernel to have synchronization in between them.
- \* If Mutex is allocated to some other process then the area will consist of the process till the area is having the process in it.

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### Question # 41

Explain me what are the different types of Buses used by the embedded systems?

**Answer:-**

The buses are used to pass the messages between different components of the system. There are buses existing as:

- \* Memory Bus: it is related to the processor that is connected to the memory (RAM) using the data bus. This bus includes the collection of wires that are in series and runs parallel to each other to send the data from memory to the processor and vice versa.
- \* Multiplexed Address/Data Bus: Multiplex data bus consists of the bus that can read and write in the memory but it decreases the performance due to the time consumed in reading and writing of the data in the memory.
- \* De-multiplexed Bus: these consists of two wires in the same bus, where one wire consists of the address that need to be passed and the other one consists of the data that need to be passed from one to another. This is a faster method compared to other.
- \* Input/Output bus: it uses the multiplexing techniques to multiplex the same bus input and output signals. This creates the problem of having the deadlock due to slow processing of it.

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### Question # 42

Explain me how to create a child process in linux?

**Answer:-**

- \* Prototype of the function used to create a child process is `pid_t fork(void)`;
- \* Fork is the system call that is used to create a child process. It takes no arguments and returns a value of type `pid_t`.
- \* If the function succeeds it returns the pid of the child process created to its parent and child receives a zero value indicating its successful creation.
- \* On failure, a -1 will be returned in the parent's context, no child process will be created, and `errno` will be set.
- \* The child process normally performs all its operations in its parents context but each process independently of one another and also inherits some of the important attributes from it such as UID, current directory, root directory and so on.

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### Question # 43

Do you know of the 128-byte internal RAM how many bytes are bit addressable?

**Answer:-**

- \* Only 16 bytes of the 128 bytes of RAM are bit addressable.
- \* The bit addressable RAM locations are 20H to 2FH.
- \* They are addressed as 0 to 127 (decimal) or 00 to 7F.
- \* Also the internal RAM locations 20 to 2FH are both byte and bit addressable.
- \* These 16 bytes can be by single bit instructions using only direct addressing mode.

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### Question # 44

Tell me how much time is required by an instruction for execution in 8051?

**Answer:-**

- \* Time required depends on the number of clock cycles used to execute instruction.
- \* These clock cycle are called machine cycle.
- \* Length of machine cycle of an instruction depends on frequency of crystal oscillator of controller.
- \* Also one machine cycle lasts 12 oscillator period so machine cycle is 1/12 of crystal frequency.
- \* Crystal frequency 8051 = 11.0592MHz
- \* Machine cycle =  $11.0592\text{MHz} \times 12 = 921.6\text{KHz} = 1.085\text{micro second}$ .

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### Question # 45

Differentiate between mutexes vs semaphores?

**Answer:-**

- \* Semaphores is a synchronization tool to overcome the critical section problem.
- \* A semaphore S is basically an integer variable that apart from initialization is accesses only through atomic operations such as `wait()` and `signal()`.
- \* Semaphore object basically acts as a counter to monitor the number of threads accessing a resource.
- \* Mutex is also a tool that is used to provide deadlock free mutual exclusion. It protects access to every critical data item. If the data is locked and is in use, it either waits for the thread to finish or awakened to release the lock from its inactive state.

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### Question # 46

Do you know what are the different types of system involved in embedded system?

**Answer:-**

Embedded systems are used to give the response in real time. So, it consists of the real time systems that allow the correct information to be passed to get the correct responses. For example, it includes of the flight control system that produce the responses in real time and it always the take the values also in real time. If any delay been caused by the system then it deals in the fatal error. The real time system includes the system that provides the response on time with the small delay. Real time systems include of many other system such as:

Hard Real-Time Systems - These are the systems that server the purpose of having constraints that are hard and it totally depends on the time to provide the response on time.

Soft Real-Time Systems - These systems serves the purpose of having few delays in giving up the responses that can tolerate small variations.

Hybrid Real-Time Systems - These systems includes the properties from both the systems and increases the performance.

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### Question # 47

Tell me can port 0 be used as input output port?

**Answer:-**

- \* Yes, port 0 can be used as input output port.
- \* Port 0 is an open drain unlike ports 2,3,4.
- \* To use it as input or output the 10k ohm pull-up resistors are connected to it externally.
- \* To make port 0 as input port it must be programmed by writing 1 to all bits.

Example:

```
MOV A,#0FFH
MOV P0,A
```

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### Question # 48



Explain me what is microcontroller?

**Answer:-**

The microcontroller is a self-contained system with peripherals, memory and a processor that can be used as embedded system.

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**Question # 49**

What is a Watchdog Timer?

**Answer:-**

A watchdog timer is an electronic device or electronic card that execute specific operation after certain time period if something goes wrong with an electronic system.

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**Question # 50**

Explain why embedded system is useful?

**Answer:-**

With embedded system, it is possible to replace dozens or even more of hardware logic gates, input buffers, timing circuits, output drivers, etc. with a relatively cheap microprocessor.

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**Question # 51**

Explain me what is the function of Watchdog timer in embedded system?

**Answer:-**

The embedded system should have a function that can allow the fixing the system if anything goes wrong with it. Watchdog timer is a tool that is used in embedded system and having a long-fuse that runs several seconds. Watchdog timer includes the automated timing control that count down the number from max to 0 and when the counter reaches the zero, this WDT reset the micro-controller that gets turned off when the timer was in initial phases. Watchdog require the user to put some value before it runs out of time and reset the whole process as this can harm the data and the system. Resetting by WDT can be done when the process is half complete. Watchdog timer have the counter that is used to watch the processes that are running and if there is any issue occurs then WDT itself times out. The resetting of the system will be done to always give it the best possible way to execute the process.

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**Question # 52**

Do you know how does the interrupts handle by using the threads?

**Answer:-**

The interrupts that comes in between the input/output operations gets detected when the input/output devices are ready. The interrupt never gets handled directly rather, it sends the interrupt signal to the thread to the input/output device that is ready to allow the thread to take necessary actions. The thread uses the signaling concept that allows the initialization to be done using the semaphore that keeps the states updated and handle the interrupt in an easy way. The input/output device getting the request and it also passes the semaphore to handle. The input/output device takes the semaphore that is ready. The thread is having the minimum latency that uses the first level interrupt handler to handle the interrupts completely. It allows the priority of the thread to be set and it doesn't allow the context to be change as well.

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**Question # 53**

Please explain what is the difference between Hardware design and Software Design?

**Answer:-**

\* Hardware design is designed with the collaboration of interconnected parallel components that inherits the properties of each other. Whereas, Software design is designed with sequential components, that are based on objects and threads.

\* Hardware design structure doesn't change dynamically and it can't be created, modified or removed easily. Whereas, Software design structure can be changed dynamically and re-usability features, used to define the components. It also includes easy creation, modification and removal of the components from the software.

\* Hardware design focuses on individual components that are represented using analytical model that uses the transfer functions. Whereas, Software design represent the components using computation model that can have abstract execution engine or it can use the virtual machine that are non-deterministic.

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**Question # 54**

Explain me which port in 8051 performs a dual role?

**Answer:-**

\* The port 3 can be used as simple input /output port or provides signals like interrupts.

\* P3.0 and p3.1 are used for serial communication.

\* P3.2 and P3.3 are used as external interrupts.

\* P3.4 and P3.5 are used for timers.

\* P3.6 and P3.7 are used as read write signals of external memory.

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**Question # 55**

Explain me what is interrupt latency and how can we decrease it?

**Answer:-**



1. Interrupt latency basically refers to the time span an interrupt is generated and it being serviced by an appropriate routine defined, usually the interrupt handler.
2. External signals, some condition in the program or by the occurrence of some event, these could be the reasons for generation of an interrupt.
3. Interrupts can also be masked so as to ignore them even if an event occurs for which a routine has to be executed.
4. Following steps could be followed to reduce the latency
  - \* ISRs being simple and short.
  - \* Interrupts being serviced immediately
  - \* Avoiding those instructions that increase the latency period.
  - \* Also by prioritizing interrupts over threads.
  - \* Avoiding use of inappropriate APIs.

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### Question # 56

Tell me how are labels named in assembly language?

**Answer:-**

- \* Label name should be unique and must contain alphabetic letters in both uppercase and lowercase.
- \* 1st letter should always be an alphabetic letter.
- \* It can also use digits and special characters ?,.,@,\_,,\$.
- \* Label should not be one of the reserved words in assembly language.
- \* These labels make the program much easier to read and maintain.

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### Question # 57

Explain me what are the essential components of embedded system?

**Answer:-**

Essential components of embedded system includes

- \* Hardware
- \* Processor
- \* Memory
- \* Timers
- \* I/O circuits
- \* System application specific circuits
- \* Software
- \* It ensures the availability of System Memory
- \* It checks the Processor Speed availability
- \* The need to limit power lost when running the system continuously
- \* Real Time Operating System
- \* It runs a process as per scheduling and do the switching from one process to another

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### Question # 58

List out various uses of timers in embedded system?

**Answer:-**

Timers in embedded system are used in multiple ways

- \* Real Time Clock (RTC) for the system
- \* Initiating an event after a preset time delay
- \* Initiating an even after a comparison of preset times
- \* Capturing the count value in timer on an event
- \* Between two events finding the time interval
- \* Time slicing for various tasks
- \* Time division multiplexing
- \* Scheduling of various tasks in RTOS

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### Question # 59

Explain me how does Input/Output bus functions?

**Answer:-**

Input and output devices or functions allow the user to interact with the external files. Input and output functions are used to transfer the load on the bus. It uses the multiplexes having the input and output signals that remain same. Input and output buses move at the slower rate or speed than the processor speed. This increases the problem of bottleneck or the deadlock due to poor performance. There is a possibility to send more transistors for a layout to be given. These different devices may have very different speeds of communication. When programming IO bus control, make sure to take this into account.

In some systems, memory mapped IO is used. In this scheme, the hardware reads its IO from predefined memory addresses instead of over a special bus. This means you'll have simpler software, but it also means main memory will get more access requests.

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### Question # 60

Please explain which 8051 version is using UV-EPROM?

**Answer:-**

- \* Ultraviolet EPROM is used in the version 8751.
- \* Here it becomes easier to erase the data using uv rays.
- \* It takes around 20 minutes to erase the data.
- \* To overcome this short coming flash ROM versions of 8751 available.



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### Question # 61

Explain me what is the need for DMAC in ES?

**Answer:-**

- \* Direct memory access is mainly used to overcome the disadvantages of interrupt and program controlled I/O.
- \* DMA modules usually take the control over from the processor and perform the memory operations and this is mainly because to counteract the mismatch in the processing speeds of I/O units and the processor. This is comparatively faster.
- \* It is an important part of any embedded systems, and the reason for their use is that they can be used for bursty data transfers instead of single byte approaches.
- \* It has to wait for the systems resources such as the system bus in case it is already in control of it.

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### Question # 62

Explain issues related to stack and bank 1?

**Answer:-**

- \* Bank 1 uses the same RAM space as the stack.
- \* Stack pointer is incremented or decremented according to the push or pop instruction.
- \* If the stack pointer is decremented it uses locations 7,6,5... which belongs to register bank 0.
- \* If a given program uses R1 then stack is provided new memory location.
- \* The push instruction may also take stack to location 0 i.e. it will run out of space.

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### Question # 63

Tell us what is semaphore?

**Answer:-**

A semaphore is an abstract datatype or variable that is used for controlling access, by multiple processes to a common resource in a concurrent system such as multiprogramming operating system. Semaphores are commonly used for two purposes

- \* To share a common memory space
- \* To share access to files

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### Question # 64

What is JNC?

**Answer:-**

- \* It is a command used to jump if no carry occurs after an arithmetic operation.
- \* It is called as jump if no carry( conditional jump instruction).
- \* Here the carry flag bit in PSW register is used to make decision.
- \* The processor looks at the carry flag to see if it is raised or not.
- \* If carry flag is 0 ,CPU fetches instructions from the address of the label.

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### Question # 65

Explain me what is the need for an infinite loop in Embedded systems?

**Answer:-**

\* Infinite Loops are those program constructs where in there is no break statement so as to get out of the loop, it just keeps looping over the statements within the block defined.

Example:

```
While(Boolean True) OR for(;;);
```

```
{
//Code
}
```

\* Embedded systems need infinite loops for repeatedly processing/monitoring the state of the program. One example could be the case of a program state continuously being checked for any exceptional errors that might just occur during run time such as memory outage or divide by zero etc.,

\* For e.g. Customer care Telephone systems where in a pre-recorded audio file is played in case the dialer is put on hold..

\* Also circuits being responsible for indicating that a particular component is active/alive during its operation by means of LED's.

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### Question # 66

Do you know what is EQU?

**Answer:-**

- \* EQU is the equate assembler directive used to define a constant without occupying a memory location.
- \* It associates a constant value with data label .
- \* Whenever the label appears in the program ,constant value is substituted for label.
- \* Advantage: The constant value occurring at various positions in a program can be changed at once using this directive.
- \* Syntax: label EQU constant value

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### Question # 67



Do you know what is lst file?

**Answer:-**

- \* This file is also called as list file.
- \* It lists the opcodes ,addresses and errors detected by the assembler.
- \* List file is produced only when indicated by the user.
- \* It can be accessed by an editor and displayed on monitor screen or printed.
- \* Programmer uses this file to find the syntax errors and later fix them.

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**Question # 68**

Explain me what are real-time embedded systems?

**Answer:-**

Real-time embedded systems are computer systems that monitor, respond or control an external environment. This environment is connected to the computer system through actuators, sensors, and other input-output interfaces.

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**Question # 69**

What are buses used for communication in embedded system?

**Answer:-**

For embedded system, the buses used for communication includes

I2C: It is used for communication between multiple ICs

CAN: It is used in automobiles with centrally controlled network

USB: It is used for communication between CPU and devices like mouse, etc.

While ISA, EISA, PCI are standard buses for parallel communication used in PCs, computer network devices, etc.

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**Question # 70**

Tell me why is Model transformations used in the embedded system?

**Answer:-**

Model transformations involve multiple models that are used to define different views of a system. It provides different level of granularity that it doesn't use either the top-down approach or the bottom-up approach to implement the basic functionality of the system. It is used to integrate the library components used that involves the iteration of the model that needs to be constructed. It also involves the analysis of the model so that the process can be made automated by using the construction tools. The compilation made the progress by improving the code that is written in high level language and the code generator produce the code that is required for the machine language.

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**Question # 71**

Explain me which 8051 version uses Flash ROM?

**Answer:-**

- \* Atmel Corporation is manufacturing flash ROM
- \* At 89C51 chip of atmel is using flash ROM.
- \* Here no Rom eraser is needed.
- \* Erasing process is done by the PROM burner itself.
- \* To avoid use of PROM burner the 8052 version support in-system programming.

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**Question # 72**

Tell me are all the bits of flag register used in 8051?

**Answer:-**

- \* The flag register also called as the program status word uses only 6 bits.
- \* The two unused bits are user defineable flags.
- \* Carry, auxillary carry, parity and overflow flags are the conditional flags used in it.
- \* PSW.1 is a user definable bit and PSW.5 can be used as general purpose bit.
- \* Rest all flags indicate some or the other condition of an arithmetic operation.

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**Question # 73**

Explain which 2 ports combine to form the 16 bit address for external memory access?

**Answer:-**

- \* Port0 and port2 together form the 16 bit address for external memory.
- \* Port0 uses pins 32 to 39 of 8051 to give the lower address bits(AD0-AD7)
- \* Port2 uses pins 21 to 28 of 8051 to give the higher address bits(A8-A15)
- \* This 16 bit address is used to access external memory if attached.
- \* When connected to external memory they cannot be used as input output ports.

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**Question # 74**



Explain me what are the commonly found errors in Embedded Systems?

**Answer:-**

- \* Damage of memory devices due to transient current and static discharges.
- \* Malfunctioning of address lines due to a short in the circuit.
- \* Malfunctioning of Data lines.
- \* Some memory locations being inaccessible in storage due to garbage or errors.
- \* Improper insertion of Memory devices into the memory slots.
- \* Faulty control signals.

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**Question # 75**

What is interrupt latency? How can you reduce it?

**Answer:-**

Interrupt latency is a time taken to return from the interrupt service routine post handling a specific interrupt. By writing minor ISR routines, interrupt latency can be reduced.

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**Question # 76**

Tell me what is the difference between microprocessor and microcontroller?

**Answer:-**

Microprocessor is managers of the resources (I/O, memory) which lie outside of its architecture  
Microcontroller have I/O, memory, etc. built into it and specifically designed for control

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