

EEL 6795

Exam

Name:

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Answer-1:

Power is the fundamental and basic thing that is needed and required by any circuit for its operation. Without power, no system can work at all. Now the power is used to do the work and majority of the power is converted into useful work but not all of the power is converted into useful activity while some power is lost as well or it gets wasted and such power is termed as power dissipation. Same is the scenario in CMOS as well. There are multiple sources from where the power gets wasted and we will list them below:

- i. Dynamic Power Dissipation
- ii. Static Power Dissipation
- iii. Short Circuit Power Dissipation

Now every component of the power mentioned above have some reason linked with it because there is some origin or source of the power dissipation. If we talk about Dynamic power, then it is actually the power that is lost in switching activities of the capacitor and the capacitance that is involved in the circuit. Capacitor needs to get charged and discharged frequently and the power is required for this and during the transition phase of the power cycle, energy is wasted in this and that energy or power is the dynamic power which is dissipated in this switching process.

Then we have Static power and it is basically present because of the leakage current that is associated with the transistors even though they are not in working condition or in active state but still some current is flowing from them and that is the leakage current which is the cause of the Static Power Dissipation. There is Short circuit component of power also but it flows for momentarily of time just when both the pull up and pull down transistors are conducting but it happens only for smaller duration of time and in that duration, some direct path is established and current flows from it and it is termed as Short Circuit Power.

Answer-2:

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Each and every component of the system use power for its fundamental operations and now there is some power drawing capability of each of the system and one cannot go beyond that power drawing capability and cannot break that limit because power limit needs to be followed and violation of power limit means excessive power is flowing from the component as compared to the nominal rating of the component and that excessive power damages the component and when any component is damaged, then entire system gets damaged and it is no more in working condition as needed. Power aware computing basically focusses on such design that takes least power or minimum power for their operation as by doing this, we will get many advantages like that size of the component or the system will be small, battery rating will reduce, cost will reduce and so on. Hence power or thermal aware computing is really important.

Answer-3:

Single processor has many limitation as it can process limited number of instructions at a time and parallel processing cannot be done using that because it has limited processing ability and resources required for its operation are also limited and in short it cannot process instructions beyond the set limit. Now in modern world, processing needs to be fast, processing time needs to be less, multiple instructions need to be executed in parallel in order to reduce the processing time and also reduce the processing delay and enhance the operational performance and also efficiency. Multi core architecture has the such ability to meet all these needs and they can work on many set of instructions at a time and can process large number of instruction sets in parallel and this will not only improve the performance and efficiency and also reduces the operational processing time.

Answer-4:

Now any program has series and instructions and sequence of operations that need to be considered while processing that program. Number of instruction sets that need to be processed is huge and it takes lot of time to process those set of instructions and sometimes resources are being wasted due to large time involved in this. Here comes the concept of concurrency. It is the concept in which multiple instruction sets are executed or processed simultaneously and these instruction threads that are being executed and processed in parallel need to access shared memory and resources and it results in several problems. Amdahl proposed a law which is termed as Amdahl's law and this law limits the application of concurrency and to how much this concept can be implemented without compromising on the overall performance of the system. It basically related to how much performance improvement can be done in the system by focusing on any part that needs improvement and what is the maximum limit to which any design improvement can be made in the system.

Answer-5:

IC is basically Integrated chip technology and any chip has the transistors in it and transistor has multiple Logic gates and logic gates are the fundamental units of the transistors. Multiple logic

gates can be there in any operation and every operation needs certain logical gates to perform those operations. Now there are different logic gates and combination of logical gates is there to process any task. Now in traditional technology, independent netlist is there of the logical gates but these are random and they are not aligned with technology so concept of technology mapping comes here and it tends to introduce the dependable netlist of logic gates that are aligned with technology and technological aligned gates will lead to optimal utilization of resources and less power will be consumed when concept of technology mapping is there.

Answer-6:

There are few things that are common in all systems and these are the signal variation and the time. Now there are two type of systems there in common and these are synchronous and asynchronous system. Now the asynchronous system has some generic understanding or the basis and which is that the signals are binary but time is not discretized. Now when it is assumed that the time is not discretized, then it will result in many advantages and major benefit is the absence of clock skew which is basically the difference in arrival time difference of the clock signal at various parts of the system. In the absence of clock skew and there will be no toggling of the clock and it will reduce the charging and the discharging phases that are involved in the capacitance and thus it will result in low power consumption. Further there are no issues related to global timing as most portion of the system can be optimized in order to have highest clock rate. There are few issues also there in asynchronous system. One of the major issue is that the design gets complex and simplification isn't there and it results in several design issues as compared to synchronous system.

Answer-7:

DVFS is an important concept in power optimization and it stands for Dynamic Voltage and Frequency system. It can be termed as one of the fundamental and the backbone of the low power system. All the systems have certain goal and in order to achieve that goal, every system has several components and these components are assigned several goals and nature of these goals are different. In order to meet those goals, requirements are also different for all parts. Like some part has important task to perform and high voltage and frequency is the need of that part while some part is not that important and it remains in idle condition in most of the time of operations. On the basis of these functional requirements, DVFS technology works and those parts that are important are supplied with high voltage and where switching is important, high frequency is applied and those parts that are not that important are fed with low voltage and low frequency. Thus variable frequency and voltages are there in the system depending on the system requirement and it results in least wastage of resources.

Answer-8:

Memory is important element in the computing architecture as it is assigned with the task for storing all the records, archives and each and every kind of data. Now it can be RAM or ROM depending upon the nature of the information, it is provided with a related or relevant

destination. Some information need to be accessed frequently while some information is not needed that much regularly. That information which are required randomly and frequently are stored in such a way that least number of operations are required to access that data or information and time consumed along with power consumption is also less. Now memory has major role in the power consumption that is there is CMOS and SRAM Power consumption can be termed as a biggest element in active power dissipation. Concept of hierarchical bit lines and word bit lines are used in this scenario. Sub division of bit lines is done and more sub bit lines are there and levels of hierarchies are also increased and in a composite new hierarchical setup, bit lines capacitance is reduced and it results in less power consumption.

Answer-9:

Processor has several circuit elements and chips. It is the responsibility of the processor to execute several tasks and it is the wish of every user that the processor should finish the tasks in least time and also to finish the tasks, resources consumption should also be least so that efficient work is done using the least number of resources. Now we have two major options to enhance the performance of the processor. First option is that we replace the circuit elements with those elements or chips that work at fast pace but obviously for this, cost will be increased. There is second option and that is related to the arrangement of available elements and resources in such a way that parallel operation of several tasks and instructions can be done and this concept is termed as Pipelining. It results in executing the multiple instructions at a time and that too utilizing available resources and it results in time saving and resources saving thus leading to power optimization.

Answer-10:

General purpose processors have to take into account all the possible conditions that they might can face. It may be ranging from a smaller task to much large task and every task has its own complexity level and for that processing, resources required are also high if one has to cater multiple type of scenarios. Further some tasks need particular element for operation which general purpose processor lags, so they are not that optimal or ideal for particular applications apart from consuming more power. When we see Customized processor, they are meant to perform a particular task and they are designed specifically for such task and it will have processing resources in order to meet that assigned task and no extra wastage of energy or memory requirements will be there. Hence they are much more efficient in terms of utilizing the resources.

Answer-11:

All the systems have certain goal and in order to achieve that goal, every system has several components and these components are assigned several goals and nature of these goals are different. In order to meet those goals, requirements are also different for all parts. Like some part has important task to perform and high voltage and frequency is the need of that part while some part is not that important and it remains in idle condition in most of the time of

operations. System parts that need high power and switching capacity are fed with clock signal all the time while such parts that do not require power all the time, they are not given the clock signal and thus clock gating effectively reduces the dynamic power consumption. Clock can be local or global given the circumstances and the position of the clock signal in the system.

Answer-12:

Software is needed to accomplish certain goal and it has certain methodology that is implemented in order to achieve that goal. Every software has some logic or working technique behind that which is termed as working methodology. Now this working methodology is based on any particular algorithm which is devised to accomplish the required task and every algorithm is written in any programming language. Now there are always some room available for improvement. With time, the requirements of end user might change and it can make the existing software uneconomical and not reasonable enough. There are two parameters that can be improved any time and these parameters are the executing time or processing time and the other parameter is the memory required. One has to see time to time that the algorithm is working in a perfect manner such a way that apart from meeting the requirements of end user, it is also making use of resources optimally and not wasting the resources. One has to update algorithm working and source code as the end user requirements can change anytime and this thing need to be addressed time to time so that efficiency and performance of the software is not compromised.

Answer-13:

This video is all about the existing low power systems and their applications in the embedded systems. Following important points are discussed in the video:

- Existing low power systems
- Evolution of Embedded systems
- Linking the embedded system and IoT
- How Low power system can be integrated with Embedded systems and IoT technology
- Concept of Artificial intelligence and evolving Embedded systems based on the concept of AI

Focus is there on the evolving technologies and how the things will look like in future and how fast evolution is coming in the fields of Embedded system with the concept of AI and how low power system is the need of all this technology and how updating the existing low power systems in context of embedded intelligence is mandatory.