

Embedded Systems
(TE 3059)
Segundo Examen Parcial
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Instructions: You are not allowed to take out your class notes during the exam. Hacerlo implica una calificación parcial de 10/100 además de las sanciones indicadas en el Reglamento General de Alumnos.

iGood luck!

1. **(2 points) Provide a definition of what an embedded system is.**
An embedded system is a collection of programmable parts which interacts with the environment through some actuators, sensor or any other inputs to perform a given task.
2. **(3 points) Mention 3 distinguishing features of an embedded system.**
 1. The tasks are implemented in software.
 2. Hardware only used to increase performance.
 3. They must respond in a specific time interval.
3. **(3 points) What is a real-time system? What is a hard real-time system and describe an example of a hard real-time system, describing explicitly what makes your system "hard real-time"**
A real-time system is when a task must be done in a given specific time.
Hard real-time system is when they must be done in a specific time with not errors allowed, it don't tolerate any missed time. An example is an airplane sensor where any error is fatal.
What makes a hard real-time system is considering strict deadline, because if one deadline is missed, the system will failed.
4. **(3 points) Mention 3 main benefits of doing embedded system design versus a hardware system**
 1. Lower system cost.
 2. Easy to develop.
 3. Short product development cycles.
5. **(2 points) Mention what an operating system is and when it is justified to use an operating system in an embedded system**
An Operating System (OS) is the software that handles the memory and all the processes of the computer.
An OS is justified to use in an embedded system when this would be more efficient by managing the hardware in a most efficient way.
6. **(1 point) What is a device driver in an embedded system**
It is a low-level software that was made in order to control a specific type of device that is being attached to the system.
7. **(2 points) If you were to design an embedded system for a digital signal processing application, what features would you consider when selecting an embedded processor.**
I would consider clock speed due all the mathematical operations needed. I would also consider the data word length because we don't want to missed any information that is being transmitted and in order to have a better precision.
8. **(2 points) What makes a RISC processor more suitable for embedded system applications? Mention at least two characteristics and explain them.**
It has fixed-length instructions which makes easier to implement pipelining.
The execution time is minimized due pipelining.
It has a low power consumption because it has a simple architecture.
9. **(1 point) What is the memory map in an embedded processor**
It is like a database that has a complete information of how the memory is distributed.

- 10. (2 points) Describe two types of interrupts and compare them.**

The two types are hardware and software interrupt. A hardware is when an external device is communicating with the processor and need immediate attention. A software is when the system itself requires an interrupt after certain instruction.

- 11. (3 points) Provide a detailed description of how interrupts work in an embedded processor**

When an interrupt is detected, the system stops whatever it's doing, save the address where the PC was, and then attend the interrupt. After the interrupt is done, the system returns where it was by reading the register that kept the PC.

- 12. (2 points) What is an interrupt vector table?**

It is a list that holds the address of the ISR which every interrupt has one.

- 13. (2 point) What happens if the memory space of the ISR is shorter than the instructions that need to be serviced in the ISR?**

The request is held pending.

- 14. (2 points) Describe at least two differences between the RISC and CISC processor.**

In a CISC processor is more difficult to implement pipeline that in a RISC processor.

The execution time in a RISC processor it is better than CISC.

RISC has lower power consumption than CISC.