Chapter 1. Problems

1S. Identify and explain steps from high level language to executable code. Identify products on the market that enable you to perform these steps for the computer system of your choice.

Solution
    Compile → Assemble → Linker

1U. What are the advantages and disadvantages of writing in a high level language such as C.

Solution:

2S. What is a LAN and provide a LAN type that is commonly used today.

Solution
    * Local Area Network is typically used to network computers in a small geographical environment such as a building.
    * Wireless, IEEE 802.3, token ring, …

2U. What type of network is Bluetooth and what are its common uses?

Solution

3S. What are the types of memory and storage? Create a list showing memory and storage types from the fastest to slowest and another list from least expensive to most expensive.

Solution
    Memory types listed from fastest to slowest which also from most expensive to cheapest:
    * Cache
    * DRAM
    * FLASH RAM
    * Hard Drive
    * DVD and CD
    * Tape drive

3U. Cache is the fastest memory available; so why not use only Cache memory throughout the system?

Solution

4S. List the major functional blocks or elements of a typical processor.

Solution
    * Interface and control logic
    * I/O Interface
    * Graphics Controller
    * Core Processing
    * Arithmetic Logic Unit (ALU)

4U. Provide three examples of computer systems that do not have a dedicated display or keyboard.

Solution

5S. if you had a choice to upgrade to a 10% faster processor or get 10% more memory, which would you choose and why? Assume the cost of both upgrades are the same.

Solution
    The answer depends on which is the critical path (Limiting the performance). If the processor speed is the issue then 10% fast processor is the right answer otherwise consider 10% more memory.

5U. if you upgrade to a 30% faster processor, will your application run 30% faster? Explain your answer.

Solution

6S. What are the dimensions of a typical transistor today and what is the number of transistors used in your favorite processor? If you had to use vacuum tubes (3 $inch^3$) to build this processor, how much space do you need?

Solution
    As of 2009 $\rightarrow$ there are over 1Billion transistors in a typical PC processor.   Therefore, we would need more 3 Billion $inch^3$ of space to implement the same processor using vacuum tubes.

6U. Let say Moore's law holds that number of transistors doubles every 2 years per unit area. Assuming a 0.25 $inch^2$ chip die has one billion transistors in 2013, how many transistors will the 0.5 $inch^2$ chip die have in 2020.

Solution

7S. What is the most important benefit of CMOS technology?

Solution
    CMOS technology requires minimal power (nano-watts) when not switching.

7U. What would be a reason for not using CMOS technology for all components of a computer systems?

8S. What are the six most important consideration in microprocessor system design and why?

Solution
    Functionality + Performance + Memory + Reliability + Usability + Maintainability

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8U. How has the importance of Usability and Memory Size in computer design changed over the past decade?

Solution

9S. What are the differences between Microprocessor and Microcontroller? Which factors would lead you to select one over the other?

Solution
    Microcontroller is a full computer system on a chip. Most embedded systems that require minimal expandability use Microcontrollers while general purpose computers use microprocessors and implement all the needed subsystem externally.   Microcontrollers are typically designed for specific applications.

9U. Based on your online research and knowledge of computing world, name 4 processors you consider most popular.   Also specify if the processors are Microprocessor or Microcontroller?

Solution

10S. In the next 5 years, what are the top three trends in Computers? Support you statements with example of documented research or market trends.

Solution
    * Miniaturization
    * Reduce power
    * Increased functionality
    * Bio/Electronic interface
    * Machine Learning…

10U. In your opinion, what is the most impactful trends in Computers? Support you choice.

Solution

11S. What are the key components of Development IDEs such as MPLAB IDE?.

Solution
    * Editor
    * Assembler
    * Compiler
    * Linker
    * Simulator
    * Debugger

11U. After the PICmicro code has been written, compiled, assembled and linked, what tools in the MPLAB IDE is most useful in determining the correctness and completion of your code?

Solution