COSC 290

Ch.1 Class Exercises

1. Measuring Units
   1. How many milliseconds (ms) are in 0.002 second?

2

* 1. How many microseconds (µs) are in 0.002 second?

2,000

* 1. How many nanoseconds (ns) are in 0.002 second?

2,000,000

* 1. How many nanoseconds (ns) are in 0.002 milliseconds?

2,000

* 1. How many microseconds (µs) are in 0.002 millisecond?

2

* 1. How many kilobytes(KB) are in 0.002 gigabyte(GB)?

2,000

* 1. How many bytes are in 0.002 megabyte(MB)?

2,000

* 1. 125 MHz is equal to 8 ns/cycle.

1. Fill up the name of each level for Abstract Levels of Mordern Computing Systems and match its description.
   1. Level 6 (User) E
   2. Level 5 (High-Level Language) F
   3. Level 4 (Assembly Language) A
   4. Level 3 (System Software) D
   5. Level 2 (Machine) B
   6. Level 1 (Control) C
   7. Level 0 (Digital Logic) G
2. It is a one-to-one translation that one assembly language instruction is translated to exactly one machine language instruction.
3. It consists of the machine language recognized by the particular architecture of the computer system.
4. Instructions are decoded and executed and data is moved where and when it should be.
5. It deals with operating system instructions, multiprogramming, protecting memory, etc..
6. It is composed of applications such as word processors, or games.
7. It consists of languages such as Fortran, C++. And it use a compiler or an interpreter.
8. It consists of the fundamental building blocks, the implementations of the mathematical logics.
9. What are the three types of Cloud computing platforms? And brief define and list at least three characteristics of each service.
   1. Software as a Service(SaaS)

SaaS consumers buy application services. The development and hosting of these services is completely handled by the service provider, the consumer only needs to worry about connecting to the server hosting the service. An advantage of SaaS programs is that developing and implementing updates are quite fast. Examples of SaaS include Gmail, Dropbox, and Netflix.

* 1. Platform as a Service (PaaS)

PaaS consumers buy hardware, operating systems, database services, security components, and backup and recovery services. These products can be managed by either the consumer or the provider, and are aimed at simplifying the process for clients looking to deploy computing solutions. Examples include the Google App Engine and Microsoft Windows Azure Cloud Services.

* 1. Infrastructure as a Service (IaaS)

IaaS consumers buy server hardware, secure network access to the servers, and backup and recovery services. The burden of upkeep, as well as supplying appropriate operating systems and databases falls on the consumer. The provider merely allows the consumer to access more computational power and resources for whatever they may need it for. Some examples include Amazon EC2, Google Compute Engine, Microsoft Azure Services Platform, Rackspace, and HP Cloud.

1. Open a free Chat GPT account and briefly describe the following non-Von Neumann Models using ChatGPT.
   1. Harvard Architecture

“The Harvard Architecture is a computer architecture design that separates and uses different memory pathways for data and instructions. In this architecture, there are distinct memory units for storing program instructions and data, each with its own dedicated bus system. This separation allows the processor to fetch and access data and instructions simultaneously, improving overall system performance. The two main components in Harvard Architecture are the Instruction Memory (often referred to as Program Memory) and the Data Memory. This design is in contrast to the Von Neumann Architecture, where a single memory unit is used for both data and instructions, sharing a common bus. The Harvard Architecture is commonly found in embedded systems and microcontrollers due to its efficiency in managing and accessing program instructions and data.”

* 1. Digital signal processors

“Digital Signal Processors (DSPs) are specialized microprocessors designed for efficient digital signal processing. They excel in tasks like audio and image processing, communications, and control systems. DSPs have specialized instructions, support parallel processing, and often use fixed-point arithmetic. They are known for real-time processing, low power consumption, and specific input/output interfaces. DSPs find applications in telecommunications, audio processing, medical imaging, and more.”

* 1. Dataflow machines

“Dataflow machines execute instructions based on the availability of data, allowing for parallel processing. They track data dependencies, schedule instructions dynamically, and lack a fixed execution order. Suited for tasks with inherent parallelism, they differ from traditional architectures by not relying on a central control unit. Despite some experimental use, widespread adoption has been limited.”

* 1. Neural networks

“Neural networks are computational models inspired by the human brain. They consist of interconnected nodes organized into layers, with each node applying weights to inputs and using an activation function. During training, the network adjusts weights to minimize errors. Neural networks, especially deep ones, are used for tasks like image recognition and natural language processing.”

* 1. Cognitive computers

“Cognitive computers are advanced computing systems designed to mimic human cognitive functions, such as learning, reasoning, and problem-solving. These systems often leverage artificial intelligence (AI) technologies, including machine learning and natural language processing, to analyze and interpret data, make decisions, and adapt to changing conditions. The goal of cognitive computing is to create systems that can perform tasks traditionally requiring human intelligence, enabling more sophisticated problem-solving and decision-making capabilities.”

* 1. Quantum computation

“Quantum computation is a type of computing that leverages the principles of quantum mechanics to perform computations. Unlike classical computers that use bits to represent either 0 or 1, quantum computers use quantum bits or qubits. Qubits can exist in multiple states simultaneously, thanks to superposition, and can be entangled, meaning the state of one qubit is dependent on the state of another. Quantum computers have the potential to solve certain problems much faster than classical computers, particularly in areas such as factorization, optimization, and simulation of quantum systems.”

1. Top of Form
2. Bottom of Form
3. Briefly describe the following terms using ChatGPT
   1. Von Neumann Architecture

“Von Neumann Architecture is the foundation of most classical computers. It features a CPU that sequentially executes instructions fetched from a single memory unit, which stores both program instructions and data. This architecture includes a Control Unit and an ALU for managing operations”. This is then connected to an I/O source.

* 1. Multicore computer

“A multicore computer is a type of computer architecture that includes multiple processing cores (or CPU units) on a single chip. Each core functions as an independent processing unit, capable of executing its own set of instructions simultaneously. Multicore processors enable parallel processing, allowing the computer to perform multiple tasks or execute multiple threads concurrently, leading to improved overall performance and efficiency in handling diverse workloads.”

* 1. Multiprocessor computer

“A multiprocessor computer is a system that includes multiple independent processors (CPU units) working together. Unlike a multicore processor where multiple cores share the same chip, in a multiprocessor system, each processor has its own chip. These processors can operate concurrently, allowing for parallel processing and improved overall performance by dividing and handling various tasks simultaneously. Multiprocessor systems are designed to enhance computational power and are commonly used in server environments and high-performance computing applications.”

* 1. Multitasking

“Multitasking is the concurrent execution of multiple tasks or processes on a computer system. In a multitasking environment, the operating system allows different applications or tasks to run concurrently, giving the appearance of simultaneous execution. This enables users to switch between programs and perform various activities without having to wait for one task to finish before starting another. Multitasking can be achieved through time-sharing, where the CPU rapidly switches between tasks, or through parallel processing on systems with multiple processors or cores. It enhances overall system efficiency and user productivity.”

* 1. Multithreading

“Multithreading is a programming and execution model that enables concurrent execution of multiple threads within a single process. A thread is the smallest unit of execution in a program, and multithreading allows multiple threads to run independently, sharing the same resources such as memory space but having their own execution flow.

Multithreading is a way to achieve parallelism, where different parts of a program can execute concurrently, improving overall performance and responsiveness. Threads within a process can run concurrently on multicore processors, or they can be scheduled to run in interleaved fashion on a single-core processor. Multithreading is commonly used to handle concurrent tasks, asynchronous operations, and to enhance the responsiveness of applications, particularly in graphical user interfaces and server applications.”

* 1. Difference between CPU and GPU

“The CPU (Central Processing Unit) and GPU (Graphics Processing Unit) are both types of processors, but they have distinct architectures and are optimized for different tasks.

1. **Primary Function:**
   * **CPU:** General-purpose processor designed for a wide range of tasks, including running operating systems, executing applications, and managing overall system functionality.
   * **GPU:** Specialized processor initially designed for rendering graphics but evolved to handle parallel processing tasks efficiently, making them well-suited for graphics rendering, simulations, and parallel computations.
2. **Architecture:**
   * **CPU:** Optimized for sequential processing and tasks that require fast access to a small amount of complex data.
   * **GPU:** Optimized for parallel processing with a focus on handling numerous simpler tasks simultaneously, making it highly effective for graphics rendering and parallel computing.
3. **Processing Cores:**
   * **CPU:** Typically has fewer cores (often 2 to 16 cores) optimized for handling complex tasks.
   * **GPU:** Features a large number of smaller cores (hundreds to thousands) designed to efficiently process multiple simpler tasks in parallel.
4. **Memory Hierarchy:**
   * **CPU:** Has a complex memory hierarchy with multiple levels of cache for fast access to a small amount of data.
   * **GPU:** Utilizes high-bandwidth memory designed to efficiently handle large amounts of data simultaneously, which is crucial for graphics rendering and parallel computation.
5. **Use Cases:**
   * **CPU:** Suited for general-purpose computing, running operating systems, and handling tasks with complex dependencies.
   * **GPU:** Excelling in parallel tasks such as graphics rendering, scientific simulations, machine learning, and other computations that benefit from parallel processing.

In summary, CPUs are versatile and handle a broad range of tasks with complex dependencies, while GPUs are specialized processors optimized for parallel processing, making them particularly effective for graphics rendering and parallel computations in various domains.”

1. Pretend you are ready to buy a new lab top computer for personal use. First, take a look at ads from various magazines and newspapers and write the specifications from the ads (hardware, software, and price) which you choose. List terms you don’t quite understand in the specification on the ads and give a brief written explanation.

A computer monitor with a blue screen and wires

Description automatically generated with medium confidence

A screenshot of a computer

Description automatically generated

This is actually the laptop that I currently have, I got it in 2022 for around $500 if I remember correctly. I’m familiar with most of the terms listed, there’s only a few acronyms that I must use context clues for. I’m aware that DDR4 ram is a more contemporary type of ram that is much faster than other, older types. In addition, SSD storage typically has much faster access times than HDDs or other alternatives. I am a bit surprised to learn that the processor runs at 1.8Ghz out of the box with a max overclock of ~2.5 times that, but after reflecting, I’m sure it’s to prolong battery life. I’m not sure how a WOOV HDMI cable differs from a regular HDMI, but I’m sure it’s trivial and doesn’t impact use cases. I’m not sure what 802.11ax WLAN connectivity is specifically, other than a standard for WLANs. I know that DAX3 is a Dolby proprietary standard for handling audio. Everything else in the description seems trivial and self-explanatory.