

Session 1: Homework Solution

1. What are system Daemons?

A daemon is a long-running background process that answers requests for services

2. What is firmware?

Firmware is a software program or set of instructions programmed on a hardware device. It provides the necessary instructions for how the device communicates with the other computer hardware

3. Key Differences Between Stack and Heap Allocations

In a stack, the allocation and deallocation are automatically done, whereas, in heap, it needs to be done by the programmer manually. Handling of Heap frame is costlier than the handling of the stack frame. Memory shortage problem is more likely to happen in stack whereas the main issue in heap memory is fragmentation. Stack frame access is easier than the heap frame as the stack have a small region of memory and is cache-friendly, but in case of heap frames which are dispersed throughout the memory so it causes more cache misses. A stack is not flexible, the memory size allotted cannot be changed whereas a heap is flexible, and the allotted memory can be altered. Accessing time of heap takes is more than a stack.

4. What are Interrupts? How many types of interrupts are there?

Interrupts are signals sent to the CPU by external devices, normally I/O devices. They tell the CPU to stop its current activities and execute the appropriate part of the operating system.

There are three types of interrupts:

a) Hardware Interrupts: These are generated by hardware devices to signal that they need some attention from the OS. They may have just received some data (e.g., keystrokes on the keyboard or an data on the Ethernet card); or they have just completed a task which the operating system previous requested, such as transferring data between the hard drive and memory.

b) Software Interrupts: These are generated by programs when they want to request a system call to be performed by the operating system.

c) Traps: These are generated by the CPU itself to indicate that some error or condition occurred for which assistance from the operating system is needed. Interrupts are important because they give the user better control over the computer. Without interrupts, a user may have to wait for a given application to have a higher priority over the CPU to be ran. This ensures that the CPU will deal with the process immediately.

5. Define data analytics.

Data analytics is the process of examining data sets to draw conclusions about the information they contain, increasingly with the aid of specialized systems and software.

6. What is Von-Neumann bottleneck?

A single path between the CPU and main memory is known as the ***von Neumann bottleneck***.

7. Explain Harvard architecture?

Uses two memory systems and two separate busses

- Instruction Memory
- Data Memory

8. What are the steps in Instruction Execution?

- Fetch
- Execute
- Interrupt

9. What are objectives of an Operating system?

- Convenience
- Efficiency
- Ability to evolve and offer new services
- Maximize System performance
- Protection and access control
- Footprint of OS should be small

10. List operations of OS.

- Dual-mode operation
- User mode
- Kernel mode

11. What are the services provided by an OS?

- Process Management
- Memory Management
- Storage Management
- Protection and security

12. Is Computer Architecture different from a Computer Organization?

Computer Architecture

It is the way hardware is connected to create a computer system.

Computer architecture is the connection between software and hardware.

It makes understanding of the system's functions easy.

Registers, instructions, and addressing modes are parts of the architecture.

Architecture comes first in computer system design.

Computer Organization

It is the computer's design and the behavior as perceived by the user.

In a system, it handles a component's connection.

It maps all the units in a system, their interconnection, and arrangement.

The realization of computer architecture is the organization.

The base of an organization is architecture.

Computer Architecture	Computer Organization
Deals with high-level issues of designs. Involves Logic.	Deals with low-level issues of design. It involves physical components.

13. What are the various Interrupts in a Microprocessor system?

There are three types of interrupts:

- **External** interrupts that come from external input/output devices.
- **Internal** interrupts are the result of any exception caused by the program itself.
- **Software** interrupts occur only during the execution of an instruction. The main aim of such interrupts is to switch modes from the user to the supervisor.

14. What are the common Components of a Microcomputer?

Control units, I/O units, Cache, ALU, and Registers are some of the common components of a Microprocessor.

15. What do you know about Virtual Memory?

Virtual memory is a feature of an operating system that enables a computer to be able to compensate shortages of physical memory by transferring pages of data from random access memory to disk storage. This process is done temporarily and is designed to work as a combination of RAM and space on the hard disk. This means that when RAM runs low, virtual memory can move data from it to a space called a paging file. This process allows for RAM to be freed up so that a computer can complete the task.

16. What is the difference between Software and Hardware interrupts?

Hardware Interrupt :Hardware Interrupt is caused by some hardware device such as request to start an I/O, a hardware failure or something similar. Hardware interrupts were introduced as a way to avoid wasting the processor's valuable time in polling loops, waiting for external events.

For example, when an I/O operation is completed such as reading some data into the computer from a tape drive.

Software Interrupt :Software Interrupt is invoked by the use of INT instruction. This event immediately stops execution of the program and passes execution over to the INT handler. The INT handler is usually a part of the operating system and determines the action to be taken. It occurs when an application program terminates or requests certain services from the operating system.

For example, output to the screen, execute file etc.

17. What is von Neumann bottleneck?

The von Neumann bottleneck is the idea that computer system throughput is limited due to the relative ability of processors compared to top rates of data transfer. According to this description of computer architecture, a processor is idle for a certain amount of time while memory is accessed.