1. **2016-1a**

   Circle or cross: "**T**" if True – "**F**" if False.

   T / F   A clustered system can provide high-availability service.

   T / F   The advantages of a multiprocessor system include: increased throughput, economy of scale, and increased reliability.

   T / F   Android (Google) features middle-ware that supports (for example) Linux.

   T / F   Microsoft Windows 10 provides only a GUI (Graphical User Interface) with no CLI (Command Line Interface).

   T / F   Using the Windows Application Programing Interface (API), you can compile the same source code to run natively on either 32-bit Windows or 64-bit Windows.

   T / F   Linux does not provide any Application Programing Interface (API).

   T / F   Most modern operating systems – including Linux and Windows – have a kernel structure similar to that of a micro-kernel, but to implement that structure in the manner of a monolithic kernel.

2. **2016-1b**

   Circle or cross: "**T**" if True – "**F**" if False.

   T / F   Virtual Machines are fully isolated from one another – no Virtual Machine is aware of the presence of another Virtual Machine.

   T / F   With containers, a host operating system is installed on the system first, and then a container layer is installed atop the host Operating Systems.

   T / F   Software as a Service (SaaS) – is a software stack ready for application use via the Internet (i.e. a database server).

3. **2016-2a**

   Circle or cross: "T" if True – "F" if False.

   T / F   An Operating System is a software that manages the computer hardware (OSCE2).

   T / F   The purpose of an Operating System is to provide an environment in which a user can execute programs in a convenient and efficient manner (OSCE2).

   T / F   There are at least three types of programs, the kernel, system programs, and application programs (OSCE2).

   T / F   Most prominent mobile Operating System features a core kernel along with middle-were that support Data Base, Multimedia, Graphics, etc (OSCE2).

   T / F   The Interrupt is a privilege instruction.

   T / F   After interrupt, the system will be in non-privilege mode.

4. **2016-2b**

   Answer the following questions:

   (a) Name the three most common operating systems for personal computers!

   (b) Name the two most common operating systems for mobile devices!

   (c) A 64-bit DDR3 memory system has two transfers per cycle of a quadrupled (4x) clock signal. What is the transfer rate (in Mega-Bytes/second) if the memory clock-rate is 200MHz?

   (d) If the signal propagation is 300 000 km/s. How long (cm) is the wave-length of a 3GHz signal?

5. **2016-2c**

   (a) Fill this following with "ASP" (Application Software Provider) or "SaaS" (Software as a Service)

	a separate instance of the application is maintained for each business
	always Up-to-Date for the whole service
	closer to Legacy Software
	lacks scalability for the vendor
	supports multi-tenancy (multiple customers)

   (b) Fill this following with "IaaS" (Infrastructure as a Service), "PaaS" (Platform as a Service), or "SaaS" (Software as a Service)

	CRM System
	Database Server
	GMAIL
	Google Apps
	Network
	Office 365 (Microsoft)
	Servers
	Storage
	Virtual Machines
	Webserver

   (c) Fill this following with "Container", "Full Virtualization", "Hypervisor", or "Para Virtualization"

	a complete simulation of the underlying hardware
	creates and runs virtual machines
	guests run a modified operating system
	LXC
	operating-system-level virtualization

6. **2017-1a**

   Circle or cross: "T" if True – "F" if False.

   T / F The von Neumann architecture describes a computer architecture with parts consisting of a Central Processing Unit (CPU); a Control Unit (CU); a Memory to store both data and instructions; external Mass Storage; and Input and Output mechanisms.

   T / F An Operating System provides protected access to shared resources (UCB162).

   T / F A program is an instance of a process that runs (UCB162).

   T / F AMD64 (aka x64 or x86_64) is the 64-bit version of the x86 instruction set.

   T / F An Operation System acts as an intermediary between the computer user and the computer hardware (OSC9).

   T / F An Operating System as resource allocator manages the execution of user programs to prevent errors and improper use of the computer (OSC9).

   T / F Android Operating Systems includes Linux as middleware.

   T / F "Kernel mode" is also called "Supervisor mode" whereas "User mode" is also called "Privileged mode".

   T / F System calls provide an interface to the Application Programming Interface (API).

   T / F API specifies a set of functions that are available to an application programmer, including the passing parameters and return values.

7. **2017-1b**

   Circle or cross: "T" if True – "F" if False.

   T / F If you use services like Facebook or GMail or Twitter, then you already use the cloud system.

   T / F One of the essential Cloud Computing characteristics is "On Demand Self-Service".

   T / F Amazon Elastic Compute Cloud (EC2) is an Electronic Commerce / Internet-based Retailer system.

   T / F Organizations today have no choices: all technology-enabled business processes will be moved to the cloud.

   T / F A disadvantage of Cloud Computing is that it requires a constant network connection.

   T / F OpenStack is a software platform, mostly deployed as an Infrastructure-as-a-Service (IaaS).

   T / F A Hypervisor is computer software, firmware, or hardware, that creates and runs virtual machines.

   T / F There are three main Cloud Computing components: grid computing, utility computing, and autonomic computing.

   T / F Cloud computing is always public cloud by definition.

   T / F Any conventional OS distribution can be run on top of a paravirtualizing Hypervisor.

8. **2017-2a**

(01) is a software that manages the computer hardware. Android is an open source (02) for (03) that includes a (04) kernel, (05), and key (06). A (07) is any hardware or software used to host an application or service. Anything between the kernel and user applications is considered as (08). A (09) is an abstraction in which common code providing generic functionality. (10) provide an interface to the services made available by an (11). The (12) specifies a set of functions that are available to an application programmer.

Match the number of the sentence above with these following phrases:

[   ] Application Programming Interface (API)   [   ] Applications   [   ] Linux-based

[   ] Middleware   [   ] Middleware   [   ] Mobile Devices

[   ] Operating System   [   ] Operating System   [   ] Platform

[   ] Software Framework   [   ] Software Stack   [   ] System Calls

9. **2017-2b**

- In the von Neumann architecture, the **Central Processing Unit** consists of two main parts: the (01) and the (02).
- A (03) is a collection of **instructions**, while a (04) is the actual execution of those **instructions**.
- One **Hexadecimal** digit represents (05) binary bits, whereas one **Octal** digit represents (06) binary bits.
- A (07) uses a Page Table to map (08) **numbers** of (09) **memory** into (10) **numbers** of (11) **memory**.
- The most common use of (12) is **printing**. A (13) is a component that **stores data** so future requests for that data can be served **faster**. A (14) is used **temporarily** store data while it is being moved from one place to another.
- (15) means simultaneous or concurrently execution of **multiple processes**.
- The **three-state** process model is constituted of (16), (17), and (18).
- If a process is unable to change its state **indefinitely** because the (19) requested by it are being used by another waiting process, then the system is said to be in a (20).

Match the number of the sentence above with these following phrases:

[   ] Arithmetic Logic Unit   [   ] buffer   [   ] cache   [   ] computer program

[   ] Control Unit   [   ] deadlock   [   ] four (4)   [   ] frame

[   ] Memory Management Unit   [   ] multitasking   [   ] page   [   ] physical

[   ] process   [   ] ready   [   ] resources   [   ] running

[   ] spooling   [   ] three (3)   [   ] virtual   [   ] waiting

10. **2018-1**

   As a control program, an Operating System serves two major functions: supervision of the execution of (01) programs and management of the operation and control of (02) devices. An Operating System provides an (03) for a computer user to execute programs on computer hardware in a (04) and (05) manner. A Graphical User Interface (GUI) might waste (06) cycles, but it optimizes the (07)'s interaction with the system. In a (08) system, the response time should not exceed the time constraint. The CPU has very limited capability when executing in (09) mode. Privileged CPU instructions could be executed only when the CPU is in (10) mode. The most common (11) device is a (12) which holds large quantities of data permanently. Multiprocessor systems have three main advantages: increased (13), increased (14), and (15) of scale. In (16) multiprocessing, each processor is assigned a specific task, and in (17) multiprocessing, all processors are peers. Hardware-based VMM (Virtual Machine Managers) are generally known as (18) hypervisors. Operating-system-like VMM are known as (19) hypervisors. Operating Systems that provide VMM functions are known as (20) hypervisors. Operating Systems's applications that provide VMM features are known as (21) hypervisors. In the trap-and-emulate virtualization method, the VMM will (22) and then (23) the priviliged instruction of the guest. (24) operating systems often include not only a core kernel but also (25) - a set of software frameworks that provide additional services.

   Match the number of the sentence above with these following phrases:

   [   ] asymmetric   [   ] convenient   [   ] CPU   [   ] economy   [   ] efficient

   [   ] emulate   [   ] environment   [   ] I/O   [   ] kernel   [   ] magnetic disk

   [   ] middleware   [   ] Mobile   [   ] real-time   [   ] reliability   [   ] secondary-storage

   [   ] symmetric   [   ] throughput   [   ] trap   [   ] type 0   [   ] type 1

   [   ] type 1   [   ] type 2   [   ] user   [   ] user   [   ] user

11. **2018-2 (71%)**

   A computer system structure can be divided into four components: (01), (02), (03) and (04). The one program running at all times (part of the operating system) is the (05). The Operating System of a mobile system also includes (06), a set of software frameworks that provide addition services such as (07), (08) and (09). Two types of Multiprocessing: (10) and (11). A process is a (12) in execution. A multi-threaded process has one (13) per (14). An Operating System provides certain services including user-interfaces like: (15), (16), (17) and (18). With (19), the guest operating system is modified for optimized performance. Virtualization first appeared in (20) in 1972.

   Match the number of the sentence above with these following phrases:

   [   ] asymmetric (100%)   [   ] application programs (50%)   [   ] batch (50%)

   [   ] Command-Line Interpreter (80%)   [   ] databases (60%)   [   ] graphics (70%)

   [   ] Graphics User Interface (90%)   [   ] hardware (100%)   [   ] IBM Mainframes (80%)

   [   ] kernel (60%)   [   ] middleware (60%)   [   ] multimedia (80%)

   [   ] operating system (90%)   [   ] para-virtualization (70%)   [   ] program (70%)

   [   ] program counter (30%)   [   ] symmetric (100%)   [   ] thread (40%)

   [   ] Touch-screen (70%)   [   ] users (70%)   [   ] —

12. **2019-1 (87.9%)** (Ref: Schilberschatz et.al.)

A computer system can be divided roughly into four components: the (01), the (02), the (03), and a (04).

(05) = A set of software frameworks that provide additional services to application developers.

(06) = The hardware that executes instructions to perform arithmetic, logic, controll and I/O operations.

(07) = The basic computation unit of the CPU.

(08) = Several computing cores reside on a single chip.

(09) = The use of two or more CPUs within a computer system.

(10) = The memory access time depends on the memory location relative to the processor,

(11) = The CPU executes multiple processes by switching among them.

Most CPUs have two types of interrupt lines: (12) and (13). There are two types of Random Access Memory: (14) and (15). Two most common secondary-storage devices are: (16) and (17). Most computer systems provide at least two separate hardware support operation modes: (18) mode and (19) mode. For a program to be executed, it must be loaded into (20).

Match the number(s) in the sentence above with these following phrases:

[ ] APPLICATION PROGRAMS (87%)	[ ] CORE (88%)	[ ] CPU (CENTRAL PROCESSING UNIT) (96%)	[ ] DYNAMIC (DRAM) (98%)
[ ] HARD-DISK DRIVE (HDD) (99%)	[ ] HARDWARE (96%)	[ ] KERNEL (73%)	[ ] MASKABLE (MI) (83%)
[ ] MEMORY (83%)	[ ] MIDDLEWARE (81%)	[ ] MULTICORE (85%)	[ ] MULTIPROCESSOR (83%)
[ ] MULTITASKING (89%)	[ ] NON-MASKABLE (NMI) (84%)	[ ] NUMA: NON-UNIFORM MEMORY ACCESS (94%)	[ ] OPERATING SYSTEM (94%)
[ ] STATIC (SRAM) (97%)	[ ] SOLID STATE DRIVE (SSD) (99%)	[ ] USER (87%)	[ ] USER (87%)

13. **2019-2 (75.7%)**

Interrupts are a key way in which (01) interacts with the (02).

Clustered systems are composed of two or more (03) or (04) joined together.

(05) = A set of software frameworks that provide additional services to application developers.

(06) = The hardware that executes instructions to perform arithmetic, logic, controll and I/O operations.

(07) = The basic computation unit of the CPU.

(08) = Several computing cores reside on a single chip.

(09) = The use of two or more CPUs within a computer system.

(10) = The memory access time depends on the memory location relative to the processor,

(11) = The CPU executes multiple processes by switching among them.

Most CPUs have two types of interrupt lines: (12) and (13). There are two types of Random Access Memory: (14) and (15). Two most common secondary-storage devices are: (16) and (17). Most computer systems provide at least two separate hardware support operation modes: (18) mode and (19) mode. For a program to be executed, it must be loaded into (20).

Match the number(s) in the sentence above with these following phrases:

[ ] CORE (63%)	[ ] CPU (CENTRAL PROCESSING UNIT) (79%)	[ ] DYNAMIC (DRAM) (99%)	[ ] HARDWARE (21%)
[ ] HARD-DISK DRIVE (HDD) (94%)	[ ] OPERATING SYSTEM (23%)	[ ] KERNEL (76%)	[ ] MASKABLE (MI) (90%)
[ ] MEMORY (74%)	[ ] MIDDLEWARE (73%)	[ ] MULTICORE (86%)	[ ] MULTIPROCESSOR (86%)
[ ] MULTITASKING (81%)	[ ] NON-MASKABLE (NMI) (91%)	[ ] NON-UNIFORM MEMORY ACCESS (89%)	[ ] INDIVIDUAL SYSTEMS (70%)
[ ] STATIC (SRAM) (99%)	[ ] SOLID STATE DRIVE (SSD) (96%)	[ ] USER (67%)	[ ] NODES (56%)

14. **2020-1**

    Supposed you have got a consultation gig in a newly founded startup company **XYZZY**. **XYZZY** has asked you to briefly explain the issues of Cloud Computing.

    (a) Briefly define with one sentence only, these following terms:

    ”Application” _____

    ”Data” _____

    ”Runtime” _____

    ”Middleware” _____

    ”Operating System” _____

    ”Virtualization” _____

    ”Server” _____

    ”Storage” _____

    ”Networking” _____

    (b) Who will manage the following: **”XYZZY”** (”Your Company”) or **SP** (the Service Provider). Please fill in. (Hint: use the model from Nunnikhoven's presentation).

	On-Premises	IaaS	PaaS	SaaS
”Application”				
”Data”				
”Runtime”				
”Middleware”				
”Operating System”				
”Virtualization”				
”Server”				
”Storage”				
”Networking”				

    (c) What is the **last** digit of your Student ID (NPM)? _____

    (d) **IF** the **LAST DIGIT** is (0 or 1), then **X=IaaS**; **ELSEIF** (2 or 3), then **X=PaaS**; **ELSE X=SaaS**.

    X = _____

    (e) Give two (2) examples ONLY of **X** services (brand).

    (f) Give two (2) examples of the limitations and concerns of **X**. Explain each example in a sentence.