Homework Assignment #2

1. 1.) [8 pts., 4 pts. ea.] Which type of hypervisor:
    a. Does not require an existing operating system?
        i. **Type 1 Hypervisor**
    b. Gives developers an operating system virtualization solution that they can run on their current Windows 10 desktops to build and test custom apps?
        i. **Type 2 Hypervisor**

2. [12 pts., 4 pts. ea.] For each of the following definitions, what is the appropriate virtualization term?
    a. A hardware standard that supersedes BIOS.
        i. **UEFI**
    b. A memory management technique that takes unused memory from virtual machines and allocates it where it is needed by other virtual machines.
        i. **Memory Ballooning**
    c. The ability of a hypervisor to deduplicate virtual memory pages for optimal memory usage.
        i. **Transparent Page Sharing**
    d. Grouping multiple network storage devices into a single storage unit.
        i. **Storage Virtualization**

3. [24 pts., 4 pts. ea.] Assume that you are the virtualization administrator. What would you do in each of the following cases? Explain your reasoning for each.
    a. You need to employ a virtual disk type on a hypervisor host. There is limited disk space and you don't know how much disk space a VM will require over time. Which virtual disk option do you choose?
        i. **Thin Disk.** This is the virtual disk type that is similar to the concept of dynamically expanding, which is what needs to be employed to meet these requirements.
    b. Next, assume you're using MS Hyper-V. Which virtual disk option would you use to reduce disk space consumption?
        i. **Fixed size.** This is the MS Hyper-V option that limits the storage the virtual disk uses.
    c. You need to configure a VM so that it can communicate on the physical corporate LAN. What hypervisor component do you put between its virtual NIC and the physical network?
        i. **Virtual switches.** This allows the other network devices to communicate to each other via the LAN. Controls how the network traffic flows between VMs and the host computer.
    d. You have newly deployed VMs in a public Cloud and you need to ensure that they are malware-free. What is the first item you should configure?
        i. **Antivirus.** This item scans files resident on a machine and processes in memory and analyzes them for signatures or anomalous behavioral patterns.

e. You are preparing a host's HW settings so that it can be a hypervisor. Which setting should you definitely enable?
    i. **HW-Assisted Virtualization.** This concept is the way that HW can be configured so that it can be a viable hypervisor.
f. You are configuring virtual network settings, and you expect VMs connected to your virtual network to receive their TCP/IP settings automatically. Which local service should you enable to distribute IP addresses to the VMs?
    i. **DHCP Server.** These servers lease out IPs to all devices connected on a network.

4. [6 pts., 2 pts. ea.] For each of the following cases, which type of key is used?
    a. To create digital signatures
        i. Private Key
    b. To verify digital signatures
        i. Public Key
    c. To encrypt network data in a PKI
        i. Public Key

5. [16 pts., 4 pts. ea.] What is the difference between each of the following terms?
    a. Scaled out vs. Scaled up
        i. Scaled out requires adding more nodes which add more capacity and performance, all accessed as a single system. Scaled up is the addition of resources like memory and computation power, also within a single system.
    b. IDS vs. IPS
        i. **IDS is a tool that is primarily used for detection and monitoring. IPS is a prevention tool. IDS does not actually do anything to prevent intrusions, it only detects them. IPS actually prevents them. Ideally, an IDPS system would be utilized which is a combination of these two tools.**
    c. HIDS vs. NIDS
        i. **HIDS concerns hardware, such as what pieces of data are being used and accessed and where. NIDS monitors the traffic through a given network.**
    d. .vmdk vs. .vhdx
        i. **vdmk is used by vSphere, whereas vhdx is used by Hyper-V. vmdk file sizes grow by adding the vdmk file extension. vhdx files grow by increasing the file size. Vmdk files are stored in data stores, where vhdx is stored through SMB. vhdx also has the added benefit of deduplication and scalability for external storage.**

6. [10 pts. 2 pts. ea.] Of the following hypervisor products—VMware ESXi, Xen Server, and Hyper-V:
    a. Which are open source?
        i. Xen Server
    b. What is the maximum number of virtual CPUs per host?
        i. Vmware – 4096, Xen – 2048, Hyper – 2048
    c. What is the maximum number of virtual machines per host?

        i. **Vmware – 1024, Xen – 1000, Hyper – 1024**
    d. What is the memory limit for a VM?
        i. **Vmware – 6TB, Xen – 1.5TB, Hyper – 12TB**
    e. What is the limit on virtual NICs?
        i. **Vmware – 10, Xen – 7, Hyper – 12**

7. [4 pts., 2 pts. ea.] Explain in detail. Of the set {1,2,3,4},
    a. Which is/are a safe number of vCPUs to allocate to each physical CPU?
        i. **3:1 (vCPU:CPU).** Each vCPU added requires a close evaluation of the workload of all VMs on the server. Contention of computational resources is created when several machines attempt to utilize vCPUs at the same time. Exceeding this amount will require close monitoring.
    b. Which is/are a safe number of virtual RAM units to allocate for each physical RAM unit?
        i. **1.25:1 (vRAM:physRAM).** This concept only works if the actual consumption of memory amongst all virtual RAM allocations are lower than the actual physical memory of the system. Any more than this ratio requires close monitoring.

8. [8 pts., 4 pts. ea.] Explain in detail which type of migration (P2V, V2P, P2P, V2V) should be done in each of the following cases:
    a. An on-premises database needs to be migrated to the Cloud as a VM.
        i. **P2V.** The reason for this type of migration is because the on-premises database is a physical storage system that houses the data that needs to be migrated to a virtual cloud.
    b. Your on-premises private Cloud uses virtualization. The newest version of the current hypervisor will be available on new upgraded HW, and you want to ensure existing VMs continue running on the new hypervisor.
        i. **V2V.** The reason for this type of migration is because the cloud utilizes virtualization. Even though HW is involved, the data migration is fundamentally happening between two virtual systems.

9. [12 pts., 4 pts. ea] Which process should you employ for when you want to do the following tasks:
    a. Move a busy VM's storage to a faster storage array.
        i. **Storage Migration**
    b. Make a separate copy of a VM for either testing, separate use, or archival purposes.
        i. **Cloning**
    c. Save the current state of a VM so that you can revert to that state in case of a SW installation failure or an administrative mistake.
        i. **Snapshot**