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HOMEWORK 1 The due date to submit – September 11, 16

	Answer:	References:
1. Why **the Von Neumann model** is essential in understanding computers ? (Chapter 1)	Firstly, in the Von Neumann model, the CPU was to include ALU, memory, and CU components. The control unit read instructions from memory and executed them. A method of handling input/output through the control unit was also developed. This model contained every major feature which is essential to modern computer architecture and modern computer architecture is still referred to as von Neumann architecture. Besides, Von Neumann made two main improvements. One is that the program instructions and data are both stored in memory while being processed which is known as the stored program concept. The other is binary processing of data which simplifies the design of computer. The above contents are the reasons that the Von Neumann model is essential in understanding computers.	Irv Englander. (n.d.). *The Architecture of Computer Hardware, Systems Software, & Networking: An Information Technology Approach*(5th ed.). John Wiley & Sons, Inc. Page 27
2. **Numbers:** Please write TWO examples representing the numerical data in any possible base, including binary, hexadecimal and octal, as well as floating point number notations	1. 100 (10 base) Binary:1100100 Octal: 144 Hexadecimal：0x64 2. 255(10 base) Binary:11111111 Octal:377 Hexadecimal: 0xff 3. Floating point number: 25.75(base 10)； Binary: 11001.11; Octal: 31.6; Hexadecimal:19.C; 4. Floating point number:144.75(base 10); Binary notation: 10010000.11; Octal notation: 220.6; Hexadecimal notation: 90.C;	Irv Englander. (n.d.). *The Architecture of Computer Hardware, Systems Software, & Networking: An Information Technology Approach*(5th ed.). John Wiley & Sons, Inc. Page 87,166

3. **Data** - Please describe any TWO examples representing different formats of data used for still images (bitmap versus object images), video, audio and alphanumerical data. (Ch 4 p. 100-135)	Still images(bitmap): PNG and JPEG; Still images(object): SVG and PostScript; Video: Quicktime and WMV; Audio: MP3 and WMA; Alphanumerical data: Unicode and ASCII;	Irv Englander. (n.d.). *The Architecture of Computer Hardware, Systems Software, & Networking: An Information Technology Approach*(5th ed.). John Wiley & Sons, Inc. Page 103
4. **LMC** - Explain the inner workings of the Little Man Computer and its relation with real life computers, including the basics of assembly instructions. (A three-four sentences answer will suffice) Ch 6—p.178-193	The LMC performs work by following simple instructions based on three-digit numbers. The first digit specifies an operation and the last two digits are used for various purposes, but most commonly to point to an address. The instructions provide operations that can move data between the mail slots and the calculator, move data between the calculator and the input and output baskets, perform addition and subtraction, and allow the Little Man to stop working. There are also instructions that cause the Little Man to change the order in which instructions are executed, either unconditionally or based on the value in the calculator. The Little Man Computer (LMC) is an instructional model of a computer, created by Dr. Stuart Madnick in 1965. It models a simple von Neumann architecture computer which has all of the basic features of a modern computer. But the real life computers are more complex and have more variant types.	Irv Englander. (n.d.). *The Architecture of Computer Hardware, Systems Software, & Networking: An Information Technology Approach*(5th ed.). John Wiley & Sons, Inc. Page 179-190 Little man computer. (n.d.). Retrieved September 9, 2016, from Wikipedia: https://en.wikipedia.org/wiki/Little_man_computer#Execution_cycle

5. **CPU-memory** – Explain how the CPU and memory communicate. Concept of a register (including MAR/ MDR). (A three-four sentences answer will suffice) Ch 7 p. 201	The MAR, memory address register, holds the address of a memory location. The MDR, memory data register , will hold a data value that is being stored to or retrieved from the memory location currently addressed by the memory address register. They are two significant registers of the control unit in the CPU which work as single, permanent storage location for specific use. MDR is to hold I/O data and MAR is to hold I/O address, both as I/O interface between the CPU, and then they work together to help CPU retrieve data from the memory. After that, CPU will execute many instructions using these	Irv Englander. (n.d.). *The Architecture of Computer Hardware, Systems Software, & Networking: An Information Technology Approach*(5th ed.). John Wiley & Sons, Inc. Page 201
6. **Fetch-execute** – What is the fetch-execution ? (Ch 7.4 p. 207)	Fetch-execute cycle is what the little man does. First, the little man starts by checking at the counter for number, which is a mailbox number. Second, He increments the counter, so that next time he comes it will be one larger. Third, he goes to the mailbox with the number he read on the counter, and reads what is written on the slip of paper in the mailbox, i.e. 3 digits. Forth, he takes the appropriate action depending on those digits and repeat. Steps 1-3 are the fetch: the little man is fetching an instruction and step 4 is the execute: the little man does the indicated instruction.	Irv Englander. (n.d.). *The Architecture of Computer Hardware, Systems Software, & Networking: An Information Technology Approach*(5th ed.). John Wiley & Sons, Inc. Page 207, 208 Little Man Computer simulator. (n.d.). Retrieved September 9, 2016, from Community: https://community.dur.ac.uk/m.j.r.bordewich/LMC.html
7. **Stack** - How the stack is permanently used through any subroutine call to better write code? (Ch 7.13 p. 221)	The stack should store the return address. The original address is directly stored in the stack that lies below the most recent address. Then the program will be in the reverse order from which the routines were entered. Through this method, can we check that it returns from the last called subroutine to the previous one. It prevents the code from some bugs, such running into an infinite loop.	Irv Englander. (n.d.). *The Architecture of Computer Hardware, Systems Software, & Networking: An Information Technology Approach*(5th ed.). John Wiley & Sons, Inc. Page 221

8. **I/O** – Please list different types of Input/Output: Programmed I/O vs Interrupts and explain how they each work, as well as their advantages and disadvantages. (Ch 9.3)	1.Programmed I/O: Programmed I/O refers to data transfers initiated by a CPU under driver software control to access registers or memory on a device. **Advantages** Programs in the CPU can use it to send the important commands to the I/O controller. It is easy to program and understand **Disadvantages** the CPU has to wait a long time for the I/O module of concern to be ready for either reception or transmission of data. The CPU, while waiting, must repeatedly check the status of the I/O module, and this process is known as Polling. As a result, the level of the performance of the entire system is severely degraded. 2.Interrupts: An interrupt message will trigger by different I/O controllers in the system. An interrupt line will make the computer to suspend the program and jump to a special interrupt processing program. **Advantages** As an external event notifier to free the CPU from necessity of continuously checking; As a completion signal to control the computer from an input device to an output device; Work as a method of allocation CPU time; Work as an abnormal event indicator; **Disadvantages** Most interrupts can be temporarily and selectively disabled by program instructions and still it is not that efficient because the CPU has to transfer the data word by word between I/O module and memory.	Irv Englander. (n.d.). *The Architecture of Computer Hardware, Systems Software, & Networking: An Information Technology Approach*(5th ed.). John Wiley & Sons, Inc. Page 273-286 Programmed I/O, Interrupt & Direct Memory Access (DMA). (October 2, 2009). Retrieved September 9, 2016, from Google: http:// www.louiewong.com/ archives/137

9. **DMA** - How Direct Memory Access works and when it is useful to use it? (Ch 9 p 268)	1.Computer systems provide a more efficient form of I/O that transfers block data directly between the I/O module and computer memory, under control of the I/O module. The transfer is initiated by a program in the CPU, using programmed I/O, but the CPU can then be bypassed for the remainder of the transfer. The I/O module will notify the CPU with an interrupt when the transfer is complete. Once this has occurred, the data is in memory, ready for the program to use. This technique of I/O–memory data transfer is known as direct memory access, or more commonly, simply as DMA. 2.DMA is particularly useful for transferring video data from memory to the video I/O system and large systems such as Web servers, high-speed disk-to-memory transfers and devices etc.	Irv Englander. (n.d.). *The Architecture of Computer Hardware, Systems Software, & Networking: An Information Technology Approach*(5th ed.). John Wiley & Sons, Inc. Page 268
10. **Buses** – Please list the advantages and limitations of different types of buses (serial vs parallel with many examples). Ch 7.5 page 210	**Buses**: Serial buses: **Advantages** 1.Relatively fast speeds over long distance; 2.No separate address lines; 3.Relatively less cost and less space; **Limitations** 1.Requiring modern materials to make serial buses achieve high transfer rates. 2.More circuitry to convert the parallel data to serial data; Parallel buses: **Advantages** 1.High-throughput capability; 2.Widely used in transporting data to the CPU **Limitations** 1.More cost and more space are required; 2.Limited transfered distance 3.Easily disturbed by radio-generated electrical interference; 4.Skew concerns and requirement of not changing faster than the maximum skew time both two problems may cause data corruption; 5.Cable capacitance limits unbuffered data transfers (Pages 210-214 in the textbook)	Irv Englander. (n.d.). *The Architecture of Computer Hardware, Systems Software, & Networking: An Information Technology Approach*(5th ed.). John Wiley & Sons, Inc. Page 211 Dilum Bandara. (n.d.).Buses. Retrieved September 9, 2016, from Google: http://www.slideshare.net/DilumBandara/08-busses

1. **Peripherals** - How computer peripherals work, including magnetic disk drives (floppy disks, hard drives), optical disk drives (CD-R, CD-RW, DVDROM, DVD+R, DVD-R, DVD+RW, DVD-RW), displays (CRT and LCD monitors) and laser printers and realize why it is important to limit the number of disk-read phases when writing programs. (Ch 10 p. 297)	1.Magnetic disk drives A magnetic disk consists of one or more flat, circular platters made of glass, metal, or plastic, and coated with a magnetic substance. Particles within a small area of the magnetic substance can be polarized magnetically in one of two directions with an electromagnet which can also detect the direction of polarization previously recorded. Thus, magnetic polarization can be used to distinguish 1s and 0s. A drive motor rotates the disk platter(s) about its central axis at a fixed speed. Its arm has the read/write head mounted at the end. The arm makes it possible for the head to move radially in and out across the surface of the disk. A head motor controls precisely the position of the arm on the disk. 2. Optical disk drives CD-ROM data storage's data is stored in blocks on the disk. The blocks can be arranged in files. The data is stored on a single track, which spirals from the inside of the disk to the outside and stored in linear blocks along the track. DVD disk is the same size, and is formatted similarly. However, the use of a laser with a shorter light wavelength (visible red, instead of infrared) allows tighter packing of the disk. In addition, two layers of data can be placed on the same side of the disk, one underneath the other. Finally, a different manufacturing technique allows the use of both sides of a DVD.The blister technology is used in various CD &DVD formats, called CD-R, DVD-R, and DVD+R. Additionally, there are rewriteable versions of this technology known as CD-RW, DVD-RW, DVD+RW, DVD-RAM, and DVD+RAMBD-RE. 3. Displays In order to display a pixel on the screen, the system transforms the pixel color to a screen color by reading the RGB values that correspond to the particular pixel value from the table. Then the RGB colors are delivered to the screen.	Irv Englander. (n.d.). *The Architecture of Computer Hardware, Systems Software, & Networking: An Information Technology Approach 4th Edition*. The United Stated : John Wiley & Sons, Inc. Page 299-302, 307, 310-317, 319

4. Laser printers
Laser printers is largely depended on the technology of Xerography. The image is produced electronically from the computer using a laser or light-emitting diodes.

It is important to limit the number of disk-read phases when writes the program because too many disk-read phase may limit the execution speed for many significant computer application to read stored data quickly.