**CR1350 Assignment #3**

**Due:** July 26th before 11:59PM.

**IMPORTANT:** The Dropbox will close at 12AM and no assignments will be accepted after that!

Answer all questions on the document!

DO NOT CREATE YOUR OWN! Marks will be lost!

Question 1: Data Width and Range

1. Explain the relationship between the width of a location and the range of data that can be stored in a location.

|  |
| --- |
| The width of a memory location determines the range of data that can be stored in that location, or, the number of bits that can be stored in a single memory cell or register. |

Question 2: Functions of Memory Types

1. State the function of the following types of memory:
   * Registers

|  |
| --- |
| Small, fast storage between the CPU that holds data and instructions that are currently being processed. Used for quick calculations for data. |

* + Cache

|  |
| --- |
| A small, high-speed memory location close to the CPU. It stores frequently accessed data to speed up retrieval and improve overall performance |

* + Main Memory

|  |
| --- |
| Also known as RAM, primary storage area for data the CPU needs while executing programs. Loses contents when power is turned off |

* + Secondary Storage

|  |
| --- |
| Non volatile storage (SSDs, HDDs). Used to store datd and programs for the long term. Much larger capacity but slower |

* + Off-line Storage

|  |
| --- |
| Removable storage media for backup, archiving and transporting. Things like usb flash drives, cds dvds. Non volatile and can be stored separate of the computer |

Question 3: Static RAM vs. Dynamic RAM

1. Describe the similarities and differences between static RAM and dynamic RAM.

|  |
| --- |
| * Both are volatile memory, meaning loss of data with loss of power * Both are used for temporary memory * Both allow random access to memory locations * SRAM used flip flop circuits to store bits, DRAM uses 1 transistor * DRAM requires refreshing to maintain data integrity, SRAM doesn’t * SRAM is slightly faster because t doesn’t need to be refreshed |

Question 4: Magnetic Disk Organization

1. Discuss the organization of a magnetic disk in terms of cylinders, tracks, and sectors.

|  |
| --- |
| * Magnetic disks is separated into a series of cylinders, which include all tracks at a given radius on all platters * A track is a circular path on the surface of a disk platter where data is recorded. * A sector is a *segment* of track.   In short, a magnetic disk are organized into vertical stacks of tracks, which are the circles on a platter, which contain sectors which are segments of memory |

Question 5: Disk Access Characteristics

1. Define and discuss the factors that determine the access characteristics of a disk.

|  |
| --- |
| * Data transfer rate: the time it takes to read/write to a data location * Access Patterns: the manner in which data is read/written to the disk * Cache size and efficiency: the amount of memory used to store frequently accessed data memory * Queue depth: the number of IO operations the disk can handle at once * Environmental factors: a cold disk is a slow disk, a boiling disk is a melted disk |

Question 6: RAID Levels

1. Briefly discuss the operation and layout of RAID0, RAID1, and RAID5.

|  |
| --- |
| RAID0   * ‘stripes’ data evenly across two or more disks without redundancy * Each disk stores a portion of the data   RAID1   * Duplicated the same data onto two more more disks. Each disk holds 1 exact copy of the data * Each disk holds identical copies of the same data   RAID5   * ‘stripes’ data and parity information across **three** or more disks. Parity is used for error checking and recovery * Data and parity is *distributed* across all disks which increases fault tolerance |

Question 7: Characteristics of SSDs

1. Discuss the characteristics of Solid State Drives (SSD).

|  |
| --- |
| * Uses flash memory to store data * Low power consumption, fast, and reliable due to lack of mechanical parts * Most expensive data storage format due to speed, reliability, and capacity * **Ssd’s have a finite number of write cycles** |

Question 8: Optical Disk Technologies

1. Briefly describe the characteristics of optical disk technologies.

|  |
| --- |
| * Uses laser light to read/write data to a physical disk * Most familiar use case are CDs/DVDs * Resistant to environmental factors (however can be scratched) * Lifespan ~10 years (supposedly up to 100) |

Question 9: Magnetic Tape Memory

1. Discuss the characteristics and operation of magnetic tape memory.

|  |
| --- |
| * Commonly used for data archive, exchange and system backup due to low cost * Uses sequential access to data * Long access times * Lossless data compression |

Question 10: SAN and NAS

1. Describe the characteristics and operation of a Storage Area Network (SAN) and Network Attached Storage (NAS).

|  |
| --- |
| * A NAS is a single storage device that serves data over ethernet and is relatively inexpensive and commercially available * A SAN is a tight network of *multiple* devices that is more expensive and typically used for larger businesses and requires much more IT administration than a NAS |