Arsh Chauhan
CS 321
Assignment 5

A) The MMU translates memory references made by machine code from a logical to physical address. The MMU does not need to be a part of the processor but can sit anywhere in-between the processor and memory. As such, companies could build they own MMU and inserted it between the processor and memory. The machine code logical address would go into the MMU which would translate it to a corresponding physical address before sending it off to the main processor.

B) Page size = 8 KB = 2^{32} B
Offset = 13 bits
Number of page table entries = 2^{35}

C) Yes, the POSIX open system call is necessary. If this system call did not exist, every file operation would need to specify the name of the file to be accessed. This means that the operating system would have to fetch the file's inode for every operation, while caching the inode would solve the latency issue with fetching it before every operation. An issue that would arise with caching is determining when the cache would be flushed. A timer could be used to solve this issue. However, a timer adds more complexity and the possibility of introducing an interrupt which would lead to clumsy programming and higher overhead.

D) Every new file created in a higher "directory" will contain the name of all the files In directories under it
e.g usrarshhomeexam.txt : exam.txt under usr/arsh/home

E) Storing the beginning of a file in the same block as the inode would cut down the number of disk accesses needed while reading a file from two to one for files whose size is less than or equal to the pre-determined size for the "first part" of a file. A well implemented system would be designed such that the pre-allocated block space for the "first part" of a file is big enough to accommodate average sized files. If well implemented, this system could lead to most read operations consisting of a single disk access. Even if the file does not fit into the allocated space, it would still lead to one less disk access than would be required if the inode data was stored in a different block.

F) Delhi 2013, state government elections lead to no major party or coalition obtaining a clear majority. The leading party decided not to form the government and the government was formed by the runner up party (AAP) with outside support from a third party. Unable to fulfill a major agenda of his election manifesto, the chief minister resigned after 49 days leading to dissolution of the government. With the BJP (the party having won most seats in the elections) not wanting to form a government without a clear majority, Delhi went under presidents rule. Presidents' rule lasted for an entire year while all parties refused to accept the governor’s request to form a government. Fresh elections were held in February 2015 wherein which the AAP won 67/70 seats. AAP formed the government and ended the year long gridlock.

G) Many corporate enterprises as well as home users regularly backup data on their hard-drive onto various kinds of external media. Let us consider the case where an enterprise does nightly backups to an external tape for offsite storage. Backing up data from the hard drive onto tape means that the backup program needs to have concurrent access to both the hard drive as well as the tape drive. Preventing circular wait by not only allowing each process to access one resource at a time would considerably slow down the backup process since data form the hard drive would have to first be copied into memory and then the hard drive released and tape drive acquired before the data can be transferred from memory onto the tape. This would cause huge overhead in terms of handling resources as well as slowly copying small parts of disk data into memory and then onto the tape instead of directly copying data from drive to tape.