Group 1 (Roll ending 0,3,5,7):

1. Define virtual memory and list four key benefits it offers to an operating system in m anaging memory and processes. (2.5 marks)
2. Describe the sequential steps an operating system takes to handle a page fault, from t he initial trap to the instruction restart. (2.5 marks)
3. Explain the First-In-First-Out (FIFO) page replacement algorithm. Illustrate its limit ation by describing Belady's Anomaly. (2.5 marks)

Group 2 (Roll ending 1,6,8):

1. Explain how a process's virtual address space is organized, particularly concerning th e stack and heap, and elaborate on how this design maximizes address space use and support s sparse address spaces. (2.5 marks)
2. Using the provided performance parameters (memory access time = 200 nanoseconds, avera ge page-fault service time = 8 milliseconds), calculate the Effective Access Time (EAT) if the page fault rate is 1 in 1000 accesses (p = 0.001). Show your calculation. (2.5 marks)
3. Compare and contrast Global and Local page replacement policies in terms of their impa ct on individual process performance consistency and overall system throughput. (2.5 marks )

Group 3 (Roll ending 2,4,9):

1. Describe the Copy-on-Write (COW) technique, explaining how it enables more efficient p rocess creation during operations like `fork()` and what happens when a shared page is mod ified. (2.5 marks)
2. Explain the Least Recently Used (LRU) page replacement algorithm. Discuss two common i mplementation methods (counter and stack) and their respective trade-offs in terms of comp lexity and efficiency. (2.5 marks)
3. Define "thrashing" in the context of virtual memory. Explain its root causes and the d etrimental effects it has on CPU utilization and overall system performance. (2.5 marks)