Lab Assignment Question: Implementing and Comparing Page Replacement Policies

1) Page Replacement Simulation Framework

Objective:

Create a simulation framework to evaluate the performance of page replacement algorithms.

Specifications:

a) Memory Setup: Simulate a physical memory with 'm' available page frames.
b) Reference String: Use a provided Reference String as input. Example: 0, 1, 2, 0, 3, 4, 1, 0, 3, 2, 4, 5, 1, 2, 3.
c) Logic: Implement the simulation loop:
    - Iterate through the reference string, accessing one page at a time.
    - For each page access, check if the page is currently in one of the frames or if it must be brought in (Page Fault). Follow a pure demand paging system.
    - If a Page Fault occurs and the frames are full, a replacement policy must be used to choose a victim page to evict.
    - Keep track of the total number of Page Faults.

2) Implementation and Comparison of Policies

Objective:

Implement page replacement policies within the framework and compare their performance.

Specifications:

Implement the following page replacement algorithms:

1. First-In, First-Out (FIFO)
2. Least Recently Used (LRU)
3. Optimal (OPT)

Analysis and Output:

a) Run the simulation for the given reference string (k frames) using all three policies.
b) For each policy, print:
    - A step-by-step trace showing the contents of the k frames and an indicator for a Page Fault (PF) at each memory access.
    - The Total Number of Page Faults.
    - Compare the performance (based on the number of page faults)
    - Try for different examples and check if Belady's anomaly is observed or not?