OPTIMAL PAFE REPLACEMENT

```
import java.util.*;


public class OptimalPageReplacement {


  public static void main(String[] args) {
    Scanner sc = new Scanner(System.in);


    System.out.print("Enter the number of page references: ");
    int n = sc.nextInt();


    System.out.print("Enter the page reference sequence: ");
    int[] pages = new int[n];
    for (int i = 0; i < n; i++) {
      pages[i] = sc.nextInt();
    }


    System.out.print("Enter the number of frames: ");
    int f = sc.nextInt();


    List<Integer> frames = new ArrayList<>(); // holds pages in frames
    int hits = 0, faults = 0;


    System.out.println("\n===== Optimal Page Replacement Simulation =====");


    for (int i = 0; i < n; i++) {
      int p = pages[i];
      boolean hit = false;


      // Check if page is already in frame
      if (frames.contains(p)) {
```

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  hit = true;
  hits++;
} else {
  faults++;
  if (frames.size() < f) {
    frames.add(p);
  } else {
    // choose victim: page used farthest in future (or never)
    int replaceIdx = 0;
    int farthest = -1;

    for (int j = 0; j < f; j++) {
      int nextUse = -1;
      for (int k = i + 1; k < n; k++) {
        if (frames.get(j) == pages[k]) {
          nextUse = k;
          break;
        }
      }

      if (nextUse == -1) {
        replaceIdx = j;
        break; // never used again
      }

      if (nextUse > farthest) {
        farthest = nextUse;
        replaceIdx = j;
      }
    }
```

```java
                    frames.set(replaceIdx, p);
                }
            }

            // Show frames
            System.out.print("After referencing page " + p + " → ");
            for (int j = 0; j < f; j++) {
                if (j < frames.size())
                    System.out.print(frames.get(j) + " ");
                else
                    System.out.print("- ");
            }
            System.out.println(hit ? " (Hit)" : " (Fault)");
        }

        System.out.println("\n===== Final Results =====");
        System.out.println("Total Page References: " + n);
        System.out.println("Total Page Hits:       " + hits);
        System.out.println("Total Page Faults:     " + faults);

        double hitRatio = (hits * 100.0) / n;
        double faultRatio = (faults * 100.0) / n;

        System.out.printf("Hit Ratio:   %.4f%%\n", hitRatio);
        System.out.printf("Fault Ratio: %.4f%%\n", faultRatio);

        sc.close();
    }
}
```