Operating Systems Lab Assignment

Logical-to-Physical Address Translation and Frame Identification Using Paging in C

Objective: To implement a paging-based memory management simulation that converts a logical address into a physical address and identifies the corresponding physical memory frame.

Problem Statement

Write a C program to simulate paging-based memory management. The program must accept a logical address from the user, translate it into a physical address using a page table, and identify the physical frame containing the requested data.

Consider the following memory configuration:

- **Page size / Block size:** 1024 bytes (1 KB)
- **Logical address space:** 8 KB
- **Physical memory size:** 4 KB
- **Number of pages:** 8
- **Number of frames:** 4

Assume that the following page table is provided:

Page Number	Frame Number
0	2
1	0
2	3
3	1
4	-1
5	-1
6	-1
7	-1

A frame number of -1 indicates that the corresponding page is not currently loaded into physical memory.

Tasks

1. Define the page size, logical address space, and physical memory size in your C program.
2. Create a page table using an array to store the frame number associated with each page.
3. Accept a logical address from the user.
4. Calculate the page number and offset from the logical address.
5. Use the page table to identify the corresponding physical frame.
6. If the page is present in physical memory, calculate the physical address using:
   Physical Address = (Frame Number × Page Size) + Offset
7. Offset=Logical Address mod Page size
8. Display the following information:
   - Logical address
   - Page number
   - Offset
   - Corresponding frame number
   - Physical address
   - Physical memory block containing the requested data
8. If the page is not present in physical memory, display `Page Fault`.
9. If the logical address is outside the valid logical address space, display `Invalid Logical Address`.

Example 1: Valid Logical Address

Input:

```
Enter logical address: 2500
```

Expected Output:

```
Logical Address       : 2500
```

```
Page Number           : 2
Offset                : 452
Frame Number          : 3
Physical Address      : 3524
Physical Memory Block : Frame 3
```

Example 2: Page Fault

Input:

```
Enter logical address: 4500
```

Expected Output:

```
Logical Address : 4500
Page Number     : 4
Offset          : 404
Status          : Page Fault
```

Example 3: Invalid Logical Address

Input:

```
Enter logical address: 9000
```

Expected Output:

```
Invalid Logical Address
```

Submission Requirements

1. Submit the complete C program.
2. Test the program with at least five logical addresses.
3. Include examples of successful address translation, page fault, and invalid logical address.