



Nagar Yuwak Shikshan Sanstha's
Yeshwantrao Chavan College of Engineering
(An Autonomous Institution affiliated to Rashtrasant Tukadoji Maharaj Nagpur University)
Hingna Road, Wanadongri, Nagpur - 441 110
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Department of Computer Science and Engineering (IOT)

YCCE

Vision

"To become the most preferred institution providing innovative, research and value based, professional education for the society at large".

Mission

YCCE is committed to

- Attract besttalent and create learning ambience
- Practice Innovative teaching-learning & research
- Integrate Industry-Institute Collaborations
- Nurture students towards holistic development and choicest career

Department

Vision of the Department

To be a well-known center for pursuing computer education through innovative pedagogy, value-based education and industry collaboration.

Mission of the Department

To establish learning ambience for ushering in computer engineering professionals in core and multidisciplinary arena by developing problem-solving skills through emerging technologies.



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23CT1402		Lab: Operating Systems										
Name of the Student: Parth Bhedurkar		Semester/ Section: 5 A										
Roll No: 52		Enrollment Number: 23071495										

Sr. No.	COs	Course Outcomes	POs											PSOs	
			1	2	3	4	5	6	7	8	9	10	11	PSO 1	PSO2
1	CO1	Demonstrate the ability to execute Linux process management, memory management, and shell commands to manage system resources efficiently.	3	3	3	-		-	-	-	-	-	3	3	
2	CO2	Develop programs utilizing system calls, thread programming, and page replacement algorithms to simulate and analyze operating system functionalities.	3	3	3	-	-	-	-	-	-	-	3	3	
3	CO3	Design and implement process scheduling, memory allocation, deadlock detection algorithms to address real-world operating system challenges.	3	3	3	-		-	-	-	-	-	3	3	
		Avg	3	3	-		-	-	-	-	-	-	3	3	



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Practical No. 6

Aim: Simulate the page replacement algorithm first in first out (FIFO)

Theory:

A simulation of the **First-In, First-Out (FIFO)** page replacement algorithm involves tracking the sequence of page requests (the **reference string**) and how the pages are managed within a limited number of available **frames** in physical memory.

FIFO replaces the page that has been in memory for the **longest time**, regardless of how frequently or recently it has been used.

FIFO Page Replacement Simulation

Initial Setup

- Reference String: The sequence of pages requested by the CPU.

\$\$7, 0, 1, 2, 0, 3, 0, 4, 2, 3, 0, 3, 2, 1, 2, 0, 1, 7, 0, 1\$\$

- **Available Frames:** The number of slots in physical memory.

Code: #include <iostream>

#include <vector>

#include <list>

#include <algorithm>

using namespace std;

void fifo_page_replacement(const vector<int>& reference_string, int num_frames) {



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```
vector<int> frames;  
  
list<int> fifo_queue;  
int page_faults = 0;  
  
cout << "--- FIFO Simulation with " << num_frames << " Frames ---" << endl;  
  
cout << "Reference String: ";  
  
for (int page : reference_string) {  
  
    cout << page << " ";  
  
}  
  
cout << endl << endl;  
  
for (int page : reference_string) {  
  
    bool hit = false;  
  
    if (find(frames.begin(), frames.end(), page) != frames.end()) {  
  
        hit = true;  
  
    }  
}
```



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```
cout << "Request: " << page << " | ";  
  
if (hit) {  
    cout << "Action: HIT" << endl;  
}  
else {  
  
    page_faults++;  
  
    if (frames.size() < num_frames) {  
  
        frames.push_back(page);  
        fifo_queue.push_back(page);  
        cout << "Action: FAULT, Insert " << page << endl;  
    }  
    else {  
  
        int page_to_evict = fifo_queue.front();  
        fifo_queue.pop_front();  
    }  
}
```



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```
auto it = find(frames.begin(), frames.end(), page_to_evict);

if (it != frames.end()) {

    *it = page;

}

fifo_queue.push_back(page);

cout << "Action: FAULT, Replace " << page_to_evict << " with "
<< page << endl;

}

}

cout << " Current Frames: [";

for (size_t i = 0; i < frames.size(); ++i) {

    cout << frames[i] << (i < frames.size() - 1 ? "," : "");

}

for (int i = 0; i < num_frames - frames.size(); ++i) {

    cout << (frames.empty() && i == 0 ? "" : ",") << "-";

}

cout << "]" << endl;
```



```
        }
```



```
    double hit_rate = (double)(reference_string.size() - page_faults) /  
reference_string.size() * 100;  
  
    cout << "\n ----- " << endl;  
  
    cout << "Total Requests: " << reference_string.size() << endl;  
  
    cout << "Total Page Faults: " << page_faults << endl;  
  
    cout << "Hit Rate: " << hit_rate << "%" << endl;  
  
}
```



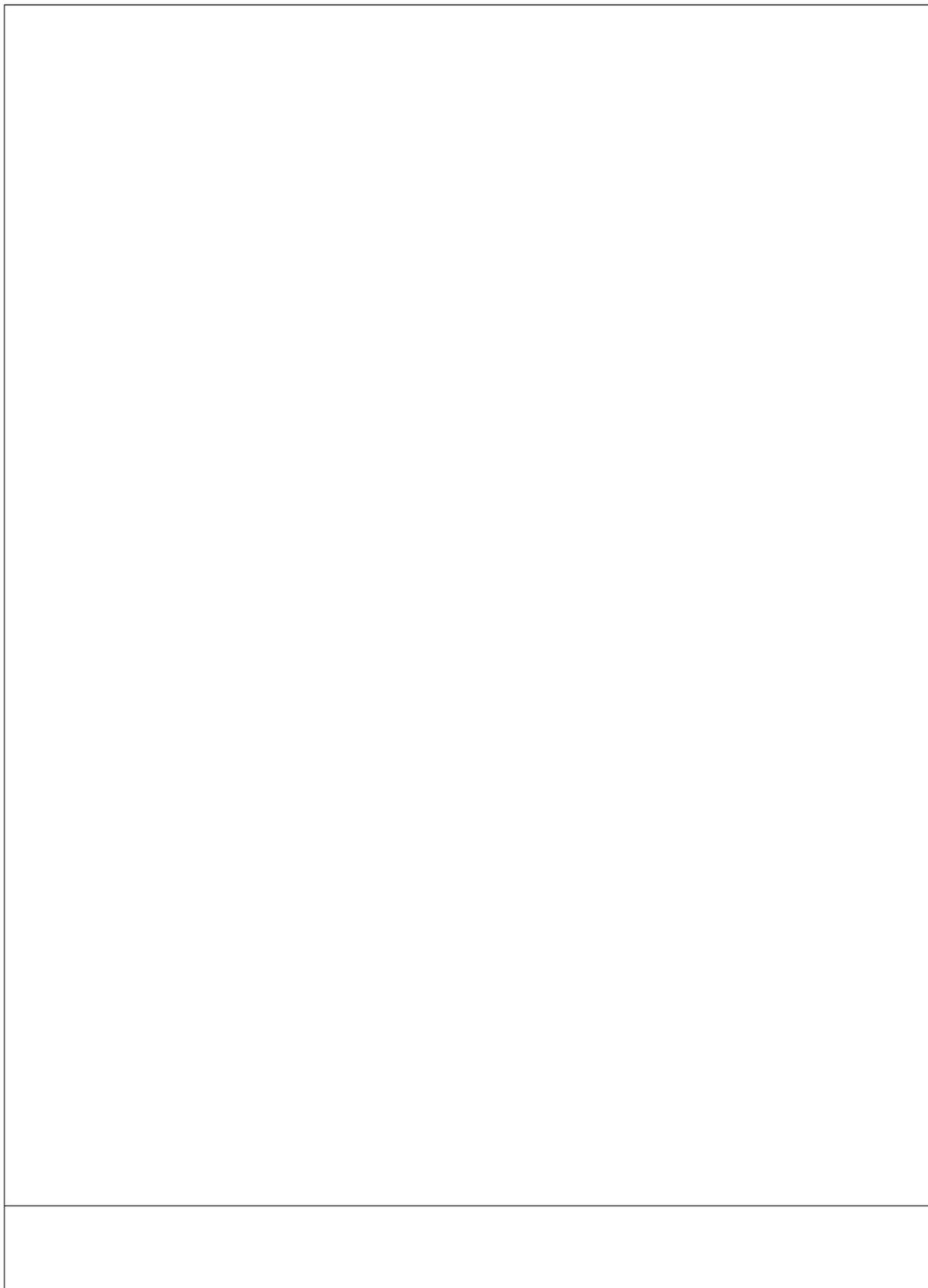
```
int main() {  
  
    vector<int> ref_str = {7, 0, 1, 2, 0, 3, 0, 4, 2, 3, 0, 3, 2, 1, 2, 0, 1, 7, 0, 1};  
  
    int num_frames = 3;  
  
    fifo_page_replacement(ref_str, num_frames);  
  
    return 0;  
}
```



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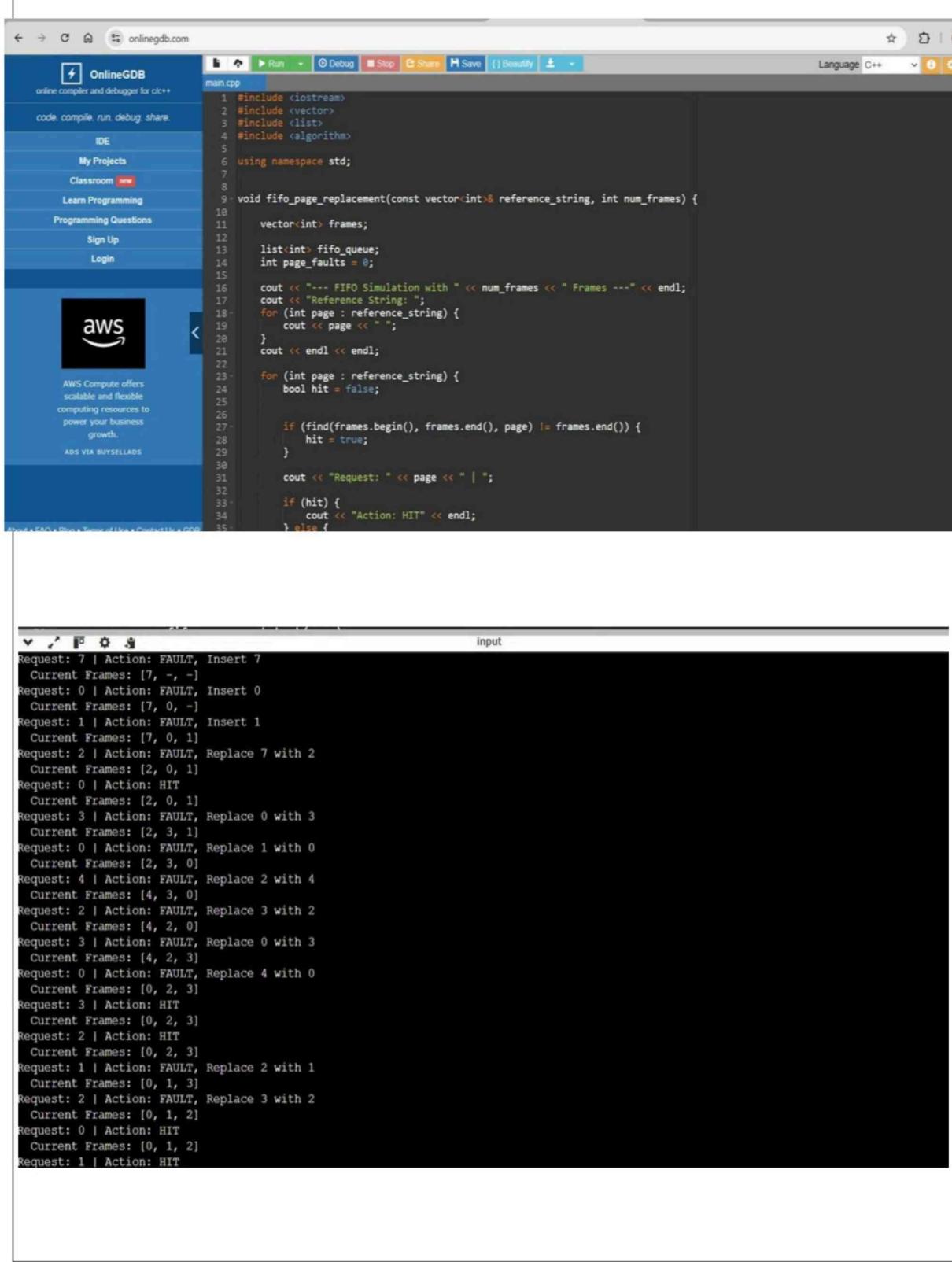
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OUTPUT (SCREEN SHOT) IF ANY:



The screenshot shows a web-based IDE interface for C++ development. The top part displays the code for a FIFO page replacement algorithm. The bottom part shows the execution results, including the sequence of requests, actions taken (FAULT or HIT), and the resulting state of the frames.

```
#include <iostream>
#include <vector>
#include <list>
#include <algorithm>
using namespace std;

void fifo_page_replacement(const vector<int>& reference_string, int num_frames) {
    vector<int> frames;
    list<int> fifo_queue;
    int page_faults = 0;

    cout << "---- FIFO Simulation with " << num_frames << " Frames ---" << endl;
    cout << "Reference String: ";
    for (int page : reference_string) {
        cout << page << " ";
    }
    cout << endl << endl;

    for (int page : reference_string) {
        bool hit = false;

        if (find(frames.begin(), frames.end(), page) != frames.end()) {
            hit = true;
        }

        cout << "Request: " << page << " | ";
        if (hit) {
            cout << "Action: HIT" << endl;
        } else {
            cout << "Action: FAULT" << endl;
            frames.push_back(page);
            fifo_queue.push_back(page);
            page_faults++;
        }
    }
}
```

Input:

```
Request: 7 | Action: FAULT, Insert 7
Current Frames: [7, -, -]
Request: 0 | Action: FAULT, Insert 0
Current Frames: [7, 0, -]
Request: 1 | Action: FAULT, Insert 1
Current Frames: [7, 0, 1]
Request: 2 | Action: FAULT, Replace 7 with 2
Current Frames: [2, 0, 1]
Request: 0 | Action: HIT
Current Frames: [2, 0, 1]
Request: 3 | Action: FAULT, Replace 0 with 3
Current Frames: [2, 3, 1]
Request: 0 | Action: FAULT, Replace 1 with 0
Current Frames: [2, 3, 0]
Request: 4 | Action: FAULT, Replace 2 with 4
Current Frames: [4, 3, 0]
Request: 2 | Action: FAULT, Replace 3 with 2
Current Frames: [4, 2, 0]
Request: 3 | Action: FAULT, Replace 0 with 3
Current Frames: [4, 2, 3]
Request: 0 | Action: FAULT, Replace 4 with 0
Current Frames: [0, 2, 3]
Request: 3 | Action: HIT
Current Frames: [0, 2, 3]
Request: 2 | Action: HIT
Current Frames: [0, 2, 3]
Request: 1 | Action: FAULT, Replace 2 with 1
Current Frames: [0, 1, 3]
Request: 2 | Action: FAULT, Replace 3 with 2
Current Frames: [0, 1, 2]
Request: 0 | Action: HIT
Current Frames: [0, 1, 2]
Request: 1 | Action: HIT
```



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Conclusion: Simulate the page replacement algorithm is done successfully.