

LAB 9

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Aim: Implement the all page replacement algorithms

a) FIFO b) LRU c) Optimal

Code:

```
1  #include <iostream>
2  #include <algorithm>
3  using namespace std;
4
5  bool pageExists(int frames[], int n, int page) {
6      for (int i = 0; i < n; i++) {
7          if (frames[i] == page) return true;
8      }
9      return false;
10 }
11
12 void fifoPageReplacement(int pages[], int n, int capacity) {
13     int frames[capacity] = {-1};
14     int front = 0, pageFaults = 0;
15
16     cout << "FIFO Page Replacement\n";
17     for (int i = 0; i < n; i++) {
18         if (!pageExists(frames, capacity, pages[i])) {
19             frames[front] = pages[i];
20             front = (front + 1) % capacity;
21             pageFaults++;
22         }
23         cout << "Frames after accessing page " << pages[i] << ": ";
24         for (int j = 0; j < capacity; j++) {
25             cout << (frames[j] == -1 ? "_" : to_string(frames[j])) << " ";
26         }
27         cout << endl;
28     }
29     cout << "Total Page Faults: " << pageFaults << endl << endl;
30 }
31
32 void lruPageReplacement(int pages[], int n, int capacity) {
33     int frames[capacity] = {-1};
34     int recent[capacity] = {0}; // Tracks recent access times
35     int time = 0, pageFaults = 0;
36
37     cout << "LRU Page Replacement\n";
38     for (int i = 0; i < n; i++) {
39         time++;
40         if (!pageExists(frames, capacity, pages[i])) {
```

```

41         int lruIndex = 0, minTime = time;
42         for (int j = 0; j < capacity; j++) {
43             if (frames[j] == -1) {
44                 lruIndex = j;
45                 break;
46             }
47             if (recent[j] < minTime) {
48                 minTime = recent[j];
49                 lruIndex = j;
50             }
51         }
52         frames[lruIndex] = pages[i];
53         pageFaults++;
54     }
55     for (int j = 0; j < capacity; j++) {
56         if (frames[j] == pages[i]) {
57             recent[j] = time;
58             break;
59         }
60     }
61     cout << "Frames after accessing page " << pages[i] << ": ";
62     for (int j = 0; j < capacity; j++) {
63         cout << (frames[j] == -1 ? "_" : to_string(frames[j])) << " ";
64     }
65     cout << endl;
66 }
67 cout << "Total Page Faults: " << pageFaults << endl << endl;
68 }
69
70 void optimalPageReplacement(int pages[], int n, int capacity) {
71     int frames[capacity] = {-1};
72     int pageFaults = 0;
73
74     cout << "Optimal Page Replacement\n";
75     for (int i = 0; i < n; i++) {
76         if (!pageExists(frames, capacity, pages[i])) {
77             int replaceIndex = -1, farthest = i + 1;
78             for (int j = 0; j < capacity; j++) {
79                 if (frames[j] == -1) {
80                     replaceIndex = j;

```

```

81         break;
82     }
83     int nextUse = n; // Assume page won't be used again
84     for (int k = i + 1; k < n; k++) {
85         if (frames[j] == pages[k]) {
86             nextUse = k;
87             break;
88         }
89     }
90     if (nextUse > farthest) {
91         farthest = nextUse;
92         replaceIndex = j;
93     }
94 }
95 frames[replaceIndex] = pages[i];
96 pageFaults++;
97 }
98 cout << "Frames after accessing page " << pages[i] << ": ";
99 for (int j = 0; j < capacity; j++) {
100     cout << (frames[j] == -1 ? "_" : to_string(frames[j])) << " ";
101 }
102 cout << endl;
103 }
104 cout << "Total Page Faults: " << pageFaults << endl << endl;
105 }
106
107 int main() {
108     int n;
109     cout << "Enter the number of pages: ";
110     cin >> n;
111
112     int pages[n];
113     cout << "Enter the page sequence: ";
114     for (int i = 0; i < n; i++) {
115         cin >> pages[i];
116     }
117
118     int capacity;
119     cout << "Enter the number of frames: ";
120     cin >> capacity;
121
122     fifoPageReplacement(pages, n, capacity);
123     lruPageReplacement(pages, n, capacity);
124     optimalPageReplacement(pages, n, capacity);
125
126     return 0;
127 }

```

Output:

```
PS C:\Users\HP\Desktop\pract> & 'c:\Users\HP\.vscode\extensions\ms-vscode.
debugAdapters\bin\WindowsDebugLauncher.exe' '--stdin=Microsoft-MIEngine-In-
crosoft-MIEngine-Out-ipc0h2gk.lo3' '--stderr=Microsoft-MIEngine-Error-kn5b3
MIEngine-Pid-5z4bfz5b.jjf' '--dbgExe=C:\msys64\ucrt64\bin\gdb.exe' '--inter
Enter the number of pages: 13
Enter the page sequence: 7 0 1 2 0 3 0 4 2 3 0 3 2
Enter the number of frames: 3
FIFO Page Replacement
Frames after accessing page 7: 7 0 0
Frames after accessing page 0: 7 0 0
Frames after accessing page 1: 7 1 0
Frames after accessing page 2: 7 1 2
Frames after accessing page 0: 0 1 2
Frames after accessing page 3: 0 3 2
Frames after accessing page 0: 0 3 2
Frames after accessing page 4: 0 3 4
Frames after accessing page 2: 2 3 4
Frames after accessing page 3: 2 3 4
Frames after accessing page 0: 2 0 4
Frames after accessing page 3: 2 0 3
Frames after accessing page 2: 2 0 3
Total Page Faults: 9
LRU Page Replacement
Frames after accessing page 7: 7 0 0
Frames after accessing page 0: 7 0 0
Frames after accessing page 1: 7 0 1
Frames after accessing page 2: 2 0 1
Frames after accessing page 0: 2 0 1
Frames after accessing page 3: 2 0 3
Frames after accessing page 0: 2 0 3
Frames after accessing page 4: 4 0 3
Frames after accessing page 2: 4 0 2
Frames after accessing page 3: 4 3 2
Frames after accessing page 0: 0 3 2
Frames after accessing page 3: 0 3 2
Frames after accessing page 2: 0 3 2
Total Page Faults: 8
Optimal Page Replacement
Frames after accessing page 7: 7 0 0
Frames after accessing page 0: 7 0 0
Frames after accessing page 1: 1 0 0
Frames after accessing page 2: 2 0 0
Frames after accessing page 0: 2 0 0
Frames after accessing page 3: 3 0 0
Frames after accessing page 0: 3 0 0
Frames after accessing page 4: 3 4 0
Frames after accessing page 2: 3 2 0
Frames after accessing page 3: 3 2 0
Frames after accessing page 0: 3 2 0
Frames after accessing page 3: 3 2 0
Frames after accessing page 2: 3 2 0
Total Page Faults: 6
```