Source Code:

```
#include <stdio.h>
void fifo(int nf, int np, int pages[]) {
   int frames[nf], hit = 0, fault = 0, i, j;
   for (i = 0; i < nf; i++) frames[i] = -1;
   printf("FIFO:\n");
   for (i = 0; i < nf; i++) printf("F%d\t", i + 1);
   printf("\n");
   for (i = 0; i < np; i++) {
      int page_found = 0;
      for (j = 0; j < nf; j++) {
         if (pages[i] == frames[j]) {
            page_found = 1;
            hit++;
            break;          }       }
      if (!page_found) {
         for (j = 0; j < nf; j++) {
            if (frames[j] == -1) {
               fault++;
               frames[j] = pages[i];
               break;              }          }
         if (j == nf) {
            fault++;
            for (j = 0; j < nf - 1; j++) frames[j] = frames[j + 1];
            frames[nf - 1] = pages[i];          }       }
      for (j = 0; j < nf; j++) {
         if (frames[j] == -1) printf("-\t");
         else printf("%d\t", frames[j]);
```

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        }
        printf("\n");
    }
    printf("Number of Page Faults: %d\n", fault);
    printf("Number of Page Hits: %d\n", hit);
    printf("Hit Ratio: %f%%\n", (float)hit / (float)(fault + hit) * 100);}

void lru(int nf, int np, int pages[]) {
    int frames[nf], timestamp[nf], hit = 0, fault = 0, i, j;
    // Initialize frames and timestamps to -1, indicating empty frames
    for (i = 0; i < nf; i++) {
        frames[i] = -1;
        timestamp[i] = -1;    }
    // Print a header indicating the LRU algorithm
    printf("\nLRU:\n");
    // Iterate through each page reference
    for (i = 0; i < np; i++) {
        int found = 0;
        int page = pages[i];
        // Check if the page is already in frames
        for (j = 0; j < nf; j++) {
            if (frames[j] == page) {
                // If found, mark found as 1, increment hit count, update timestamp, and break the loop
                found = 1;
                hit++;
                timestamp[j] = i;
                break;          }       }
        // If the page is not found in frames
        if (!found) {
```

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            // Find the index of the frame with the minimum timestamp
            int min = timestamp[0];
            int index = 0;
            for (j = 1; j < nf; j++) {
               if (timestamp[j] < min) {
                  min = timestamp[j];
                  index = j;              }          }
            // Replace the page at the index with the minimum timestamp
            frames[index] = page;
            timestamp[index] = i;
            fault++;       }
         // Print the current state of frames after each page reference
         printf("%d : \t", page);
         for (j = 0; j < nf; j++)
            printf("%d\t", frames[j]);
         printf("\n");    }
      // Print the total number of page faults, page hits, and hit ratio
      printf("\nNumber of Page Faults: %d\n", fault);
      printf("Number of Page Hits: %d\n", hit);
      printf("Hit Ratio: %.2f%%\n", (float)hit / (float)(fault + hit) * 100);}
   void optimal(int nf, int np, int pages[]) {
      int fr[nf], count[nf], fault = 0, hit = 0, dist = 0, k = 0, i, j;
      for (i = 0; i < nf; i++) {
         count[i] = 0;
         fr[i] = -1;    }
      printf("\nOPTIMAL:\n");
      for (i = 0; i < np; i++) {
         int flag = 0;
         for (j = 0; j < nf; j++) {
```

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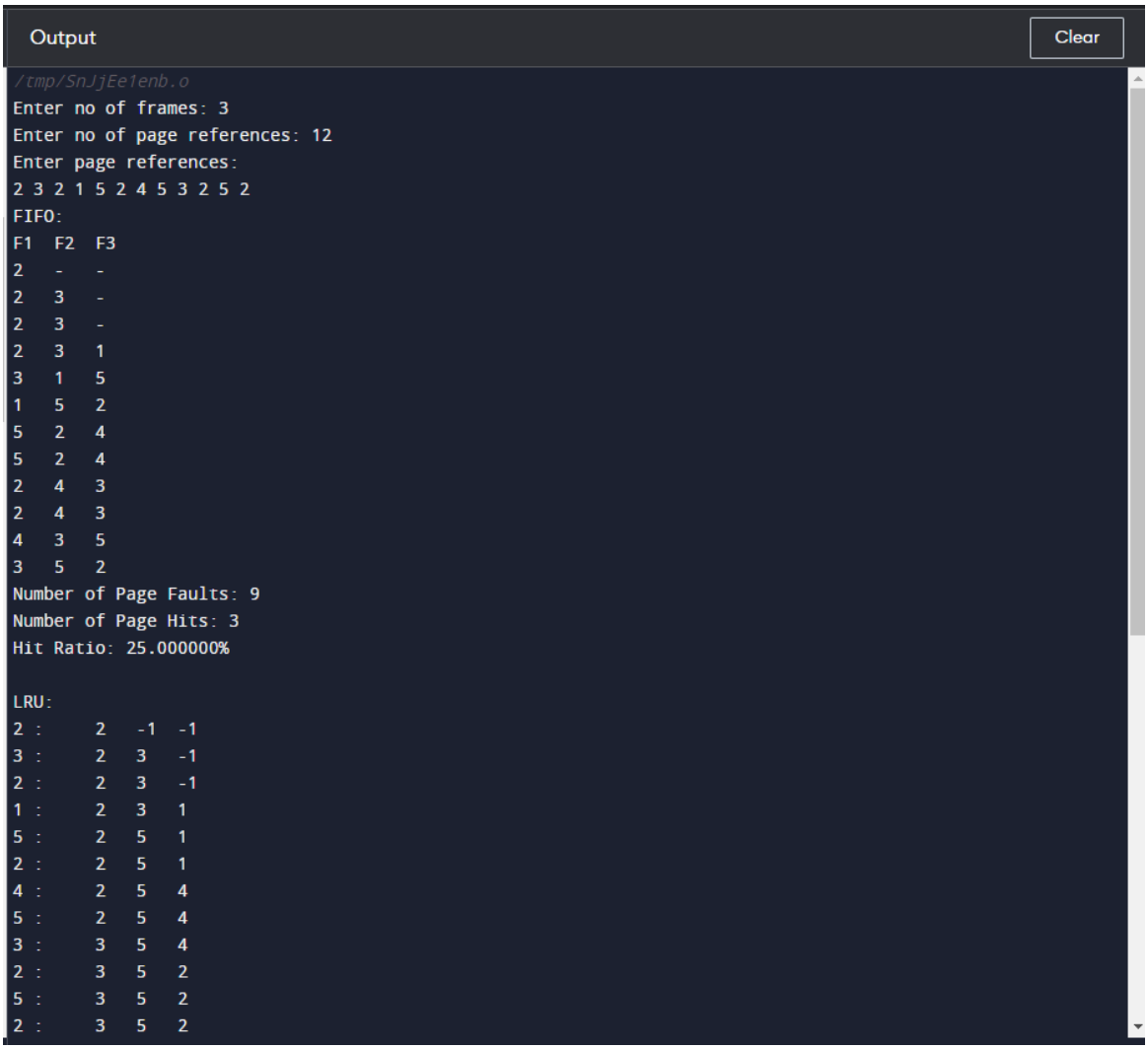
            if (pages[i] == fr[j]) {
                flag = 1;
                hit++;
                break;          }       }
        if (!flag && k < nf) {
            fault++;
            fr[k] = pages[i];
            k++;
        } else if (!flag && k == nf) {
            fault++;
            for (j = 0; j < nf; j++) {
                int current = fr[j];
                for (int c = i; c < np; c++) {
                    if (current != pages[c]) count[j]++;
                    else break;             }          }
            int max_count = 0, p;
            for (int m = 0; m < nf; m++) {
                if (count[m] > max_count) {
                    max_count = count[m];
                    p = m;              }          }
            fr[p] = pages[i];       }
        printf("\npage %d frame\t", pages[i]);
        for (j = 0; j < nf; j++) printf("%d\t", fr[j]);    }
    printf("\nNumber of Page Faults: %d\n", fault);
    printf("Number of Page Hits: %d\n", hit);
    printf("Hit Ratio: %f%%\n", (float)hit / (float)(fault + hit) * 100);}
int main() {
    int nf, np, i;
    printf("Enter no of frames: ");
```

```
scanf("%d", &nf);
printf("Enter no of page references: ");
scanf("%d", &np);
int pages[np];
printf("Enter page references: \n");
for (i = 0; i < np; i++) scanf("%d", &pages[i]);
fifo(nf, np, pages);
lru(nf, np, pages);
optimal(nf, np, pages);
return 0;        }
```



Output Clear

```
LRU:
2 :     2   -1  -1
3 :     2   3   -1
2 :     2   3   -1
1 :     2   3   1
5 :     2   5   1
2 :     2   5   1
4 :     2   5   4
5 :     2   5   4
3 :     3   5   4
2 :     3   5   2
5 :     3   5   2
2 :     3   5   2

Number of Page Faults: 7
Number of Page Hits: 5
Hit Ratio: 41.67%

OPTIMAL:

page 2 frame    2   -1  -1
page 3 frame    2   3   -1
page 2 frame    2   3   -1
page 1 frame    2   3   1
page 5 frame    2   3   5
page 2 frame    2   3   5
page 4 frame    2   3   4
page 5 frame    2   3   5
page 3 frame    2   3   5
page 2 frame    2   3   5
page 5 frame    2   3   5
page 2 frame    2   3   5
Number of Page Faults: 6
Number of Page Hits: 6
Hit Ratio: 50.000000%
```