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#include<iostream>
using namespace std;

bool check(int *present, int noFrames, int e){
    for(int i=0; i<noFrames; i++){
        if(present[i]==e) return true;
    }
    return false;
}

int search(int *arr, int size, int e, bool st){
    if(st){
        for(int i=0; i<size; i++){
            if(arr[i]==e) return i;
        }
    }
    else{
        for(int i=size-1; i>=0; i--){
            if(arr[i]==e) return i;
        }
    }
    return -1;
}

int FindLRU(int *present, int *pages, int noFrames, int size){
    int mn=INT16_MAX;
    for(int i=0; i<noFrames; i++){
        mn=min(search(pages, size, present[i], false), mn);
    }
    return mn;
}

void LRUPageRepAlgo(int *pages, int noPages, int noFrames){
    int chance=0, miss=0, hits=0;

    int *present = new int[noFrames];
    for(int i=0; i<noFrames; i++) present[i]=-1;

    // declare a chart for printing
    int **chart = new int*[noFrames+2];
    for(int i=0; i<noFrames+2; i++){
        chart[i] = new int[noPages];
        for(int j=0; j<noPages; j++){
            chart[i][j]=-1;
        }
    }
}

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    }
}

for(int i=0; i<noPages; i++){
    chart[0][i] = pages[i];
}

int k=0;

// FIFO
for(int i=0; i<noFrames; i++){

    bool missOrHit=true;

    // if page no was not found in any of the frames
    // miss case
    if(!check(present, noFrames, pages[i])){
        present[chance]=pages[i];
        chance=(chance+1)%noFrames;
        missOrHit=false;
        miss++;
    }
    // hit case
    else{
        hits++;
    }

    // add the values in the chart
    int j;
    for(j=0; j<noFrames; j++){
        chart[j+1][k] = present[j];
    }

    // update miss or hit in chart
    missOrHit ? chart[j+1][k]=1 : chart[j+1][k]=0;
    k++;
}

// LRU
for(int i=noFrames; i<noPages; i++){

    bool missOrHit=true;
    // if page no was not found in any of the frames
    // miss case
    if(!check(present, noFrames, pages[i])){

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        int lruIdx = FindLRU(present, pages, noFrames, i+1);
        int presentPageIdx = search(present, noFrames, pages[lruIdx],
true);

        present[presentPageIdx]=pages[i];
        missOrHit=false;
        miss++;
    }
    // hit case
    else{
        hits++;
    }

    // add the values in the chart
    int j;
    for(j=0; j<noFrames; j++){
        chart[j+1][k] = present[j];
    }

    // update miss or hit in chart
    missOrHit ? chart[j+1][k]=1 : chart[j+1][k]=0;
    k++;
}

cout<<endl<<endl<<"Page Fault Details : "<<endl<<endl;

// Printing the chart
int NOH = (7*noPages)+1;

// First row
for(int j=0; j<noPages; j++){
    printf("    %2d  ", chart[0][j]);
}
cout<<endl;
for(int k=0; k<NOH; k++){
    cout<<"-";
}
cout<<endl;

// middle portion
for(int i=1; i<noFrames+1; i++){
    for(int j=0; j<noPages; j++){
        if(chart[i][j]==-1) printf("|          ", chart[i][j]);
        else printf("|    %2d  ", chart[i][j]);
    }
    cout<<"|"<<endl;
}

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        for(int k=0; k<NOH; k++){
            cout<<"-";
        }
        cout<<endl;
    }

    // last row
    for(int j=0; j<noPages; j++){
        if(chart[noFrames+1][j]==1) cout<<"| hit ";
        else cout<<"| miss ";
    }
    cout<<"| "<<endl;
    for(int k=0; k<NOH; k++){
        cout<<"-";
    }

    cout<<endl<<endl<<"Average Page Fault : "<<((float)miss/noPages)<<" or
"<<miss<<"/"<<noPages<<endl<<endl;
}

int main(){
    int noPages, noFrames;

    cout<<"\n\nName : Mohd Adil \nRoll No : 20BCS042";
    cout<<"\n\nEnter No of Pages and Frames : ";
    cin>>noPages>>noFrames;

    int *pages = new int[noPages];
    cout<<"\n\nEnter the Pages : ";
    for(int i=0; i<noPages; i++) cin>>pages[i];

    LRUPageRepAlgo(pages, noPages, noFrames);
    return 0;
}

// sample input:
// 7 3 1 3 0 3 5 6 3
// 14 4 7 0 1 2 0 3 0 4 2 3 0 3 2 3

```

OUTPUT

Name : Mohd Adil
Roll No : 20BCS042

Enter No of Pages and Frames : 14 4

Enter the Pages : 7 0 1 2 0 3 0 4 2 3 0 3 2 3

Page Fault Details :

7	0	1	2	0	3	0	4	2	3	0	3	2	3
7	7	7	7	7	3	3	3	3	3	3	3	3	3
0	0	0	0	0	0	0	0	0	0	0	0	0	0
1	1	1	1	1	1	1	4	4	4	4	4	4	4
2	2	2	2	2	2	2	2	2	2	2	2	2	2
miss	miss	miss	miss	hit	miss	hit	miss	hit	hit	hit	hit	hit	hit

Average Page Fault : 0.428571 or 6/14