1) **Write a C program to simulate disk scheduling algorithms**

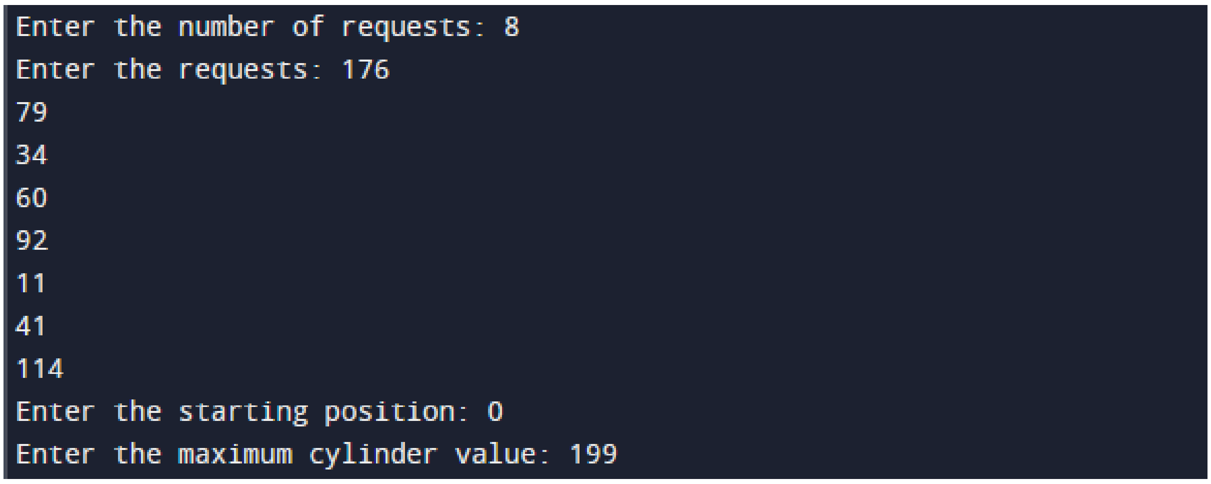
a) FCFS
b) SCAN
c) C-SCAN

Code:

```
#include <stdio.h>

#include <stdlib.h>


#define MAX_REQUESTS 100


void fcfs(int requests[], int n, int start) {

   int totalSeek = 0, current = start;


   printf("FCFS Disk Scheduling:\n");


   for (int i = 0; i < n; i++) {

      totalSeek += abs(current - requests[i]);

      printf("Move from %d to %d\n", current, requests[i]);

      current = requests[i];

   }


   printf("Total Seek Distance: %d\n", totalSeek);

}


void scan(int requests[], int n, int start, int maxCylinder) {

   int totalSeek = 0, current = start;


   printf("SCAN Disk Scheduling:\n");


   int direction = 1; // 1 for right, -1 for left

   int maxIndex = (direction == 1) ? maxCylinder : 0;
```

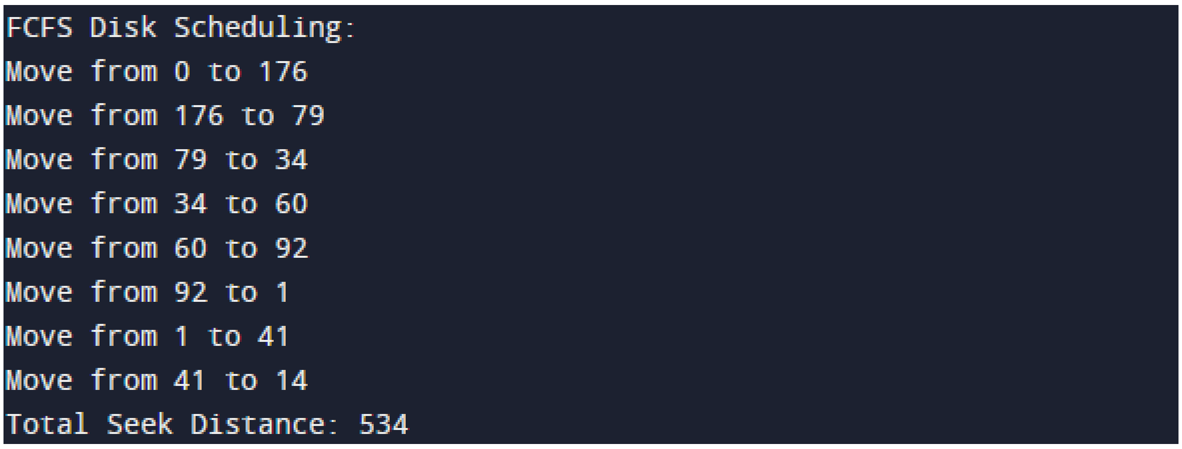
```
    for (int i = 0; i < n; i++) {
        totalSeek += abs(current - requests[i]);
        printf("Move from %d to %d\n", current, requests[i]);
        current = requests[i];
    }

    totalSeek += abs(current - maxIndex);
    printf("Move from %d to %d\n", current, maxIndex);

    for (int i = n - 1; i >= 0; i--) {
        totalSeek += abs(maxIndex - requests[i]);
        printf("Move from %d to %d\n", maxIndex, requests[i]);
        maxIndex = requests[i];
    }

    printf("Total Seek Distance: %d\n", totalSeek);
}

void cScan(int requests[], int n, int start, int maxCylinder) {
    int totalSeek = 0, current = start;

    printf("C-SCAN Disk Scheduling:\n");

    int maxIndex = maxCylinder;

    for (int i = 0; i < n; i++) {
        totalSeek += abs(current - requests[i]);
        printf("Move from %d to %d\n", current, requests[i]);
        current = requests[i];
    }
    totalSeek += abs(current - maxIndex);
    printf("Move from %d to %d\n", current, maxIndex);

    current = 0;
    for (int i = 0; i < n; i++) {
        totalSeek += abs(current - requests[i]);
        printf("Move from %d to %d\n", current, requests[i]);
        current = requests[i];
    }

    printf("Total Seek Distance: %d\n", totalSeek);
}

int main() {
    int requests[MAX_REQUESTS], n, start, maxCylinder;

    printf("Enter the number of requests: ");
    scanf("%d", &n);

    if (n > MAX_REQUESTS) {
        printf("Maximum number of requests exceeded.\n");
        return 1;
    }

    printf("Enter the requests: ");
    for (int i = 0; i < n; i++)
        scanf("%d", &requests[i]);

    printf("Enter the starting position: ");
    scanf("%d", &start);
    printf("Enter the maximum cylinder value: ");
    scanf("%d", &maxCylinder);

    fcfs(requests, n, start);
    scan(requests, n, start, maxCylinder);
    cScan(requests, n, start, maxCylinder);

    return 0;
}
```

Input:



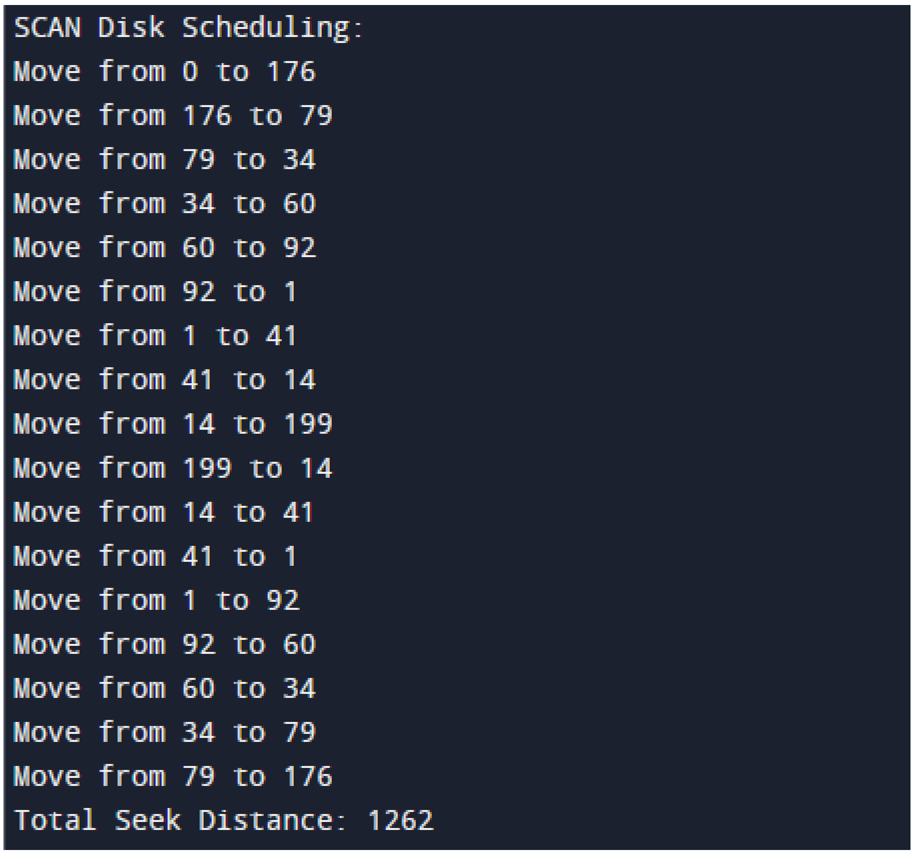
```
Enter the number of requests: 8
Enter the requests: 176
79
34
60
92
11
41
114
Enter the starting position: 0
Enter the maximum cylinder value: 199
```

FCFS Output:



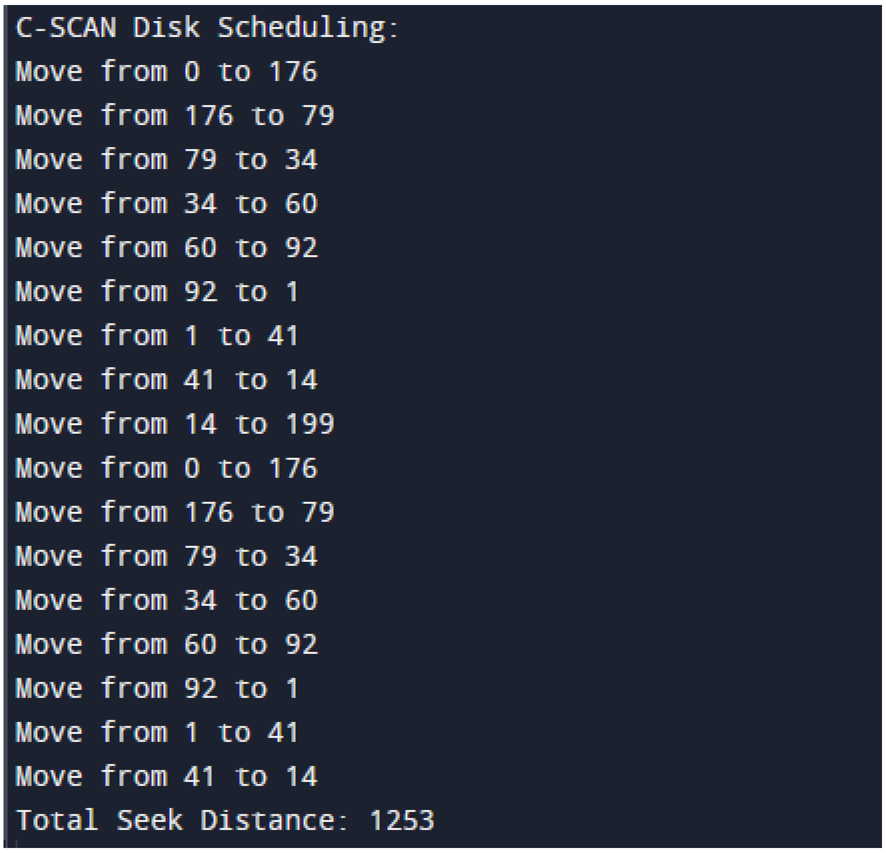
```
FCFS Disk Scheduling:
Move from 0 to 176
Move from 176 to 79
Move from 79 to 34
Move from 34 to 60
Move from 60 to 92
Move from 92 to 1
Move from 1 to 41
Move from 41 to 14
Total Seek Distance: 534
```

SCAN Output:



```
SCAN Disk Scheduling:
Move from 0 to 176
Move from 176 to 79
Move from 79 to 34
Move from 34 to 60
Move from 60 to 92
Move from 92 to 1
Move from 1 to 41
Move from 41 to 14
Move from 14 to 199
Move from 199 to 14
Move from 14 to 41
Move from 41 to 1
Move from 1 to 92
Move from 92 to 60
Move from 60 to 34
Move from 34 to 79
Move from 79 to 176
Total Seek Distance: 1262
```

C-SCAN Output:



```
C-SCAN Disk Scheduling:
Move from 0 to 176
Move from 176 to 79
Move from 79 to 34
Move from 34 to 60
Move from 60 to 92
Move from 92 to 1
Move from 1 to 41
Move from 41 to 14
Move from 14 to 199
Move from 0 to 176
Move from 176 to 79
Move from 79 to 34
Move from 34 to 60
Move from 60 to 92
Move from 92 to 1
Move from 1 to 41
Move from 41 to 14
Total Seek Distance: 1253
```

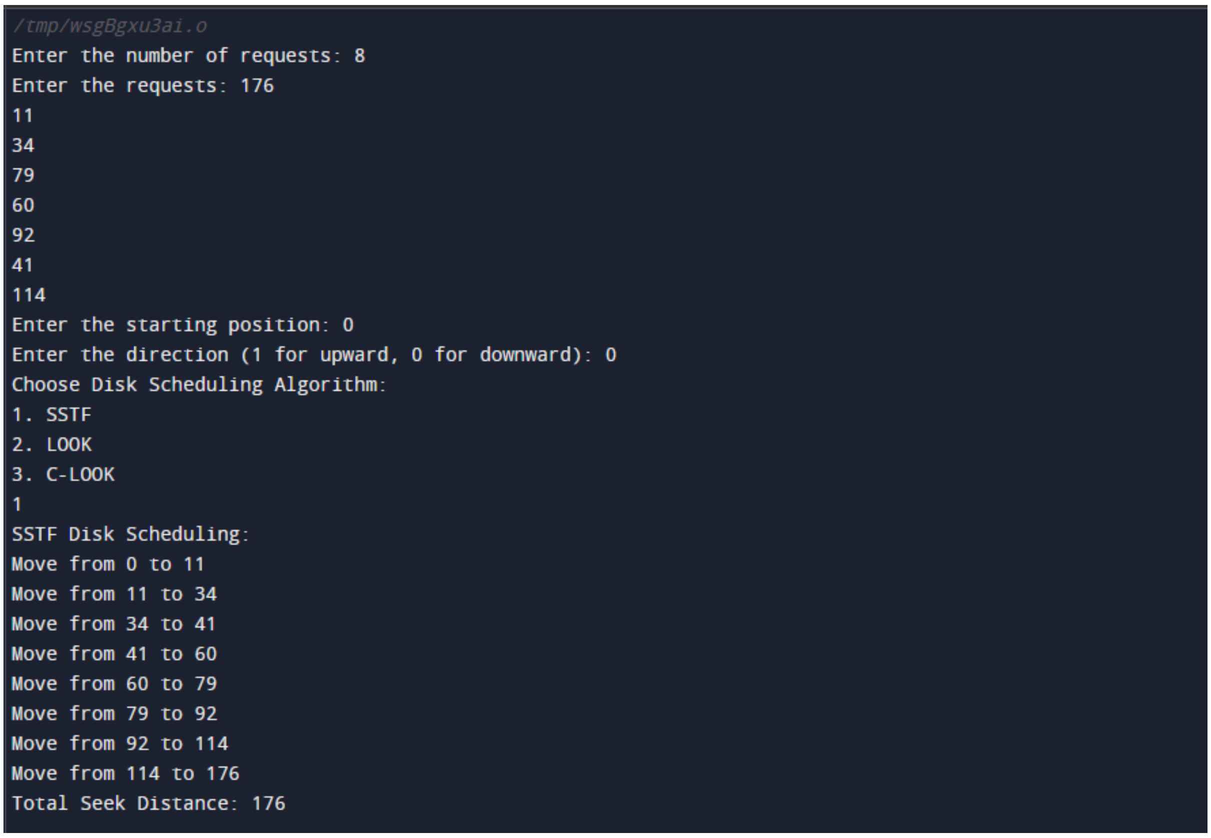
2) **Write a C program to simulate disk scheduling algorithms**

a) SSTF
b) LOOK
c) c-LOOK

Code:

```
#include <stdio.h>

#include <stdlib.h>


#define MAX_REQUESTS 100


void sort(int arr[], int n) {

    for (int i = 0; i < n - 1; i++)

        for (int j = 0; j < n - i - 1; j++)

            if (arr[j] > arr[j + 1])

                arr[j] ^= arr[j + 1] ^= arr[j] ^= arr[j + 1];

}


int absDiff(int a, int b) {

    return (a > b) ? a - b : b - a;

}


void sstf(int requests[], int n, int start) {

    int totalSeek = 0, current = start, visited[MAX_REQUESTS] = {0};


    printf("SSTF Disk Scheduling:\n");


    for (int i = 0; i < n; i++) {

        int minDist = __INT_MAX__, nextIndex = -1;


        for (int j = 0; j < n; j++) {

            if (!visited[j]) {
                int distance = absDiff(current, requests[j]);
                if (distance < minDist) {
                    minDist = distance;
                    nextIndex = j;
                }
            }
        }

        visited[nextIndex] = 1;
        totalSeek += minDist;
        printf("Move from %d to %d\n", current, requests[nextIndex]);
        current = requests[nextIndex];
    }

    printf("Total Seek Distance: %d\n", totalSeek);
}

void look(int requests[], int n, int start, int direction) {
    int totalSeek = 0, current = start;

    sort(requests, n);

    printf("LOOK Disk Scheduling:\n");

    int i = (direction == 1) ? 0 : n - 1;
    int end = (direction == 1) ? n : -1;
    int step = (direction == 1) ? 1 : -1;

    while (i != end) {
        if (direction == 1 && requests[i] < current)
            break;
        if (direction == 0 && requests[i] > current)
            break;

        totalSeek += absDiff(current, requests[i]);
        printf("Move from %d to %d\n", current, requests[i]);
        current = requests[i];
        i += step;
    }

    printf("Total Seek Distance: %d\n", totalSeek);
}

void cLook(int requests[], int n, int start) {
    int totalSeek = 0, current = start;

    sort(requests, n);

    printf("C-LOOK Disk Scheduling:\n");

    int index = 0;
    while (index < n && requests[index] <= current)
        index++;

    for (int i = index; i < n; i++) {
        totalSeek += absDiff(current, requests[i]);
        printf("Move from %d to %d\n", current, requests[i]);
        current = requests[i];
    }

    for (int i = 0; i < index; i++) {
        totalSeek += absDiff(current, requests[i]);
        printf("Move from %d to %d\n", current, requests[i]);
        current = requests[i];
    }

    printf("Total Seek Distance: %d\n", totalSeek);
}

int main() {
    int requests[MAX_REQUESTS], n, start, direction, choice;

    printf("Enter the number of requests: ");
    scanf("%d", &n);

    if (n > MAX_REQUESTS) {
        printf("Maximum number of requests exceeded.\n");
        return 1;
    }

    printf("Enter the requests: ");
    for (int i = 0; i < n; i++)
        scanf("%d", &requests[i]);

    printf("Enter the starting position: ");
    scanf("%d", &start);

    printf("Enter the direction (1 for upward, 0 for downward): ");
    scanf("%d", &direction);

    printf("Choose Disk Scheduling Algorithm:\n");
    printf("1. SSTF\n2. LOOK\n3. C-LOOK\n");
    scanf("%d", &choice);
    switch (choice) {
        case 1:
            sstf(requests, n, start);
            break;
        case 2:
            look(requests, n, start, direction);
            break;
        case 3:
            cLook(requests, n, start);
            break;
        default:
            printf("Invalid choice!\n");
            break;
    }

    return 0;
}
```

Output:



```
/tmp/wsgBgxu3ai.o
Enter the number of requests: 8
Enter the requests: 176
11
34
79
60
92
41
114
Enter the starting position: 0
Enter the direction (1 for upward, 0 for downward): 0
Choose Disk Scheduling Algorithm:
1. SSTF
2. LOOK
3. C-LOOK
1
SSTF Disk Scheduling:
Move from 0 to 11
Move from 11 to 34
Move from 34 to 41
Move from 41 to 60
Move from 60 to 79
Move from 79 to 92
Move from 92 to 114
Move from 114 to 176
Total Seek Distance: 176
```

3) **Write a C program to simulate page replacement algorithms**

a) FIFO
b) LRU
c) Optimal

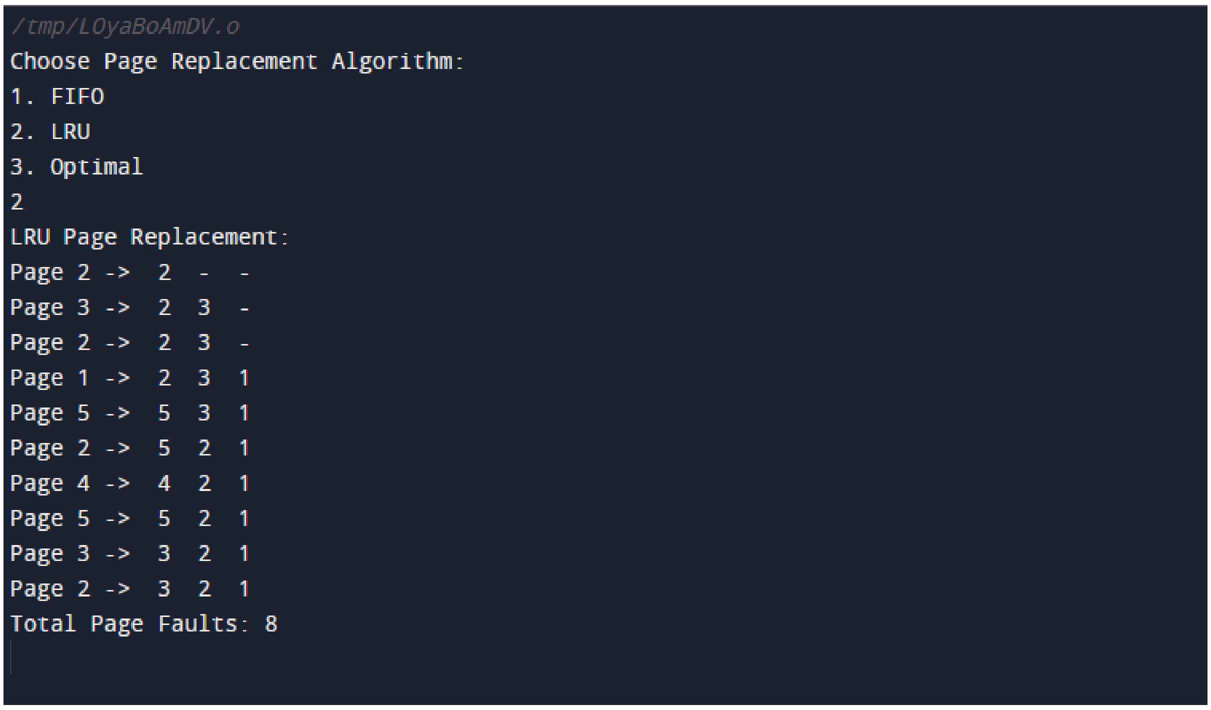
```
#include <stdio.h>

#define NUM_FRAMES 3

#define NUM_PAGES 10


void printFrames(int frames[]) {

   for (int i = 0; i < NUM_FRAMES; i++)

       printf("%2d ", frames[i]);

   printf("\n");

}


int findIndex(int arr[], int n, int element) {

   for (int i = 0; i < n; i++)

       if (arr[i] == element)
```

```
            return i;
        return -1;
}

void fifo(int pages[]) {
    int frames[NUM_FRAMES] = {0};
    int frameIndex = 0, pageFaults = 0;

    for (int i = 0; i < NUM_PAGES; i++) {
        int page = pages[i];
        if (findIndex(frames, NUM_FRAMES, page) == -1) {
            frames[frameIndex] = page;
            frameIndex = (frameIndex + 1) % NUM_FRAMES;
            pageFaults++;
        }
        printf("Page %2d -> ", page);
        printFrames(frames);
    }

    printf("FIFO Page Faults: %d\n", pageFaults);
}

void lru(int pages[]) {
    int frames[NUM_FRAMES] = {0};
    int pageFaults = 0;

    for (int i = 0; i < NUM_PAGES; i++) {
        int page = pages[i];
        int index = findIndex(frames, NUM_FRAMES, page);
        if (index == -1) {
            for (int j = 0; j < NUM_FRAMES; j++)
            if (frames[j] == 0 || findIndex(pages, i, frames[j]) == -1) {
                frames[j] = page;
                break;
            }
        pageFaults++;
    }
    printf("Page %2d -> ", page);
    printFrames(frames);
  }

  printf("LRU Page Faults: %d\n", pageFaults);
}

void optimal(int pages[]) {
  int frames[NUM_FRAMES] = {0};
  int pageFaults = 0;

  for (int i = 0; i < NUM_PAGES; i++) {
    int page = pages[i];
    int index = findIndex(frames, NUM_FRAMES, page);
    if (index == -1) {
        int optimalIndex = -1;
        for (int j = 0; j < NUM_FRAMES; j++) {
            int pageIndex = findIndex(pages, NUM_PAGES, frames[j]);
            if (pageIndex == -1) {
                optimalIndex = j;
                break;
            }
            if (optimalIndex == -1 || pageIndex > findIndex(pages, NUM_PAGES, frames[optimalIndex]))
                optimalIndex = j;
        }
```

```
            frames[optimalIndex] = page;
            pageFaults++;
        }
        printf("Page %2d -> ", page);
        printFrames(frames);
    }

    printf("Optimal Page Faults: %d\n", pageFaults);
}

int main() {
    int pages[NUM_PAGES] = {2, 3, 2, 1, 5, 2, 4, 5, 3, 2};

    printf("Page Reference Sequence: ");
    for (int i = 0; i < NUM_PAGES; i++)
        printf("%2d ", pages[i]);
    printf("\n");

    switch(ch)
    {
        case 1:
        fifo(pages); break;
        case 2:
        lru(pages); break;
        case 3:
        optimal(pages); break;
        case 4: exit(0); break;
        default: printf("Invalid\n"); break;
    }

    return 0;
```

```
}
```

Output:



```
/tmp/LOyaBoAmDV.o
Choose Page Replacement Algorithm:
1. FIFO
2. LRU
3. Optimal
2
LRU Page Replacement:
Page 2 ->  2  -  -
Page 3 ->  2  3  -
Page 2 ->  2  3  -
Page 1 ->  2  3  1
Page 5 ->  5  3  1
Page 2 ->  5  2  1
Page 4 ->  4  2  1
Page 5 ->  5  2  1
Page 3 ->  3  2  1
Page 2 ->  3  2  1
Total Page Faults: 8
```