

## CMSC 412 Final Project

Using the reference string:

0	1	2	3	4	5	6	7	8	9	0	9	1	8	2	7	3	6	4	5
N	=	5																	

Applying it to the algorithm:

### Test FIFO #1

```

Command Prompt - java FinalProject
3 - Display current reference string
4 - FIFO Simulation
5 - OPT Simulation
6 - LRU Simulation
7 - LFU Simulation

Choose next option:
4

Reference String      0      1      2      3      4      5      6      7      8      9      0      9      1      8      2      7      3      6
Physical Frame 0
Physical Frame 1
Physical Frame 2
Physical Frame 3
Physical Frame 4
Page Faults

Victim Frames

In the FIFO page-replacement algorithm, the victim frame is the oldest frame.
The simulation of the FIFO page-replacement algorithm assumes a hypothetical computer having 5
physical frames numbered 0 to 4, which form a FIFO queue. It assumes that the single process that is
running has a virtual memory of 10 frames numbered 0 to 9. The reference string is:
0, 1, 2, 3, 4, 5, 6, 7, 8, 9, 0, 9, 1, 8, 2, 7, 3, 6

Continue? ( Y / N ):
y

Reference String      0      1      2      3      4      5      6      7      8      9      0      9      1      8      2      7      3      6
Physical Frame 0      0
Physical Frame 1
Physical Frame 2
Physical Frame 3
Physical Frame 4
Page Faults          F

Victim Frames

Virtual frame 0 is referenced.
Because virtual frame 0 is not present in physical memory, a page fault is generated.
Virtual frame 0 is loaded into the FIFO queue formed by the physical frames 0 to 4.
Because there was room in the physical memory, we have no victim frame.

Continue? ( Y / N ):

```

### FIFO #2

```

Command Prompt - java FinalProject

Virtual frame 5 is referenced.
Because virtual frame 5 is not present in physical memory, a page fault is generated.
Because there is no more room in the physical memory, a frame must be replaced.
The victim frame is virtual frame 0, according to the FIFO strategy used in this algorithm
Virtual frame 0 is swapped out, and virtual frame 5 is swapped in.

Continue? ( Y / N ):
y

Reference String      0      1      2      3      4      5      6      7      8      9      0      9      1      8      2      7      3      6
Physical Frame 0      0      1      2      3      4      5      6      7      8      9      0      9      1      8      2      7      3      6
Physical Frame 1      0      1      2      3      4      5      6      7      8      9      0      9      1      8      2      7      3      6
Physical Frame 2      0      1      2      3      4      5      6      7      8      9      0      9      1      8      2      7      3      6
Physical Frame 3      0      1      2      3      4      5      6      7      8      9      0      9      1      8      2      7      3      6
Physical Frame 4      0      1      2      3      4      5      6      7      8      9      0      9      1      8      2      7      3      6
Page Faults           F      F      F      F      F      F      F      F      F      F      F      F      F      F      F      F      F      F
Victim Frames         0      1      2      3      4      5      6      7      8      9      0      9      1      8      2      7      3      6

Virtual frame 6 is referenced.
Because virtual frame 6 is not present in physical memory, a page fault is generated.
Because there is no more room in the physical memory, a frame must be replaced.
The victim frame is virtual frame 1, according to the FIFO strategy used in this algorithm
Virtual frame 1 is swapped out, and virtual frame 6 is swapped in.

Continue? ( Y / N ):
y

Reference String      0      1      2      3      4      5      6      7      8      9      0      9      1      8      2      7      3      6
Physical Frame 0      0      1      2      3      4      5      6      7      8      9      0      9      1      8      2      7      3      6
Physical Frame 1      0      1      2      3      4      5      6      7      8      9      0      9      1      8      2      7      3      6
Physical Frame 2      0      1      2      3      4      5      6      7      8      9      0      9      1      8      2      7      3      6
Physical Frame 3      0      1      2      3      4      5      6      7      8      9      0      9      1      8      2      7      3      6
Physical Frame 4      0      1      2      3      4      5      6      7      8      9      0      9      1      8      2      7      3      6
Page Faults           F      F      F      F      F      F      F      F      F      F      F      F      F      F      F      F      F      F
Victim Frames         0      1      2      3      4      5      6      7      8      9      0      9      1      8      2      7      3      6

Virtual frame 7 is referenced.
Because virtual frame 7 is not present in physical memory, a page fault is generated.
Because there is no more room in the physical memory, a frame must be replaced.
The victim frame is virtual frame 2, according to the FIFO strategy used in this algorithm
Virtual frame 2 is swapped out, and virtual frame 7 is swapped in.

Continue? ( Y / N ):

```

## FIFO #3

```

Command Prompt - java FinalProject

Physical Frame 3      0      1      2      3      4      5      6      7      7      8      8      9      0      1
Physical Frame 4      0      1      2      3      4      5      6      7      8      9      0      1      2      3
Page Faults           F      F      F      F      F      F      F      F      F      F      F      F      F      F
Victim Frames         0      1      2      3      4      5      6      7      8      9      0      1      2      3

Virtual frame 3 is referenced.
Because virtual frame 3 is not present in physical memory, a page fault is generated.
Because there is no more room in the physical memory, a frame must be replaced.
The victim frame is virtual frame 9, according to the FIFO strategy used in this algorithm
Virtual frame 9 is swapped out, and virtual frame 3 is swapped in.

Continue? ( Y / N ):
y

Reference String      0      1      2      3      4      5      6      7      8      9      0      9      1      8      2      7      3      6
Physical Frame 0      0      1      2      3      4      5      6      7      8      9      0      9      1      8      2      7      3      6
Physical Frame 1      0      1      2      3      4      5      6      7      8      9      0      9      1      8      2      7      3      6
Physical Frame 2      0      1      2      3      4      5      6      7      8      9      0      9      1      8      2      7      3      6
Physical Frame 3      0      1      2      3      4      5      6      7      8      9      0      9      1      8      2      7      3      6
Physical Frame 4      0      1      2      3      4      5      6      7      8      9      0      9      1      8      2      7      3      6
Page Faults           F      F      F      F      F      F      F      F      F      F      F      F      F      F      F      F      F      F
Victim Frames         0      1      2      3      4      5      6      7      8      9      0      9      1      8      2      7      3      6

Virtual frame 6 is referenced.
Because virtual frame 6 is not present in physical memory, a page fault is generated.
Because there is no more room in the physical memory, a frame must be replaced.
The victim frame is virtual frame 0, according to the FIFO strategy used in this algorithm
Virtual frame 0 is swapped out, and virtual frame 6 is swapped in.

In the end, a total of 16 page faults and 11 victims were generated.

FIFO Simulation complete.

0 - Exit
1 - Read Reference String
2 - Generate Reference String
3 - Display current reference string
4 - FIFO Simulation
5 - OPT Simulation
6 - LRU Simulation
7 - LFU Simulation

Choose next option:

```

## Test OPT #1

```

Choose next option:
5

Reference String      0      1      2      3      4      5      6      7      8      9      0      9      1      8      2      7      3      6
Physical Frame 0
Physical Frame 1
Physical Frame 2
Physical Frame 3
Physical Frame 4
Page Faults

Victim Frames

The optimal page-replacement algorithm is an idealized algorithm in which the victim frame is the one
that will not be accessed for the longest period of time.
This simulation assumes a hypothetical computer having 5 physical frames numbered 0 to 4. It
assumes that the single process that is running has a virtual memory of 10 frames numbered 0 to 9.
The reference string is:
0, 1, 2, 3, 4, 5, 6, 7, 8, 9, 0, 9, 1, 8, 2, 7, 3, 6

Continue? ( Y / N ):
y

Reference String      0      1      2      3      4      5      6      7      8      9      0      9      1      8      2      7      3      6
Physical Frame 0      0
Physical Frame 1
Physical Frame 2
Physical Frame 3
Physical Frame 4
Page Faults          F

Victim Frames

Virtual frame 0 is referenced.
Because virtual frame 0 is not present in physical memory, a page fault is generated.
Virtual frame 0 is loaded into physical frame 0.
Because there was room in the physical memory, we have no victim frame.

Continue? ( Y / N ):

```

## Test OPT #2

```

Command Prompt - java FinalProject

Virtual frame 6 is referenced.
Because virtual frame 6 is not present in physical memory, a page fault is generated.
Because there is no more room in the physical memory, a frame must be replaced.
The victim frame is virtual frame 5 which is the farthest (or does not occur again) in the reference string.
Virtual frame 5 is swapped out, and virtual frame 6 is swapped in.

Continue? ( Y / N ):
y

Reference String      0      1      2      3      4      5      6      7      8      9      0      9      1      8      2      7      3      6
Physical Frame 0      0      0      0      0      0      0      0      0      0
Physical Frame 1      1      1      1      1      1      1      1      1      1
Physical Frame 2      2      2      2      2      2      2      2      2      2
Physical Frame 3      3      3      3      3      3      3      3      3      3
Physical Frame 4      4      5      6      7      7      7      7      7      7
Page Faults          F      F      F      F      F      F      F      F      F      F

Victim Frames          4      5      6

Virtual frame 7 is referenced.
Because virtual frame 7 is not present in physical memory, a page fault is generated.
Because there is no more room in the physical memory, a frame must be replaced.
The victim frame is virtual frame 6 which is the farthest (or does not occur again) in the reference string.
Virtual frame 6 is swapped out, and virtual frame 7 is swapped in.

Continue? ( Y / N ):
y

Reference String      0      1      2      3      4      5      6      7      8      9      0      9      1      8      2      7      3      6
Physical Frame 0      0      0      0      0      0      0      0      0      0
Physical Frame 1      1      1      1      1      1      1      1      1      1
Physical Frame 2      2      2      2      2      2      2      2      2      2
Physical Frame 3      3      3      3      3      3      3      3      3      3
Physical Frame 4      4      5      6      7      7      7      7      7      7
Page Faults          F      F      F      F      F      F      F      F      F      F

Victim Frames          4      5      6      3

Virtual frame 8 is referenced.
Because virtual frame 8 is not present in physical memory, a page fault is generated.
Because there is no more room in the physical memory, a frame must be replaced.
The victim frame is virtual frame 3 which is the farthest (or does not occur again) in the reference string.
Virtual frame 3 is swapped out, and virtual frame 8 is swapped in.

Continue? ( Y / N ):

```

## Test OPT #3

```

Command Prompt - java FinalProject

Physical Frame 3      3      3      3      3      3      8      8      8      8      8      8      8      8      8
Physical Frame 4      4      5      6      7      7      9      9      9      9      9      9      9      9      9
Page Faults           F      F      F      F      F      F      F      F      F      F      F      F      F      F
Victim Frames         4      5      6      3      7                                0      7

Virtual frame 3 is referenced.
Because virtual frame 3 is not present in physical memory, a page fault is generated.
Because there is no more room in the physical memory, a frame must be replaced.
The victim frame is virtual frame 7 which is the farthest (or does not occur again) in the reference string.
Virtual frame 7 is swapped out, and virtual frame 3 is swapped in.

Continue? ( Y / N ):
y

Reference String      0      1      2      3      4      5      6      7      8      9      0      9      1      8      2      7      3      6
Physical Frame 0      0      0      0      0      0      0      0      0      0      0      0      0      0      0      0      7      3      6
Physical Frame 1      1      1      1      1      1      1      1      1      1      1      1      1      1      1      1      1      1      1
Physical Frame 2      2      2      2      2      2      2      2      2      2      2      2      2      2      2      2      2      2      2
Physical Frame 3      3      3      3      3      3      3      3      8      8      8      8      8      8      8      8      8      8      8
Physical Frame 4      4      5      6      7      7      9      9      9      9      9      9      9      9      9      9      9      9      9
Page Faults           F      F      F      F      F      F      F      F      F      F      F      F      F      F      F      F      F      F
Victim Frames         4      5      6      3      7                                0      7      3

Virtual frame 6 is referenced.
Because virtual frame 6 is not present in physical memory, a page fault is generated.
Because there is no more room in the physical memory, a frame must be replaced.
The victim frame is virtual frame 3 which is the farthest (or does not occur again) in the reference string.
Virtual frame 3 is swapped out, and virtual frame 6 is swapped in.

In the end, a total of 13 page faults and 8 victims were generated.

OPT Simulation complete.

0 - Exit
1 - Read Reference String
2 - Generate Reference String
3 - Display current reference string
4 - FIFO Simulation
5 - OPT Simulation
6 - LRU Simulation
7 - LFU Simulation

Choose next option:

```

## Test LRU #1

```

Choose next option:
6

Reference String      0      1      2      3      4      5      6      7      8      9      0      9      1      8      2      7      3      6
Physical Frame 0      0      0      0      0      0      0      0      0      0      0      0      0      0      0      0      7      3      6
Physical Frame 1      1      1      1      1      1      1      1      1      1      1      1      1      1      1      1      1      1      1
Physical Frame 2      2      2      2      2      2      2      2      2      2      2      2      2      2      2      2      2      2      2
Physical Frame 3      3      3      3      3      3      3      3      8      8      8      8      8      8      8      8      8      8      8
Physical Frame 4      4      5      6      7      7      9      9      9      9      9      9      9      9      9      9      9      9      9
Page Faults           F      F      F      F      F      F      F      F      F      F      F      F      F      F      F      F      F      F
Victim Frames         4      5      6      3      7                                0      7      3

In the LFU page-replacement algorithm, the victim frame is the one that has the smallest number of references.
This simulation assumes a hypothetical computer having 5 physical frames numbered 0 to 4. It
assumes that the single process that is running has a virtual memory of 10 frames numbered 0 to 9.
The reference string is:
0, 1, 2, 3, 4, 5, 6, 7, 8, 9, 0, 9, 1, 8, 2, 7, 3, 6

Continue? ( Y / N ):
y

Reference String      0      1      2      3      4      5      6      7      8      9      0      9      1      8      2      7      3      6
Physical Frame 0      0      0      0      0      0      0      0      0      0      0      0      0      0      0      0      7      3      6
Physical Frame 1      1      1      1      1      1      1      1      1      1      1      1      1      1      1      1      1      1      1
Physical Frame 2      2      2      2      2      2      2      2      2      2      2      2      2      2      2      2      2      2      2
Physical Frame 3      3      3      3      3      3      3      3      8      8      8      8      8      8      8      8      8      8      8
Physical Frame 4      4      5      6      7      7      9      9      9      9      9      9      9      9      9      9      9      9      9
Page Faults           F      F      F      F      F      F      F      F      F      F      F      F      F      F      F      F      F      F
Victim Frames         4      5      6      3      7                                0      7      3

Virtual frame 0 is referenced.
because virtual frame 0 is not present in physical memory, a page fault is generated.
Virtual frame 0 is loaded into physical frame 0.
Because there was room in the physical memory, we have no victim frame.

Continue? ( Y / N ):

```

## Test LRU #2

```

Command Prompt - java FinalProject

Virtual frame 6 is referenced.
Because virtual frame 6 is not present in physical memory, a page fault is generated.
Because there is no more room in the physical memory, a frame must be replaced.
The victim frame is virtual frame 5.
Virtual frame 5 is swapped out, and virtual frame 6 is swapped in.

Continue? ( Y / N ):
y

Reference String    0    1    2    3    4    5    6    7    8    9    0    9    1    8    2    7    3    6
Physical Frame 0    0    0    0    0    0    5    6    7    8    9    0    9    1    8    2    7    3    6
Physical Frame 1    1    1    1    1    1    1    1    1    1    1    1    1    1    1    1    1    1    1
Physical Frame 2    2    2    2    2    2    2    2    2    2    2    2    2    2    2    2    2    2    2
Physical Frame 3    3    3    3    3    3    3    3    3    3    3    3    3    3    3    3    3    3    3
Physical Frame 4    4    4    4    4    4    4    4    4    4    4    4    4    4    4    4    4    4    4
Page Faults        F    F    F    F    F    F    F    F    F    F    F    F    F    F    F    F    F    F
Victim Frames      0    5    6

Virtual frame 7 is referenced.
Because virtual frame 7 is not present in physical memory, a page fault is generated.
Because there is no more room in the physical memory, a frame must be replaced.
The victim frame is virtual frame 6.
Virtual frame 6 is swapped out, and virtual frame 7 is swapped in.

Continue? ( Y / N ):
y

Reference String    0    1    2    3    4    5    6    7    8    9    0    9    1    8    2    7    3    6
Physical Frame 0    0    0    0    0    0    5    6    7    8    9    0    9    1    8    2    7    3    6
Physical Frame 1    1    1    1    1    1    1    1    1    1    1    1    1    1    1    1    1    1    1
Physical Frame 2    2    2    2    2    2    2    2    2    2    2    2    2    2    2    2    2    2    2
Physical Frame 3    3    3    3    3    3    3    3    3    3    3    3    3    3    3    3    3    3    3
Physical Frame 4    4    4    4    4    4    4    4    4    4    4    4    4    4    4    4    4    4    4
Page Faults        F    F    F    F    F    F    F    F    F    F    F    F    F    F    F    F    F    F
Victim Frames      0    5    6    7

Virtual frame 8 is referenced.
Because virtual frame 8 is not present in physical memory, a page fault is generated.
Because there is no more room in the physical memory, a frame must be replaced.
The victim frame is virtual frame 7.
Virtual frame 7 is swapped out, and virtual frame 8 is swapped in.

Continue? ( Y / N ):
y

```

## Test LRU #3

```

Command Prompt - java FinalProject

Physical Frame 3    3    3    3    3    3    3    3    3    3    3    3    3    8    8    8    8
Physical Frame 4    4    4    4    4    4    4    4    4    4    4    4    4    2    2    2    2
Page Faults        F    F    F    F    F    F    F    F    F    F    F    F    F    F    F    F
Victim Frames      0    5    6    7    8    9    1    2    3    4    0    7

Virtual frame 3 is referenced.
Because virtual frame 3 is not present in physical memory, a page fault is generated.
Because there is no more room in the physical memory, a frame must be replaced.
The victim frame is virtual frame 7.
Virtual frame 7 is swapped out, and virtual frame 3 is swapped in.

Continue? ( Y / N ):
y

Reference String    0    1    2    3    4    5    6    7    8    9    0    9    1    8    2    7    3    6
Physical Frame 0    0    0    0    0    0    5    6    7    8    9    0    0    0    0    7    3    6
Physical Frame 1    1    1    1    1    1    1    1    1    1    1    1    9    9    9    9    9    9
Physical Frame 2    2    2    2    2    2    2    2    2    2    2    2    1    1    1    1    1    1
Physical Frame 3    3    3    3    3    3    3    3    3    3    3    3    3    8    8    8    8
Physical Frame 4    4    4    4    4    4    4    4    4    4    4    4    4    2    2    2    2
Page Faults        F    F    F    F    F    F    F    F    F    F    F    F    F    F    F    F
Victim Frames      0    5    6    7    8    9    1    2    3    4    0    7    3

Virtual frame 6 is referenced.
Because virtual frame 6 is not present in physical memory, a page fault is generated.
Because there is no more room in the physical memory, a frame must be replaced.
The victim frame is virtual frame 3.
Virtual frame 3 is swapped out, and virtual frame 6 is swapped in.

In the end, a total of 18 page faults and 13 victims were generated.

LRU Simulation complete.

0 - Exit
1 - Read Reference String
2 - Generate Reference String
3 - Display current reference string
4 - FIFO Simulation
5 - OPT Simulation
6 - LRU Simulation
7 - LFU Simulation

Choose next option:

```

## Test LFU #1

```

Choose next option:
7

Reference String      0      1      2      3      4      5      6      7      8      9      0      9      1      8      2      7      3      6
Physical Frame 0
Physical Frame 1
Physical Frame 2
Physical Frame 3
Physical Frame 4
Page Faults

Victim Frames

The LRU page-replacement algorithm is an approximation of the optimal page-replacement algorithm.
The victim frame is the one that has not been accessed for the longest period of time.
This simulation assumes a hypothetical computer having 5 physical frames numbered 0 to 4. It
assumes that the single process that is running has a virtual memory of 10 frames numbered 0 to 9.
The reference string is:

0, 1, 2, 3, 4, 5, 6, 7, 8, 9, 0, 9, 1, 8, 2, 7, 3, 6

Continue? ( Y / N ):
y

Reference String      0      1      2      3      4      5      6      7      8      9      0      9      1      8      2      7      3      6
Physical Frame 0
Physical Frame 1
Physical Frame 2
Physical Frame 3
Physical Frame 4
Page Faults          F

Victim Frames

Virtual frame 0 is referenced.
Because virtual frame 0 is not present in physical memory, a page fault is generated.
Virtual frame 0 is loaded into physical frame 0.
Because there was room in the physical memory, we have no victim frame.

Continue? ( Y / N ):

```

## Test LFU #2

```

Command Prompt - java FinalProject

Virtual frame 6 is referenced.
Because virtual frame 6 is not present in physical memory, a page fault is generated.
Because there is no more room in the physical memory, a frame must be replaced.
The victim frame is virtual frame 1 which was not used (referenced) for the longest period of time.
Virtual frame 1 is swapped out, and virtual frame 6 is swapped in.

Continue? ( Y / N ):
y

Reference String      0      1      2      3      4      5      6      7      8      9      0      9      1      8      2      7      3      6
Physical Frame 0      0      0      0      0      0      5      5      5      5      9      0      9      1      8      2      7      3      6
Physical Frame 1      1      1      1      1      1      6      6      6      6
Physical Frame 2      2      2      2      2      2      7      7
Physical Frame 3      3      3      3      3      3      8
Physical Frame 4      4      4      4      4      4
Page Faults          F      F      F      F      F      F      F      F      F

Victim Frames          0      1      2

Virtual frame 7 is referenced.
Because virtual frame 7 is not present in physical memory, a page fault is generated.
Because there is no more room in the physical memory, a frame must be replaced.
The victim frame is virtual frame 2 which was not used (referenced) for the longest period of time.
Virtual frame 2 is swapped out, and virtual frame 7 is swapped in.

Continue? ( Y / N ):
y

Reference String      0      1      2      3      4      5      6      7      8      9      0      9      1      8      2      7      3      6
Physical Frame 0      0      0      0      0      0      5      5      5      5      9      0      9      1      8      2      7      3      6
Physical Frame 1      1      1      1      1      1      6      6      6      6
Physical Frame 2      2      2      2      2      2      7      7
Physical Frame 3      3      3      3      3      3      8
Physical Frame 4      4      4      4      4      4
Page Faults          F      F      F      F      F      F      F      F      F

Victim Frames          0      1      2      3

Virtual frame 8 is referenced.
Because virtual frame 8 is not present in physical memory, a page fault is generated.
Because there is no more room in the physical memory, a frame must be replaced.
The victim frame is virtual frame 3 which was not used (referenced) for the longest period of time.
Virtual frame 3 is swapped out, and virtual frame 8 is swapped in.

Continue? ( Y / N ):

```

## Test LFU #3

```

Command Prompt - java FinalProject

Physical Frame 3      3      3      3      3      3      8      8      8      8      8      8      8      8      8
Physical Frame 4      4      4      4      4      4      9      9      9      9      9      9      9      9      9
Page Faults          F      F      F      F      F      F      F      F      F      F      F      F      F      F
Victim Frames          0      1      2      3      4      5      6      7      8      9

Virtual frame 3 is referenced.
Because virtual frame 3 is not present in physical memory, a page fault is generated.
Because there is no more room in the physical memory, a frame must be replaced.
The victim frame is virtual frame 9 which was not used (referenced) for the longest period of time.
Virtual frame 9 is swapped out, and virtual frame 3 is swapped in.

Continue? ( Y / N ):
y

Reference String      0      1      2      3      4      5      6      7      8      9      0      9      1      8      2      7      3      6
Physical Frame 0      0      0      0      0      0      5      5      5      5      0      0      0      0      0      0      7      7      7
Physical Frame 1      1      1      1      1      1      6      6      6      6      6      1      1      1      1      1      1      1      6
Physical Frame 2      2      2      2      2      2      7      7      7      7      7      2      2      2      2      2      2      2      2
Physical Frame 3      3      3      3      3      3      8      8      8      8      8      8      8      8      8      8      8      8      8
Physical Frame 4      4      4      4      4      4      9      9      9      9      9      9      9      9      9      9      9      9      9
Page Faults          F      F      F      F      F      F      F      F      F      F      F      F      F      F      F      F      F      F
Victim Frames          0      1      2      3      4      5      6      7      8      9      1

Virtual frame 6 is referenced.
Because virtual frame 6 is not present in physical memory, a page fault is generated.
Because there is no more room in the physical memory, a frame must be replaced.
The victim frame is virtual frame 1 which was not used (referenced) for the longest period of time.
Virtual frame 1 is swapped out, and virtual frame 6 is swapped in.

In the end, a total of 16 page faults and 11 victims were generated.

LFU Simulation complete.

0 - Exit
1 - Read Reference String
2 - Generate Reference String
3 - Display current reference string
4 - FIFO Simulation
5 - OPT Simulation
6 - LRU Simulation
7 - LFU Simulation

Choose next option:

```