REPORT #6

- Beyond Physical Memory: Policies -

과 목 : Operating Systems

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이 름 : 이 영 민

제 출 일 : 2019.04.30

1.

[FIFO]

[-s 0 -n 10]

```
Solving...

Access: 1  MISS FirstIn ->          [1] <- Lastin  Replaced:- [Hits:0 Misses:1]
FREQ  [1000, 1000, 1000, 1000, 1000, 1000, 1000, 1000, 1000, 1000]
Access: 8  MISS FirstIn ->       [1, 8] <- Lastin  Replaced:- [Hits:0 Misses:2]
FREQ  [1000, 1000, 1000, 1000, 1000, 1000, 1000, 1000, 1000, 1000]
Access: 7  MISS FirstIn ->    [1, 8, 7] <- Lastin  Replaced:- [Hits:0 Misses:3]
FREQ  [1000, 1000, 1000, 1000, 1000, 1000, 1000, 1000, 1000, 1000]
Access: 2  MISS FirstIn ->    [8, 7, 2] <- Lastin  Replaced:1 [Hits:0 Misses:4]
FREQ  [1000, 1000, 1000, 1000, 1000, 1000, 1000, 1000, 1000, 1000]
Access: 4  MISS FirstIn ->    [7, 2, 4] <- Lastin  Replaced:8 [Hits:0 Misses:5]
FREQ  [1000, 1000, 1000, 1000, 1000, 1000, 1000, 1000, 1000, 1000]
Access: 4  HIT  FirstIn ->    [7, 2, 4] <- Lastin  Replaced:- [Hits:1 Misses:5]
FREQ  [1000, 1000, 1000, 1000, 1000, 1000, 1000, 1000, 1000, 1000]
Access: 6  MISS FirstIn ->    [2, 4, 6] <- Lastin  Replaced:7 [Hits:1 Misses:6]
FREQ  [1000, 1000, 1000, 1000, 1000, 1000, 1000, 1000, 1000, 1000]
Access: 7  MISS FirstIn ->    [4, 6, 7] <- Lastin  Replaced:2 [Hits:1 Misses:7]
FREQ  [1000, 1000, 1000, 1000, 1000, 1000, 1000, 1000, 1000, 1000]
Access: 0  MISS FirstIn ->    [6, 7, 0] <- Lastin  Replaced:4 [Hits:1 Misses:8]
FREQ  [1000, 1000, 1000, 1000, 1000, 1000, 1000, 1000, 1000, 1000]
Access: 0  HIT  FirstIn ->    [6, 7, 0] <- Lastin  Replaced:- [Hits:2 Misses:8]
FREQ  [1000, 1000, 1000, 1000, 1000, 1000, 1000, 1000, 1000, 1000]

FINALSTATS hits 2   misses 8   hitrate 20.00
```

[-s 1 -n 10]

```
Solving...

Access: 1  MISS FirstIn ->          [1] <- Lastin  Replaced:- [Hits:0 Misses:1]
FREQ  [1000, 1000, 1000, 1000, 1000, 1000, 1000, 1000, 1000, 1000]
Access: 8  MISS FirstIn ->       [1, 8] <- Lastin  Replaced:- [Hits:0 Misses:2]
FREQ  [1000, 1000, 1000, 1000, 1000, 1000, 1000, 1000, 1000, 1000]
Access: 7  MISS FirstIn ->    [1, 8, 7] <- Lastin  Replaced:- [Hits:0 Misses:3]
FREQ  [1000, 1000, 1000, 1000, 1000, 1000, 1000, 1000, 1000, 1000]
Access: 2  MISS FirstIn ->    [8, 7, 2] <- Lastin  Replaced:1 [Hits:0 Misses:4]
FREQ  [1000, 1000, 1000, 1000, 1000, 1000, 1000, 1000, 1000, 1000]
Access: 4  MISS FirstIn ->    [7, 2, 4] <- Lastin  Replaced:8 [Hits:0 Misses:5]
FREQ  [1000, 1000, 1000, 1000, 1000, 1000, 1000, 1000, 1000, 1000]
Access: 4  HIT  FirstIn ->    [7, 2, 4] <- Lastin  Replaced:- [Hits:1 Misses:5]
FREQ  [1000, 1000, 1000, 1000, 1000, 1000, 1000, 1000, 1000, 1000]
Access: 6  MISS FirstIn ->    [2, 4, 6] <- Lastin  Replaced:7 [Hits:1 Misses:6]
FREQ  [1000, 1000, 1000, 1000, 1000, 1000, 1000, 1000, 1000, 1000]
Access: 7  MISS FirstIn ->    [4, 6, 7] <- Lastin  Replaced:2 [Hits:1 Misses:7]
FREQ  [1000, 1000, 1000, 1000, 1000, 1000, 1000, 1000, 1000, 1000]
Access: 0  MISS FirstIn ->    [6, 7, 0] <- Lastin  Replaced:4 [Hits:1 Misses:8]
FREQ  [1000, 1000, 1000, 1000, 1000, 1000, 1000, 1000, 1000, 1000]
Access: 0  HIT  FirstIn ->    [6, 7, 0] <- Lastin  Replaced:- [Hits:2 Misses:8]
FREQ  [1000, 1000, 1000, 1000, 1000, 1000, 1000, 1000, 1000, 1000]

FINALSTATS hits 2   misses 8   hitrate 20.00
```

[-s 2 -n 10]

```
Access: 9  MISS FirstIn ->          [9] <- Lastin  Replaced:- [Hits:0 Misses:1]
FREQ  [1000, 1000, 1000, 1000, 1000, 1000, 1000, 1000, 1000, 1000]
Access: 9  HIT  FirstIn ->          [9] <- Lastin  Replaced:- [Hits:1 Misses:1]
FREQ  [1000, 1000, 1000, 1000, 1000, 1000, 1000, 1000, 1000, 1000]
Access: 0  MISS FirstIn ->       [9, 0] <- Lastin  Replaced:- [Hits:1 Misses:2]
FREQ  [1000, 1000, 1000, 1000, 1000, 1000, 1000, 1000, 1000, 1000]
Access: 0  HIT  FirstIn ->       [9, 0] <- Lastin  Replaced:- [Hits:2 Misses:2]
FREQ  [1000, 1000, 1000, 1000, 1000, 1000, 1000, 1000, 1000, 1000]
Access: 8  MISS FirstIn ->    [9, 0, 8] <- Lastin  Replaced:- [Hits:2 Misses:3]
FREQ  [1000, 1000, 1000, 1000, 1000, 1000, 1000, 1000, 1000, 1000]
Access: 7  MISS FirstIn ->    [0, 8, 7] <- Lastin  Replaced:9 [Hits:2 Misses:4]
FREQ  [1000, 1000, 1000, 1000, 1000, 1000, 1000, 1000, 1000, 1000]
Access: 6  MISS FirstIn ->    [8, 7, 6] <- Lastin  Replaced:0 [Hits:2 Misses:5]
FREQ  [1000, 1000, 1000, 1000, 1000, 1000, 1000, 1000, 1000, 1000]
Access: 3  MISS FirstIn ->    [7, 6, 3] <- Lastin  Replaced:8 [Hits:2 Misses:6]
FREQ  [1000, 1000, 1000, 1000, 1000, 1000, 1000, 1000, 1000, 1000]
Access: 6  HIT  FirstIn ->    [7, 6, 3] <- Lastin  Replaced:- [Hits:3 Misses:6]
FREQ  [1000, 1000, 1000, 1000, 1000, 1000, 1000, 1000, 1000, 1000]
Access: 6  HIT  FirstIn ->    [7, 6, 3] <- Lastin  Replaced:- [Hits:4 Misses:6]
FREQ  [1000, 1000, 1000, 1000, 1000, 1000, 1000, 1000, 1000, 1000]

FINALSTATS hits 4   misses 6   hitrate 40.00
```

[LRU]

```
horoyoii@horoyoii-VirtualBox:~/Desktop/os6$ ./paging-policy.py -s 0 -n 10 -c --policy=LRU
```

[-s 0 -n 10]

```
Solving...

Access: 8  MISS LRU ->          [8] <- MRU Replaced:- [Hits:0 Misses:1]
FREQ  [1000, 1000, 1000, 1000, 1000, 1000, 1000, 1000, 1000, 1000]
Access: 7  MISS LRU ->       [8, 7] <- MRU Replaced:- [Hits:0 Misses:2]
FREQ  [1000, 1000, 1000, 1000, 1000, 1000, 1000, 1000, 1000, 1000]
Access: 4  MISS LRU ->    [8, 7, 4] <- MRU Replaced:- [Hits:0 Misses:3]
FREQ  [1000, 1000, 1000, 1000, 1000, 1000, 1000, 1000, 1000, 1000]
Access: 2  MISS LRU ->    [7, 4, 2] <- MRU Replaced:8 [Hits:0 Misses:4]
FREQ  [1000, 1000, 1000, 1000, 1000, 1000, 1000, 1000, 1000, 1000]
Access: 5  MISS LRU ->    [4, 2, 5] <- MRU Replaced:7 [Hits:0 Misses:5]
FREQ  [1000, 1000, 1000, 1000, 1000, 1000, 1000, 1000, 1000, 1000]
Access: 4  HIT  LRU ->    [2, 5, 4] <- MRU Replaced:- [Hits:1 Misses:5]
FREQ  [1000, 1000, 1000, 1000, 1000, 1000, 1000, 1000, 1000, 1000]
Access: 7  MISS LRU ->    [5, 4, 7] <- MRU Replaced:2 [Hits:1 Misses:6]
FREQ  [1000, 1000, 1000, 1000, 1000, 1000, 1000, 1000, 1000, 1000]
Access: 3  MISS LRU ->    [4, 7, 3] <- MRU Replaced:5 [Hits:1 Misses:7]
FREQ  [1000, 1000, 1000, 1000, 1000, 1000, 1000, 1000, 1000, 1000]
Access: 4  HIT  LRU ->    [7, 3, 4] <- MRU Replaced:- [Hits:2 Misses:7]
FREQ  [1000, 1000, 1000, 1000, 1000, 1000, 1000, 1000, 1000, 1000]
Access: 5  MISS LRU ->    [3, 4, 5] <- MRU Replaced:7 [Hits:2 Misses:8]
FREQ  [1000, 1000, 1000, 1000, 1000, 1000, 1000, 1000, 1000, 1000]

FINALSTATS hits 2   misses 8   hitrate 20.00
```

[-s 1 -n 10]

```
Solving...

Access: 1  MISS LRU ->          [1] <- MRU Replaced:- [Hits:0 Misses:1]
FREQ  [1000, 1000, 1000, 1000, 1000, 1000, 1000, 1000, 1000, 1000]
Access: 8  MISS LRU ->       [1, 8] <- MRU Replaced:- [Hits:0 Misses:2]
FREQ  [1000, 1000, 1000, 1000, 1000, 1000, 1000, 1000, 1000, 1000]
Access: 7  MISS LRU ->    [1, 8, 7] <- MRU Replaced:- [Hits:0 Misses:3]
FREQ  [1000, 1000, 1000, 1000, 1000, 1000, 1000, 1000, 1000, 1000]
Access: 2  MISS LRU ->    [8, 7, 2] <- MRU Replaced:1 [Hits:0 Misses:4]
FREQ  [1000, 1000, 1000, 1000, 1000, 1000, 1000, 1000, 1000, 1000]
Access: 4  MISS LRU ->    [7, 2, 4] <- MRU Replaced:8 [Hits:0 Misses:5]
FREQ  [1000, 1000, 1000, 1000, 1000, 1000, 1000, 1000, 1000, 1000]
Access: 4  HIT  LRU ->    [7, 2, 4] <- MRU Replaced:- [Hits:1 Misses:5]
FREQ  [1000, 1000, 1000, 1000, 1000, 1000, 1000, 1000, 1000, 1000]
Access: 6  MISS LRU ->    [2, 4, 6] <- MRU Replaced:7 [Hits:1 Misses:6]
FREQ  [1000, 1000, 1000, 1000, 1000, 1000, 1000, 1000, 1000, 1000]
Access: 7  MISS LRU ->    [4, 6, 7] <- MRU Replaced:2 [Hits:1 Misses:7]
FREQ  [1000, 1000, 1000, 1000, 1000, 1000, 1000, 1000, 1000, 1000]
Access: 0  MISS LRU ->    [6, 7, 0] <- MRU Replaced:4 [Hits:1 Misses:8]
FREQ  [1000, 1000, 1000, 1000, 1000, 1000, 1000, 1000, 1000, 1000]
Access: 0  HIT  LRU ->    [6, 7, 0] <- MRU Replaced:- [Hits:2 Misses:8]
FREQ  [1000, 1000, 1000, 1000, 1000, 1000, 1000, 1000, 1000, 1000]

FINALSTATS hits 2   misses 8   hitrate 20.00
```

[-s 2 -n 10]

```
Solving...

Access: 9  MISS LRU ->          [9] <- MRU Replaced:- [Hits:0 Misses:1]
FREQ  [1000, 1000, 1000, 1000, 1000, 1000, 1000, 1000, 1000, 1000]
Access: 9  HIT  LRU ->          [9] <- MRU Replaced:- [Hits:1 Misses:1]
FREQ  [1000, 1000, 1000, 1000, 1000, 1000, 1000, 1000, 1000, 1000]
Access: 0  MISS LRU ->       [9, 0] <- MRU Replaced:- [Hits:1 Misses:2]
FREQ  [1000, 1000, 1000, 1000, 1000, 1000, 1000, 1000, 1000, 1000]
Access: 0  HIT  LRU ->       [9, 0] <- MRU Replaced:- [Hits:2 Misses:2]
FREQ  [1000, 1000, 1000, 1000, 1000, 1000, 1000, 1000, 1000, 1000]
Access: 8  MISS LRU ->    [9, 0, 8] <- MRU Replaced:- [Hits:2 Misses:3]
FREQ  [1000, 1000, 1000, 1000, 1000, 1000, 1000, 1000, 1000, 1000]
Access: 7  MISS LRU ->    [0, 8, 7] <- MRU Replaced:9 [Hits:2 Misses:4]
FREQ  [1000, 1000, 1000, 1000, 1000, 1000, 1000, 1000, 1000, 1000]
Access: 6  MISS LRU ->    [8, 7, 6] <- MRU Replaced:0 [Hits:2 Misses:5]
FREQ  [1000, 1000, 1000, 1000, 1000, 1000, 1000, 1000, 1000, 1000]
Access: 3  MISS LRU ->    [7, 6, 3] <- MRU Replaced:8 [Hits:2 Misses:6]
FREQ  [1000, 1000, 1000, 1000, 1000, 1000, 1000, 1000, 1000, 1000]
Access: 6  HIT  LRU ->    [7, 3, 6] <- MRU Replaced:- [Hits:3 Misses:6]
FREQ  [1000, 1000, 1000, 1000, 1000, 1000, 1000, 1000, 1000, 1000]
Access: 6  HIT  LRU ->    [7, 3, 6] <- MRU Replaced:- [Hits:4 Misses:6]
FREQ  [1000, 1000, 1000, 1000, 1000, 1000, 1000, 1000, 1000, 1000]

FINALSTATS hits 4   misses 6   hitrate 40.00
```

[OPT]

[-s 0 -n 10]

```
Access: 8  MISS Left  ->          [8] <- Right Replaced:- [Hits:0 Misses:1]
FREQ  [1000, 1000, 1000, 1000, 1000, 1000, 1000, 1000, 1000, 1000]
Access: 7  MISS Left  ->       [8, 7] <- Right Replaced:- [Hits:0 Misses:2]
FREQ  [1000, 1000, 1000, 1000, 1000, 1000, 1000, 1000, 1000, 1000]
Access: 4  MISS Left  ->    [8, 7, 4] <- Right Replaced:- [Hits:0 Misses:3]
FREQ  [1000, 1000, 1000, 1000, 1000, 1000, 1000, 1000, 1000, 1000]
Access: 2  MISS Left  ->    [7, 4, 2] <- Right Replaced:8 [Hits:0 Misses:4]
FREQ  [1000, 1000, 1000, 1000, 1000, 1000, 1000, 1000, 1000, 1000]
Access: 5  MISS Left  ->    [7, 4, 5] <- Right Replaced:2 [Hits:0 Misses:5]
FREQ  [1000, 1000, 1000, 1000, 1000, 1000, 1000, 1000, 1000, 1000]
Access: 4  HIT  Left  ->    [7, 4, 5] <- Right Replaced:- [Hits:1 Misses:5]
FREQ  [1000, 1000, 1000, 1000, 1000, 1000, 1000, 1000, 1000, 1000]
Access: 7  HIT  Left  ->    [7, 4, 5] <- Right Replaced:- [Hits:2 Misses:5]
FREQ  [1000, 1000, 1000, 1000, 1000, 1000, 1000, 1000, 1000, 1000]
Access: 3  MISS Left  ->    [4, 5, 3] <- Right Replaced:7 [Hits:2 Misses:6]
FREQ  [1000, 1000, 1000, 1000, 1000, 1000, 1000, 1000, 1000, 1000]
Access: 4  HIT  Left  ->    [4, 5, 3] <- Right Replaced:- [Hits:3 Misses:6]
FREQ  [1000, 1000, 1000, 1000, 1000, 1000, 1000, 1000, 1000, 1000]
Access: 5  HIT  Left  ->    [4, 5, 3] <- Right Replaced:- [Hits:4 Misses:6]
FREQ  [1000, 1000, 1000, 1000, 1000, 1000, 1000, 1000, 1000, 1000]

FINALSTATS hits 4   misses 6   hitrate 40.00
```

[-s 1 -n 10]

```
Access: 1  MISS Left  ->          [1] <- Right Replaced:- [Hits:0 Misses:1]
FREQ  [1000, 1000, 1000, 1000, 1000, 1000, 1000, 1000, 1000, 1000]
Access: 8  MISS Left  ->       [1, 8] <- Right Replaced:- [Hits:0 Misses:2]
FREQ  [1000, 1000, 1000, 1000, 1000, 1000, 1000, 1000, 1000, 1000]
Access: 7  MISS Left  ->    [1, 8, 7] <- Right Replaced:- [Hits:0 Misses:3]
FREQ  [1000, 1000, 1000, 1000, 1000, 1000, 1000, 1000, 1000, 1000]
Access: 2  MISS Left  ->    [1, 7, 2] <- Right Replaced:8 [Hits:0 Misses:4]
FREQ  [1000, 1000, 1000, 1000, 1000, 1000, 1000, 1000, 1000, 1000]
Access: 4  MISS Left  ->    [1, 7, 4] <- Right Replaced:2 [Hits:0 Misses:5]
FREQ  [1000, 1000, 1000, 1000, 1000, 1000, 1000, 1000, 1000, 1000]
Access: 4  HIT  Left  ->    [1, 7, 4] <- Right Replaced:- [Hits:1 Misses:5]
FREQ  [1000, 1000, 1000, 1000, 1000, 1000, 1000, 1000, 1000, 1000]
Access: 6  MISS Left  ->    [1, 7, 6] <- Right Replaced:4 [Hits:1 Misses:6]
FREQ  [1000, 1000, 1000, 1000, 1000, 1000, 1000, 1000, 1000, 1000]
Access: 7  HIT  Left  ->    [1, 7, 6] <- Right Replaced:- [Hits:2 Misses:6]
FREQ  [1000, 1000, 1000, 1000, 1000, 1000, 1000, 1000, 1000, 1000]
Access: 0  MISS Left  ->    [1, 7, 0] <- Right Replaced:6 [Hits:2 Misses:7]
FREQ  [1000, 1000, 1000, 1000, 1000, 1000, 1000, 1000, 1000, 1000]
Access: 0  HIT  Left  ->    [1, 7, 0] <- Right Replaced:- [Hits:3 Misses:7]
FREQ  [1000, 1000, 1000, 1000, 1000, 1000, 1000, 1000, 1000, 1000]

FINALSTATS hits 3   misses 7   hitrate 30.00
```

[-s 2 -n 10]

```
Access: 9  MISS Left  ->          [9] <- Right Replaced:- [Hits:0 Misses:1]
FREQ  [1000, 1000, 1000, 1000, 1000, 1000, 1000, 1000, 1000, 1000]
Access: 9  HIT  Left  ->          [9] <- Right Replaced:- [Hits:1 Misses:1]
FREQ  [1000, 1000, 1000, 1000, 1000, 1000, 1000, 1000, 1000, 1000]
Access: 0  MISS Left  ->       [9, 0] <- Right Replaced:- [Hits:1 Misses:2]
FREQ  [1000, 1000, 1000, 1000, 1000, 1000, 1000, 1000, 1000, 1000]
Access: 0  HIT  Left  ->       [9, 0] <- Right Replaced:- [Hits:2 Misses:2]
FREQ  [1000, 1000, 1000, 1000, 1000, 1000, 1000, 1000, 1000, 1000]
Access: 8  MISS Left  ->    [9, 0, 8] <- Right Replaced:- [Hits:2 Misses:3]
FREQ  [1000, 1000, 1000, 1000, 1000, 1000, 1000, 1000, 1000, 1000]
Access: 7  MISS Left  ->    [9, 0, 7] <- Right Replaced:8 [Hits:2 Misses:4]
FREQ  [1000, 1000, 1000, 1000, 1000, 1000, 1000, 1000, 1000, 1000]
Access: 6  MISS Left  ->    [9, 0, 6] <- Right Replaced:7 [Hits:2 Misses:5]
FREQ  [1000, 1000, 1000, 1000, 1000, 1000, 1000, 1000, 1000, 1000]
Access: 3  MISS Left  ->    [9, 6, 3] <- Right Replaced:0 [Hits:2 Misses:6]
FREQ  [1000, 1000, 1000, 1000, 1000, 1000, 1000, 1000, 1000, 1000]
Access: 6  HIT  Left  ->    [9, 6, 3] <- Right Replaced:- [Hits:3 Misses:6]
FREQ  [1000, 1000, 1000, 1000, 1000, 1000, 1000, 1000, 1000, 1000]
Access: 6  HIT  Left  ->    [9, 6, 3] <- Right Replaced:- [Hits:4 Misses:6]
FREQ  [1000, 1000, 1000, 1000, 1000, 1000, 1000, 1000, 1000, 1000]

FINALSTATS hits 4   misses 6   hitrate 40.00
```

2.

[FIFO]

```
horoyoii@horoyoii-VirtualBox:~/Desktop/os6$ ./paging-policy.py --addresses=0,1,2,3,4,5,0,1,2,3,4,5 -c --cachesize=5
ARG addresses 0,1,2,3,4,5,0,1,2,3,4,5
ARG addressfile
ARG numaddrs 10
ARG policy FIFO
ARG clockbits 2
ARG cachesize 5
ARG maxpage 10
ARG seed 0
ARG notrace False

Solving
```

```
Access: 0  MISS FirstIn ->          [0] <- Lastin  Replaced:- [Hits:0 Misses:1]
FREQ  [1000, 1000, 1000, 1000, 1000, 1000, 1000, 1000, 1000, 1000, 1000, 1000]
Access: 1  MISS FirstIn ->       [0, 1] <- Lastin  Replaced:- [Hits:0 Misses:2]
FREQ  [1000, 1000, 1000, 1000, 1000, 1000, 1000, 1000, 1000, 1000, 1000, 1000]
Access: 2  MISS FirstIn ->    [0, 1, 2] <- Lastin  Replaced:- [Hits:0 Misses:3]
FREQ  [1000, 1000, 1000, 1000, 1000, 1000, 1000, 1000, 1000, 1000, 1000, 1000]
Access: 3  MISS FirstIn -> [0, 1, 2, 3] <- Lastin  Replaced:- [Hits:0 Misses:4]
FREQ  [1000, 1000, 1000, 1000, 1000, 1000, 1000, 1000, 1000, 1000, 1000, 1000]
Access: 4  MISS FirstIn -> [0, 1, 2, 3, 4] <- Lastin  Replaced:- [Hits:0 Misses:5]
FREQ  [1000, 1000, 1000, 1000, 1000, 1000, 1000, 1000, 1000, 1000, 1000, 1000]
Access: 5  MISS FirstIn -> [1, 2, 3, 4, 5] <- Lastin  Replaced:0 [Hits:0 Misses:6]
FREQ  [1000, 1000, 1000, 1000, 1000, 1000, 1000, 1000, 1000, 1000, 1000, 1000]
Access: 0  MISS FirstIn -> [2, 3, 4, 5, 0] <- Lastin  Replaced:1 [Hits:0 Misses:7]
FREQ  [1000, 1000, 1000, 1000, 1000, 1000, 1000, 1000, 1000, 1000, 1000, 1000]
Access: 1  MISS FirstIn -> [3, 4, 5, 0, 1] <- Lastin  Replaced:2 [Hits:0 Misses:8]
FREQ  [1000, 1000, 1000, 1000, 1000, 1000, 1000, 1000, 1000, 1000, 1000, 1000]
Access: 2  MISS FirstIn -> [4, 5, 0, 1, 2] <- Lastin  Replaced:3 [Hits:0 Misses:9]
FREQ  [1000, 1000, 1000, 1000, 1000, 1000, 1000, 1000, 1000, 1000, 1000, 1000]
Access: 3  MISS FirstIn -> [5, 0, 1, 2, 3] <- Lastin  Replaced:4 [Hits:0 Misses:10]
FREQ  [1000, 1000, 1000, 1000, 1000, 1000, 1000, 1000, 1000, 1000, 1000, 1000]
Access: 4  MISS FirstIn -> [0, 1, 2, 3, 4] <- Lastin  Replaced:5 [Hits:0 Misses:11]
FREQ  [1000, 1000, 1000, 1000, 1000, 1000, 1000, 1000, 1000, 1000, 1000, 1000]
Access: 5  MISS FirstIn -> [1, 2, 3, 4, 5] <- Lastin  Replaced:0 [Hits:0 Misses:12]
FREQ  [1000, 1000, 1000, 1000, 1000, 1000, 1000, 1000, 1000, 1000, 1000, 1000]

FINALSTATS hits 0   misses 12   hitrate 0.00
```

[LRU]

```
horoyoii@horoyoii-VirtualBox:~/Desktop/os6$ ./paging-policy.py --addresses=0,1,2,3,4,5,0,1,2,3,4,5 -c --policy=LRU --cachesize=5
ARG addresses 0,1,2,3,4,5,0,1,2,3,4,5
ARG addressfile
ARG numaddrs 10
ARG policy LRU
ARG clockbits 2
ARG cachesize 5
ARG maxpage 10
ARG seed 0
ARG notrace False

Solving...
```

```
Access: 0  MISS LRU ->          [0] <- MRU Replaced:- [Hits:0 Misses:1]
FREQ  [1000, 1000, 1000, 1000, 1000, 1000, 1000, 1000, 1000, 1000, 1000, 1000]
Access: 1  MISS LRU ->       [0, 1] <- MRU Replaced:- [Hits:0 Misses:2]
FREQ  [1000, 1000, 1000, 1000, 1000, 1000, 1000, 1000, 1000, 1000, 1000, 1000]
Access: 2  MISS LRU ->    [0, 1, 2] <- MRU Replaced:- [Hits:0 Misses:3]
FREQ  [1000, 1000, 1000, 1000, 1000, 1000, 1000, 1000, 1000, 1000, 1000, 1000]
Access: 3  MISS LRU -> [0, 1, 2, 3] <- MRU Replaced:- [Hits:0 Misses:4]
FREQ  [1000, 1000, 1000, 1000, 1000, 1000, 1000, 1000, 1000, 1000, 1000, 1000]
Access: 4  MISS LRU -> [0, 1, 2, 3, 4] <- MRU Replaced:- [Hits:0 Misses:5]
FREQ  [1000, 1000, 1000, 1000, 1000, 1000, 1000, 1000, 1000, 1000, 1000, 1000]
Access: 5  MISS LRU -> [1, 2, 3, 4, 5] <- MRU Replaced:0 [Hits:0 Misses:6]
FREQ  [1000, 1000, 1000, 1000, 1000, 1000, 1000, 1000, 1000, 1000, 1000, 1000]
Access: 0  MISS LRU -> [2, 3, 4, 5, 0] <- MRU Replaced:1 [Hits:0 Misses:7]
FREQ  [1000, 1000, 1000, 1000, 1000, 1000, 1000, 1000, 1000, 1000, 1000, 1000]
Access: 1  MISS LRU -> [3, 4, 5, 0, 1] <- MRU Replaced:2 [Hits:0 Misses:8]
FREQ  [1000, 1000, 1000, 1000, 1000, 1000, 1000, 1000, 1000, 1000, 1000, 1000]
Access: 2  MISS LRU -> [4, 5, 0, 1, 2] <- MRU Replaced:3 [Hits:0 Misses:9]
FREQ  [1000, 1000, 1000, 1000, 1000, 1000, 1000, 1000, 1000, 1000, 1000, 1000]
Access: 3  MISS LRU -> [5, 0, 1, 2, 3] <- MRU Replaced:4 [Hits:0 Misses:10]
FREQ  [1000, 1000, 1000, 1000, 1000, 1000, 1000, 1000, 1000, 1000, 1000, 1000]
Access: 4  MISS LRU -> [0, 1, 2, 3, 4] <- MRU Replaced:5 [Hits:0 Misses:11]
FREQ  [1000, 1000, 1000, 1000, 1000, 1000, 1000, 1000, 1000, 1000, 1000, 1000]
Access: 5  MISS LRU -> [1, 2, 3, 4, 5] <- MRU Replaced:0 [Hits:0 Misses:12]
FREQ  [1000, 1000, 1000, 1000, 1000, 1000, 1000, 1000, 1000, 1000, 1000, 1000]

FINALSTATS hits 0   misses 12   hitrate 0.00
```

[MRU]

```
horoyoii@horoyoii-VirtualBox:~/Desktop/os6$ ./paging-policy.py --addresses=0,1,2,3,4,5,4,5,4,5 -c --policy=MRU --cachesize=5
ARG addresses 0,1,2,3,4,5,4,5,4,5
ARG addressfile
ARG numaddrs 10
ARG policy MRU
ARG clockbits 2
ARG cachesize 5
ARG maxpage 10
ARG seed 0
ARG notrace False
```

```
Solving...

Access: 0  MISS LRU ->          [0] <- MRU Replaced:- [Hits:0 Misses:1]
FREQ  [1000, 1000, 1000, 1000, 1000, 1000, 1000, 1000, 1000, 1000]
Access: 1  MISS LRU ->       [0, 1] <- MRU Replaced:- [Hits:0 Misses:2]
FREQ  [1000, 1000, 1000, 1000, 1000, 1000, 1000, 1000, 1000, 1000]
Access: 2  MISS LRU ->    [0, 1, 2] <- MRU Replaced:- [Hits:0 Misses:3]
FREQ  [1000, 1000, 1000, 1000, 1000, 1000, 1000, 1000, 1000, 1000]
Access: 3  MISS LRU -> [0, 1, 2, 3] <- MRU Replaced:- [Hits:0 Misses:4]
FREQ  [1000, 1000, 1000, 1000, 1000, 1000, 1000, 1000, 1000, 1000]
Access: 4  MISS LRU -> [0, 1, 2, 3, 4] <- MRU Replaced:- [Hits:0 Misses:5]
FREQ  [1000, 1000, 1000, 1000, 1000, 1000, 1000, 1000, 1000, 1000]
Access: 5  MISS LRU -> [0, 1, 2, 3, 5] <- MRU Replaced:4 [Hits:0 Misses:6]
FREQ  [1000, 1000, 1000, 1000, 1000, 1000, 1000, 1000, 1000, 1000]
Access: 4  MISS LRU -> [0, 1, 2, 3, 4] <- MRU Replaced:5 [Hits:0 Misses:7]
FREQ  [1000, 1000, 1000, 1000, 1000, 1000, 1000, 1000, 1000, 1000]
Access: 5  MISS LRU -> [0, 1, 2, 3, 5] <- MRU Replaced:4 [Hits:0 Misses:8]
FREQ  [1000, 1000, 1000, 1000, 1000, 1000, 1000, 1000, 1000, 1000]
Access: 4  MISS LRU -> [0, 1, 2, 3, 4] <- MRU Replaced:5 [Hits:0 Misses:9]
FREQ  [1000, 1000, 1000, 1000, 1000, 1000, 1000, 1000, 1000, 1000]
Access: 5  MISS LRU -> [0, 1, 2, 3, 5] <- MRU Replaced:4 [Hits:0 Misses:10]
FREQ  [1000, 1000, 1000, 1000, 1000, 1000, 1000, 1000, 1000, 1000]

FINALSTATS hits 0   misses 10   hitrate 0.00
```

>> 어떤 정책이든 hit rate을 0으로 만들 수 있는 메모리 참조 스트림이 존재하기에 캐시의 크기는 커야 할 것이다.

3.

MEM Ref Stream : 8, 7, 4, 2, 5, 4, 7, 3, 4, 5

Cache Size : 3

에 대하여 여러 정책들의 결과

[FIFO]

```
FINALSTATS hits 1   misses 9   hitrate 10.00
```

[LRU]

```
FINALSTATS hits 2   misses 8   hitrate 20.00
```

[OPT]

```
FINALSTATS hits 4   misses 6   hitrate 40.00
```

[RAND]

```
FINALSTATS hits 0   misses 10   hitrate 0.00
```

[MRU]

```
FINALSTATS hits 2   misses 8   hitrate 20.00
```

[CLOCK]

```
FINALSTATS hits 1   misses 9   hitrate 10.00
```

>> OPT는 가장 이상적이며, 그 다음으로 LRU, MRU 가 좋은 성능을 보여주고 있다.

4.

캐시 사이즈를 3으로 하여 약간의 지역성을 가지는 스트림을 아래와 같이 생성하였다.

```
horoyoii@horoyoii-VirtualBox:~/Desktop/os6$ ./paging-policy.py --addresses=0,1,2,3,2,3,2,3,0,2,3,2 -c --policy=LRU
ARG addresses 0,1,2,3,2,3,2,3,0,2,3,2
ARG addressfile
ARG numaddrs 10
ARG policy LRU
ARG clockbits 2
ARG cachesize 3
ARG maxpage 10
ARG seed 0
ARG notrace False
```

```
Access: 0  MISS LRU ->          [0] <- MRU Replaced:- [Hits:0 Misses:1]
FREQ  [1000, 1000, 1000, 1000, 1000, 1000, 1000, 1000, 1000, 1000, 1000, 1000]
Access: 1  MISS LRU ->       [0, 1] <- MRU Replaced:- [Hits:0 Misses:2]
FREQ  [1000, 1000, 1000, 1000, 1000, 1000, 1000, 1000, 1000, 1000, 1000, 1000]
Access: 2  MISS LRU ->    [0, 1, 2] <- MRU Replaced:- [Hits:0 Misses:3]
FREQ  [1000, 1000, 1000, 1000, 1000, 1000, 1000, 1000, 1000, 1000, 1000, 1000]
Access: 3  MISS LRU ->    [1, 2, 3] <- MRU Replaced:0 [Hits:0 Misses:4]
FREQ  [1000, 1000, 1000, 1000, 1000, 1000, 1000, 1000, 1000, 1000, 1000, 1000]
Access: 2  HIT  LRU ->    [1, 3, 2] <- MRU Replaced:- [Hits:1 Misses:4]
FREQ  [1000, 1000, 1000, 1000, 1000, 1000, 1000, 1000, 1000, 1000, 1000, 1000]
Access: 3  HIT  LRU ->    [1, 2, 3] <- MRU Replaced:- [Hits:2 Misses:4]
FREQ  [1000, 1000, 1000, 1000, 1000, 1000, 1000, 1000, 1000, 1000, 1000, 1000]
Access: 2  HIT  LRU ->    [1, 3, 2] <- MRU Replaced:- [Hits:3 Misses:4]
FREQ  [1000, 1000, 1000, 1000, 1000, 1000, 1000, 1000, 1000, 1000, 1000, 1000]
Access: 3  HIT  LRU ->    [1, 2, 3] <- MRU Replaced:- [Hits:4 Misses:4]
FREQ  [1000, 1000, 1000, 1000, 1000, 1000, 1000, 1000, 1000, 1000, 1000, 1000]
Access: 0  MISS LRU ->    [2, 3, 0] <- MRU Replaced:1 [Hits:4 Misses:5]
FREQ  [1000, 1000, 1000, 1000, 1000, 1000, 1000, 1000, 1000, 1000, 1000, 1000]
Access: 2  HIT  LRU ->    [3, 0, 2] <- MRU Replaced:- [Hits:5 Misses:5]
FREQ  [1000, 1000, 1000, 1000, 1000, 1000, 1000, 1000, 1000, 1000, 1000, 1000]
Access: 3  HIT  LRU ->    [0, 2, 3] <- MRU Replaced:- [Hits:6 Misses:5]
FREQ  [1000, 1000, 1000, 1000, 1000, 1000, 1000, 1000, 1000, 1000, 1000, 1000]
Access: 2  HIT  LRU ->    [0, 3, 2] <- MRU Replaced:- [Hits:7 Misses:5]
FREQ  [1000, 1000, 1000, 1000, 1000, 1000, 1000, 1000, 1000, 1000, 1000, 1000]

FINALSTATS hits 7   misses 5   hitrate 58.33
```

>> 그 결과 58.33 의 hit rate이 나온다.

그리고 아래와 같이 같은 스트림에 대한 참조를 RAND 정책으로 실행할 경우

```
Access: 0  MISS Left  ->          [0] <- Right Replaced:- [Hits:0 Misses:1]
FREQ  [1000, 1000, 1000, 1000, 1000, 1000, 1000, 1000, 1000, 1000, 1000, 1000]
Access: 1  MISS Left  ->       [0, 1] <- Right Replaced:- [Hits:0 Misses:2]
FREQ  [1000, 1000, 1000, 1000, 1000, 1000, 1000, 1000, 1000, 1000, 1000, 1000]
Access: 2  MISS Left  ->    [0, 1, 2] <- Right Replaced:- [Hits:0 Misses:3]
FREQ  [1000, 1000, 1000, 1000, 1000, 1000, 1000, 1000, 1000, 1000, 1000, 1000]
Access: 3  MISS Left  ->    [0, 1, 3] <- Right Replaced:2 [Hits:0 Misses:4]
FREQ  [1000, 1000, 1000, 1000, 1000, 1000, 1000, 1000, 1000, 1000, 1000, 1000]
Access: 2  MISS Left  ->    [0, 1, 2] <- Right Replaced:3 [Hits:0 Misses:5]
FREQ  [1000, 1000, 1000, 1000, 1000, 1000, 1000, 1000, 1000, 1000, 1000, 1000]
Access: 3  MISS Left  ->    [0, 2, 3] <- Right Replaced:1 [Hits:0 Misses:6]
FREQ  [1000, 1000, 1000, 1000, 1000, 1000, 1000, 1000, 1000, 1000, 1000, 1000]
Access: 2  HIT  Left  ->    [0, 2, 3] <- Right Replaced:- [Hits:1 Misses:6]
FREQ  [1000, 1000, 1000, 1000, 1000, 1000, 1000, 1000, 1000, 1000, 1000, 1000]
Access: 3  HIT  Left  ->    [0, 2, 3] <- Right Replaced:- [Hits:2 Misses:6]
FREQ  [1000, 1000, 1000, 1000, 1000, 1000, 1000, 1000, 1000, 1000, 1000, 1000]
Access: 0  HIT  Left  ->    [0, 2, 3] <- Right Replaced:- [Hits:3 Misses:6]
FREQ  [1000, 1000, 1000, 1000, 1000, 1000, 1000, 1000, 1000, 1000, 1000, 1000]
Access: 2  HIT  Left  ->    [0, 2, 3] <- Right Replaced:- [Hits:4 Misses:6]
FREQ  [1000, 1000, 1000, 1000, 1000, 1000, 1000, 1000, 1000, 1000, 1000, 1000]
Access: 3  HIT  Left  ->    [0, 2, 3] <- Right Replaced:- [Hits:5 Misses:6]
FREQ  [1000, 1000, 1000, 1000, 1000, 1000, 1000, 1000, 1000, 1000, 1000, 1000]
Access: 2  HIT  Left  ->    [0, 2, 3] <- Right Replaced:- [Hits:6 Misses:6]
FREQ  [1000, 1000, 1000, 1000, 1000, 1000, 1000, 1000, 1000, 1000, 1000, 1000]

FINALSTATS hits 6   misses 6   hitrate 50.00
```

>> LRU보다 조금 떨어지는 hit rate을 보여준다.

CLOCK 정책의 경우 LRU와 동일한 성능을 보여주었다.

```
Access: 0  MISS Left  ->          [0] <- Right Replaced:- [Hits:0 Misses:1]
FREQ  [1000, 1000, 1000, 1000, 1000, 1000, 1000, 1000, 1000, 1000, 1000, 1000]
Access: 1  MISS Left  ->       [0, 1] <- Right Replaced:- [Hits:0 Misses:2]
FREQ  [1000, 1000, 1000, 1000, 1000, 1000, 1000, 1000, 1000, 1000, 1000, 1000]
Access: 2  MISS Left  ->    [0, 1, 2] <- Right Replaced:- [Hits:0 Misses:3]
FREQ  [1000, 1000, 1000, 1000, 1000, 1000, 1000, 1000, 1000, 1000, 1000, 1000]
Access: 3  MISS Left  ->    [0, 1, 3] <- Right Replaced:2 [Hits:0 Misses:4]
FREQ  [1000, 1000, 1000, 1000, 1000, 1000, 1000, 1000, 1000, 1000, 1000, 1000]
Access: 2  MISS Left  ->    [0, 3, 2] <- Right Replaced:1 [Hits:0 Misses:5]
FREQ  [1000, 1000, 1000, 1000, 1000, 1000, 1000, 1000, 1000, 1000, 1000, 1000]
Access: 3  HIT  Left  ->    [0, 3, 2] <- Right Replaced:- [Hits:1 Misses:5]
FREQ  [1000, 1000, 1000, 1000, 1000, 1000, 1000, 1000, 1000, 1000, 1000, 1000]
Access: 2  HIT  Left  ->    [0, 3, 2] <- Right Replaced:- [Hits:2 Misses:5]
FREQ  [1000, 1000, 1000, 1000, 1000, 1000, 1000, 1000, 1000, 1000, 1000, 1000]
Access: 3  HIT  Left  ->    [0, 3, 2] <- Right Replaced:- [Hits:3 Misses:5]
FREQ  [1000, 1000, 1000, 1000, 1000, 1000, 1000, 1000, 1000, 1000, 1000, 1000]
Access: 0  HIT  Left  ->    [0, 3, 2] <- Right Replaced:- [Hits:4 Misses:5]
FREQ  [1000, 1000, 1000, 1000, 1000, 1000, 1000, 1000, 1000, 1000, 1000, 1000]
Access: 2  HIT  Left  ->    [0, 3, 2] <- Right Replaced:- [Hits:5 Misses:5]
FREQ  [1000, 1000, 1000, 1000, 1000, 1000, 1000, 1000, 1000, 1000, 1000, 1000]
Access: 3  HIT  Left  ->    [0, 3, 2] <- Right Replaced:- [Hits:6 Misses:5]
FREQ  [1000, 1000, 1000, 1000, 1000, 1000, 1000, 1000, 1000, 1000, 1000, 1000]
Access: 2  HIT  Left  ->    [0, 3, 2] <- Right Replaced:- [Hits:7 Misses:5]
FREQ  [1000, 1000, 1000, 1000, 1000, 1000, 1000, 1000, 1000, 1000, 1000, 1000]

FINALSTATS hits 7   misses 5   hitrate 58.33
```