Implementation:

1. FIFO (lab8stepFIFO.c): The FIFO algorithm replaces the oldest page in memory when a page fault occurs. It maintains a pointer (placeInArray) that tracks the next replacement position.
2. LRU (lab8stepLRU.c): The LRU algorithm replaces the page that was least recently used. Each page access updates a counter, and on a fault, the page with the smallest counter value is replaced.
3. Second Chance (lab8step2CHANCE.c): This algorithm is similar to FIFO but provides a "second chance" to pages. Each page is given a reference bit; on a fault, if the page's reference bit is set, it is cleared and the page is given another chance.

Overall:

All the algorithms perform quite equally. There is a small difference in fault counts and thus it effects the hit and miss rates minimally across cache sizes.

Testing: A. Small test file (testInput.txt) with cache size 10 produced the following faulting pages for all algorithms:

7
49
23
8
30
22
44
28
9

B. Large test file (accessesForReport.txt with 10,000 requests) produced the following fault counts:

**FIFO Page Faults**

- **Cache=10:** 9916 faults
  Miss Rate = 9916/10000 = 0.9916 (99.16%)
  Hit Rate = 1 - 0.9916 = 0.0084 (0.84%)
- **Cache=50:** 9515 faults
  Miss Rate = 9515/10000 = 0.9515 (95.15%)
  Hit Rate = 1 - 0.9515 = 0.0485 (4.85%)
- **Cache=100:** 9018 faults
  Miss Rate = 9018/10000 = 0.9018 (90.18%)
  Hit Rate = 1 - 0.9018 = 0.0982 (9.82%)

- **Cache=250:** 7534 faults
  Miss Rate = 7534/10000 = 0.7534 (75.34%)
  Hit Rate = 1 - 0.7534 = 0.2466 (24.66%)
- **Cache=500:** 5130 faults
  Miss Rate = 5130/10000 = 0.5130 (51.30%)
  Hit Rate = 1 - 0.5130 = 0.4870 (48.70%)

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**LRU Page Faults**

- **Cache=10:** 9915 faults
  Miss Rate = 9915/10000 = 0.9915 (99.15%)
  Hit Rate = 1 - 0.9915 = 0.0085 (0.85%)
- **Cache=50:** 9510 faults
  Miss Rate = 9510/10000 = 0.9510 (95.10%)
  Hit Rate = 1 - 0.9510 = 0.0490 (4.90%)
- **Cache=100:** 9029 faults
  Miss Rate = 9029/10000 = 0.9029 (90.29%)
  Hit Rate = 1 - 0.9029 = 0.0971 (9.71%)
- **Cache=250:** 7532 faults
  Miss Rate = 7532/10000 = 0.7532 (75.32%)
  Hit Rate = 1 - 0.7532 = 0.2468 (24.68%)
- **Cache=500:** 5206 faults
  Miss Rate = 5206/10000 = 0.5206 (52.06%)
  Hit Rate = 1 - 0.5206 = 0.4794 (47.94%)

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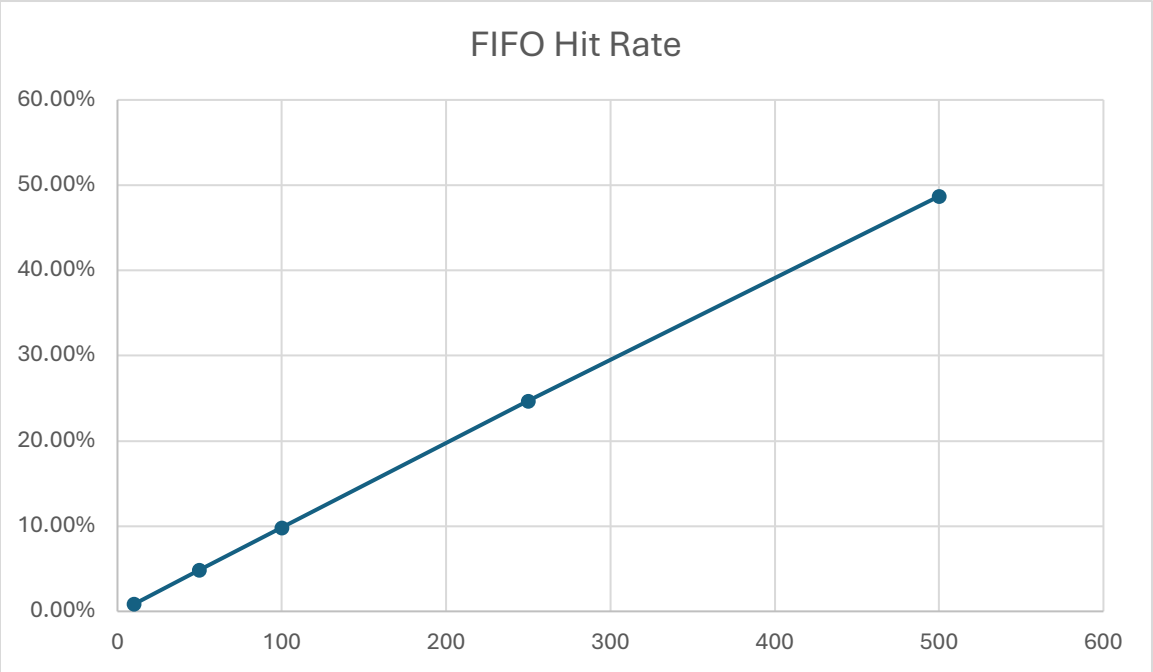
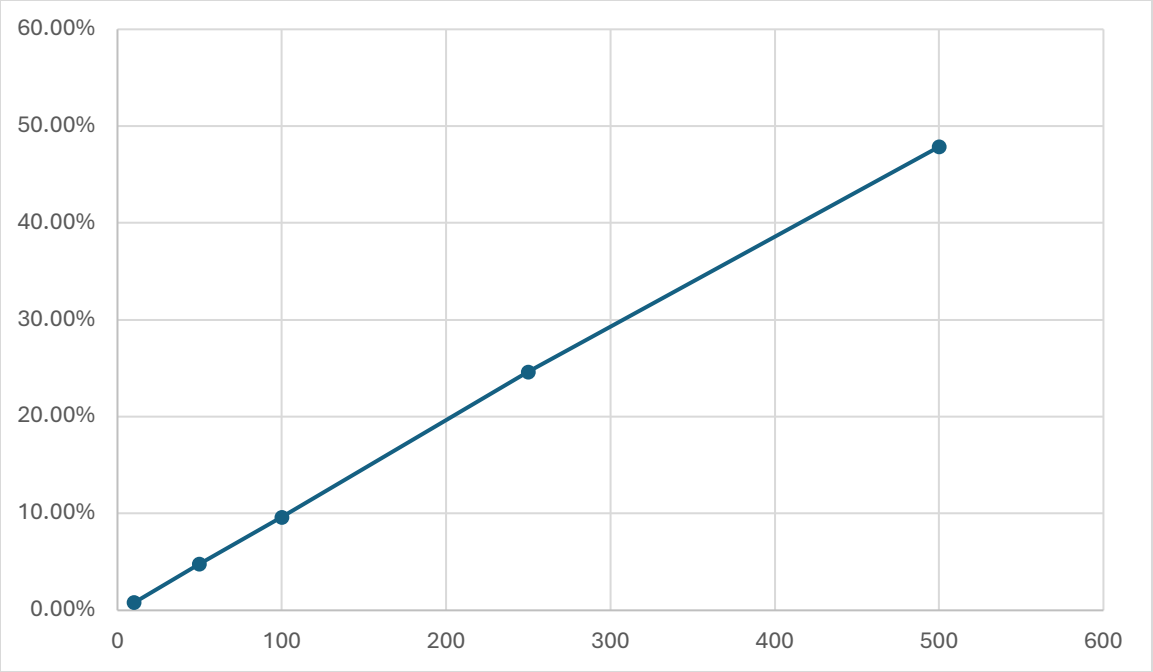
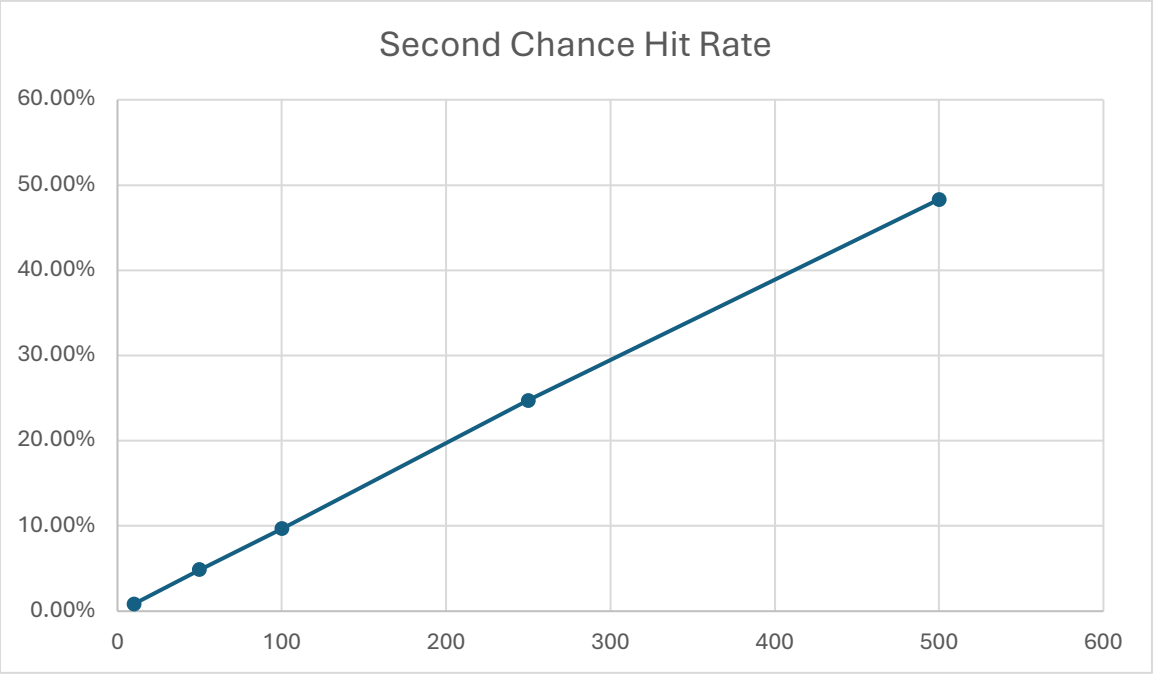
**Second Chance Page Faults**

- **Cache=10:** 9915 faults
  Miss Rate = 9915/10000 = 0.9915 (99.15%)
  Hit Rate = 1 - 0.9915 = 0.0085 (0.85%)
- **Cache=50:** 9510 faults
  Miss Rate = 9510/10000 = 0.9510 (95.10%)
  Hit Rate = 1 - 0.9510 = 0.0490 (4.90%)
- **Cache=100:** 9022 faults
  Miss Rate = 9022/10000 = 0.9022 (90.22%)
  Hit Rate = 1 - 0.9022 = 0.0978 (9.78%)
- **Cache=250:** 7522 faults
  Miss Rate = 7522/10000 = 0.7522 (75.22%)
  Hit Rate = 1 - 0.7522 = 0.2478 (24.78%)
- **Cache=500:** 5188 faults
  Miss Rate = 5188/10000 = 0.5188 (51.88%)
  Hit Rate = 1 - 0.5188 = 0.4812 (48.12%)

| Cache Size | FIFO Faults | FIFO Miss Rate | FIFO Hit Rate | LRU Faults | LRU Miss Rate | LRU Hit Rate | Second Chance Faults | Second Chance Miss Rate | Second Chance Hit Rate |
|---|---|---|---|---|---|---|---|---|---|
| 10 | 9916 | 99.16 % | 0.84% | 9915 | 99.15 % | 0.85% | 9915 | 99.15% | 0.85% |
| 50 | 9515 | 95.15 % | 4.85% | 9510 | 95.10 % | 4.90% | 9510 | 95.10% | 4.90% |
| 100 | 9018 | 90.18 % | 9.82% | 9029 | 90.29 % | 9.71% | 9022 | 90.22% | 9.78% |
| 250 | 7534 | 75.34 % | 24.66 % | 7532 | 75.32 % | 24.68 % | 7522 | 75.22% | 24.78% |
| 500 | 5130 | 51.30 % | 48.70 % | 5206 | 52.06 % | 47.94 % | 5188 | 51.88% | 48.12% |






Output for shell file:

```
➜  Lab 8 ./lab8step6.sh
gcc -o fifo lab8stepFIFO.c
gcc -o lru lab8stepLRU.c
gcc -o sec_chance lab8step2CHANCE.c
```

```
---------- FIFO with testInput.txt (cache=10) ----------
7
49
23
8
30
22
44
28
9
---------- End FIFO ----------

---------- LRU with testInput.txt (cache=10) ----------
7
49
23
8
30
22
44
28
9
---------- End LRU ----------

---------- Second Chance with testInput.txt (cache=10) ----------
7
49
23
8
30
22
44
28
9
---------- End Second Chance ----------

FIFO test with accessesForReport.txt at cache sizes 10, 50, 100, 250,
500
    9916
    9515
    9018
    7534
    5130

LRU test with accessesForReport.txt at cache sizes 10, 50, 100, 250,
500
    9915
    9510
    9029
    7532
```

```
    5206

Second Chance test with accessesForReport.txt at cache sizes 10, 50,
100, 250, 500
    9915
    9510
    9022
    7522
    5188

rm -f fifo lru sec_chance
```