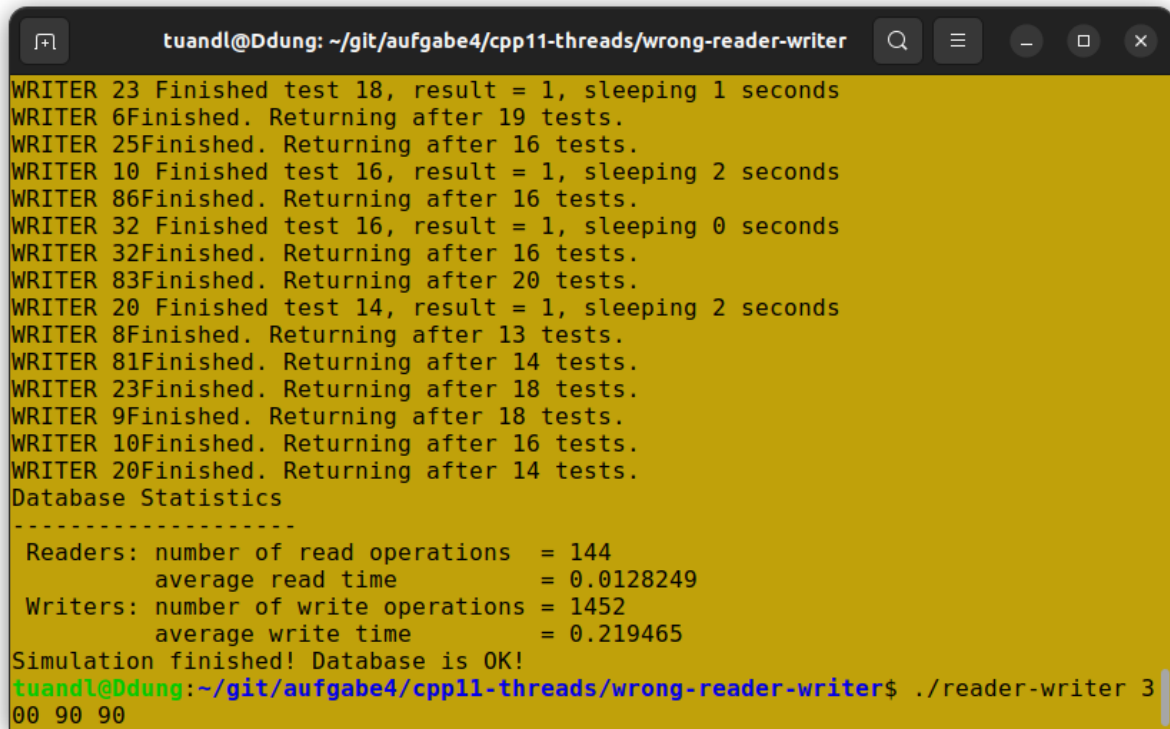


Read-Write Problem Solutions

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1. First solution: reader preferred

- 300 sekunden mit 10 Leser und 90 Schreiber



```
tuandl@Ddung: ~/git/aufgabe4/cpp11-threads/wrong-reader-writer
WRITER 23 Finished test 18, result = 1, sleeping 1 seconds
WRITER 6Finished. Returning after 19 tests.
WRITER 25Finished. Returning after 16 tests.
WRITER 10 Finished test 16, result = 1, sleeping 2 seconds
WRITER 86Finished. Returning after 16 tests.
WRITER 32 Finished test 16, result = 1, sleeping 0 seconds
WRITER 32Finished. Returning after 16 tests.
WRITER 83Finished. Returning after 20 tests.
WRITER 20 Finished test 14, result = 1, sleeping 2 seconds
WRITER 8Finished. Returning after 13 tests.
WRITER 81Finished. Returning after 14 tests.
WRITER 23Finished. Returning after 18 tests.
WRITER 9Finished. Returning after 18 tests.
WRITER 10Finished. Returning after 16 tests.
WRITER 20Finished. Returning after 14 tests.
Database Statistics
-----
Readers: number of read operations  = 144
         average read time          = 0.0128249
Writers: number of write operations = 1452
         average write time         = 0.219465
Simulation finished! Database is OK!
tuandl@Ddung:~/git/aufgabe4/cpp11-threads/wrong-reader-writer$ ./reader-writer 3
00 90 90
```

- 300 sekunden mit 90 Leser und 90 Schreiber

```
tuandl@Ddung: ~/git/aufgabe4/cpp11-threads/wrong-reader-writer
WRITER 7 Finished test 12, result = 1, sleeping 1 seconds
WRITER 63 Finished test 19, result = 1, sleeping 2 seconds
WRITER 22 Finished test 18, result = 1, sleeping 0 seconds
WRITER 22 Finished. Returning after 18 tests.
WRITER 35 Finished. Returning after 18 tests.
WRITER 42 Finished test 23, result = 1, sleeping 1 seconds
WRITER 67 Finished. Returning after 14 tests.
WRITER 75 Finished test 19, result = 1, sleeping 1 seconds
WRITER 7 Finished. Returning after 12 tests.
WRITER 0 Finished test 16, result = 1, sleeping 0 seconds
WRITER 0 Finished. Returning after 16 tests.
WRITER 59 Finished. Returning after 21 tests.
WRITER 55 Finished. Returning after 21 tests.
WRITER 42 Finished. Returning after 23 tests.
WRITER 75 Finished. Returning after 19 tests.
WRITER 63 Finished. Returning after 19 tests.
Database Statistics
-----
Readers: number of read operations = 1837
         average read time         = 0.00320443
Writers: number of write operations = 1591
         average write time         = 0.197482
Simulation finished! Database is OK!
tuandl@Ddung: ~/git/aufgabe4/cpp11-threads/wrong-reader-writer$
```

- 300 Sekunden mit 90 Leser und 10 Schreiber

```
-----
Readers: number of read operations = 16504
         average read time         = 0.00282203
Writers: number of write operations = 1371
         average write time         = 0.198304
Simulation finished! Database is OK!
```

- Wenn es viele Leser gibt, muss der erst wartende Schreiber immer noch warten und wird verhungert. Aus dem Bild kann man sehen, dass **average write time** in diesen Fällen deutlich mehr als **average read time** ist.

2. Second solution: Writer preferred

- 300 Sekunden mit 10 Leser und 90 Schreiber

```
-----
Readers: number of read operations = 10
         average read time         = 0.0296071
Writers: number of write operations = 1446
         average write time         = 0.219918
Simulation finished! Database is OK!
```

Number of read operations ist hier gleich die gegebene Anzahl der Leser.

- 300 Sekunden mit 90 Leser und 90 Schreiber

```
-----
Readers: number of read operations  = 89
         average read time          = 0.0111575
Writers: number of write operations = 1446
         average write time         = 0.220069
Simulation finished! Database is OK!
```

Average write time ist in diesem Fall nicht mehr sehr weit von **average read time**. Das heisst Leser muessen nicht mehr sehr lang warten.

- 300 Sekunden mit 90 Leser und 10 Schreiber

```
-----
Readers: number of read operations  = 89
         average read time          = 0.0920718
Writers: number of write operations = 1330
         average write time         = 0.226523
Simulation finished! Database is OK!
```

Gilt auch mit mehreren Schreiber.

- Der erst wartende Schreiber fuehrt zuerst aus statt der naechste Leser (deswegen heisst es Writer Preferred), damit er nicht im Fall einer sehr lange list von Leser immer noch warten muss und verhungert wird. Also **fair** hier bedeutet, beide Leser und Schreiber sind *fast* gleichweise behandelt. Ist ein Schreiber verhungert, gilt dies natuerlich nicht mehr.